Cal OES
GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

Post-Disaster Safety Assessment Program (SAP)

Evaluator Student Manual

Version 18

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Forward

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Cal OES wishes to acknowledge the many organizations and individuals who contributed or permitted use of their photos for use in this instruction manual. Photo credits are found beneath each individual photo, when known. Cal OES also acknowledges the assistance of the Applied Technology Council in allowing the reproduction and use of their photographs and diagrams used in this manual as well.

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Figure 1.1 – An inspector at work

1.1 Becoming a SAP Evaluator

- SAP Evaluators examine buildings in the field after a disaster to see if they can be either used as is, used partially with restrictions, or are unsafe to occupy. Some SAP evaluators examine geotechnical issues or infrastructure.
- How do I become a SAP Evaluator? You must attend a SAP class taught by a Cal OES certified SAP instructor, and have certain building inspector certifications or one of several professional licenses (see pgs. 26 & 27).
- If you have these accomplished, you will receive a SAP ID card and be part of the statewide cadre for disaster deployment.
- If you have taken the class, but do not have one of the approved credentials or licenses, you will receive a Certificate of Completion.
    - If you obtain one of these credentials or licenses within 5 years of your SAP training, please let Cal OES know at sap@caloes.ca.gov. We will confirm your status, and on approval, can issue you a SAP ID card and include you in the statewide cadre.
- How do you renew at the end of 5 years? You can take another in-person or virtual SAP evaluator class, or take the online refresher course.
    - Emails are sent 90 days before the cards expires so individuals have time to either take a class, or go online to the refresher course.

Figure 1.2 – A SAP Coordinator reviews the day's work with the SAP evaluators. Photo courtesy of Dave Karina.

1.2 - Becoming a SAP Coordinator

- SAP Coordinators manage the post-disaster SAP response on behalf of local governments.
- How do I become a SAP Coordinator? By taking the SAP Evaluator course, and then taking the additional 2-hour SAP Coordinator training.
- Because SAP Coordinators are managing people, equipment, and arrangements, rather than inspecting buildings, *it is not necessary to have one of the building inspection credentials or professional licenses required to be a SAP Evaluator.*
- Commonly, the local government SAP Coordinator will also be the Building Official or one of their senior building inspectors, but the SAP Coordinator can also be someone the Building Official designates, such as a fire or law official, city manager, emergency manager, or other individual. It is imperative that the SAP Coordinator take all necessary training to complete this role.
- SAP Coordinators with SAP ID cards who live in California will have "SAP Coordinator" designated on their ID badge.
- If not credentialed or licensed, you will receive a Certificate of Completion as a SAP Coordinator, but cannot do field evaluations of

buildings. You can certainly coordinate the SAP deployment, as your training describes.
- Renewal every 5 years occurs by virtual or in-person instruction, or by taking the SAP Coordinator online refresher course.

Figure 1.3 – A SAP trainer teaching a class in Thornton, CO. Photo courtesy Jim C. Barnes.

1.3 - Becoming a SAP Trainer

- How do I become a SAP Trainer? By attending the SAP Train-the-Trainer course offered by Cal OES. This course includes the SAP Evaluator and Coordinator classes, and additional material required in order to become an effective Trainer for the program.
- This status will allow you to teach both SAP Evaluator and SAP Coordinator classes.
- If you are eligible for a SAP ID card, you will be marked in the Cal OES database as a Trainer, but your SAP ID card will say "DSW Coordinator" for California residents.
- Like the SAP Coordinator, the SAP Trainer does not need to be a credentialed building inspector or a licensed building professional (though these are preferred), but will need to have one of these credentials in order to receive a SAP ID card.

- A SAP Trainer's ID card is extended another 5 years every time he or she teaches a class. A SAP Trainer's status in the program is reviewed every 5 years; if no training was provided, the Trainer designation is changed in status to a Coordinator.

1.4 - Registration in the Safety Assessment Program

- At the end of this class, the instructor or the class administrator will go over how to register in the Safety Assessment Program electronically (this was done in previous years by a paper registration form).

Unit 2: Program Overview

Figure 2.1 – Survivors wait outside a collapsed building.

2.1 – Program Objectives

The primary objective of the Safety Assessment Program is to identify those homes and businesses that can be occupied after a disaster, while identifying those structures that are more marginal, or that are too dangerous to occupy.

By doing this, disaster survivors can leave the shelters and other temporary living arrangements and return to their homes. This reduces the disaster's impact on shelters.

The Safety Assessment Program also helps communities come back to life. Since some people can return home, and some businesses can reopen, the community can go back to work, and otherwise return to their routines.

A side benefit of the Safety Assessment Program is that the local building department, whom the SAP evaluators are helping, will be able to follow up on any structural repair issues that the SAP evaluators identified in their reports.

Figure 2.2 – The newly constructed Olive View Hospital was heavily damaged in the 1971 Sylmar Earthquake.

2.2 – History of the Safety Assessment Program

Immediately after the 1971 Sylmar Earthquake (M6.5) near Los Angeles, local governments were overwhelmed with the number of structures needing evaluation prior to re-occupancy. The Structural Engineers Association of Southern California volunteered to have local structural engineers assist with the work of assessing damaged buildings for safe use. There was no formal training, official guidance, or ID cards for those helping with this work; it was all done informally.

Professional assistance and building inspector mutual aid were also given informally after the 1983 Coalinga Earthquake (M6.5) and the 1984 Morgan Hill Earthquake (M6.2).

After the 1987 Whittier-Narrows Earthquake (M5.9), Jim Alexander, a senior emergency services coordinator with the California Governor's Office of Emergency Services (Cal OES) pushed for the formalizing of the safety assessment efforts into a program. This led to formal training, the issuing of SAP ID badges, and the creation of a cadre of ready individuals who were able to assist.

At the same time, Cal OES recognized that there was no formal guidance to help these building professionals make more accurate and uniform decisions on tagging buildings. Cal OES made an agreement with the Applied Technology Council (ATC) in Redwood City, CA, to write a standard guidance for safety assessment. This led to the release of *ATC-20: Procedures for Postearthquake Safety Evaluation of Buildings,* just a few weeks before the October 17, 1989 Loma Prieta Earthquake (M6.9) happened. Loma Prieta was the first earthquake SAP response that used ATC-20.

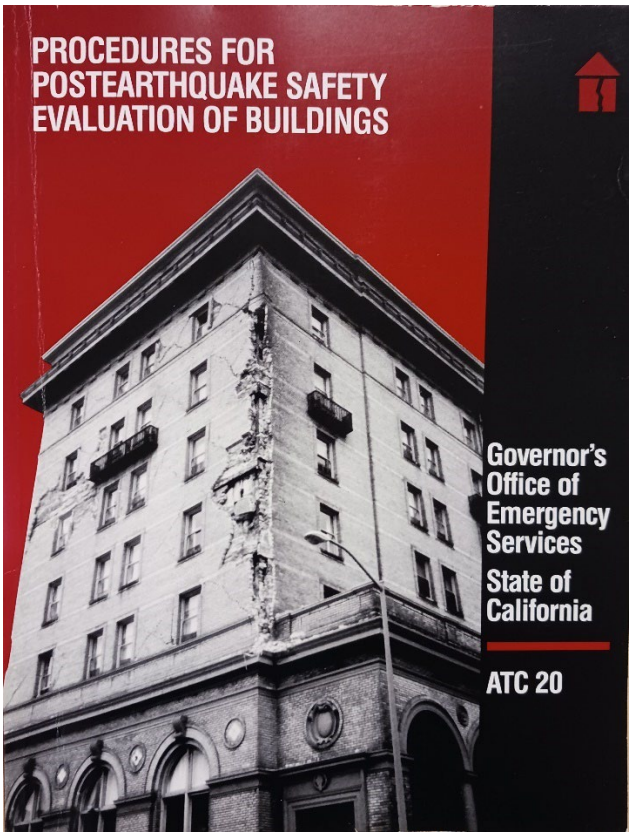


Figure 2.3 – Original version, ATC-20

In 1992, there were three earthquakes that received SAP evaluator responses. These were the Big Bear (M6.5), Landers (M7.3), and Petrolia (Ferndale) (M7.0) Earthquakes.

Over 600 SAP evaluators were deployed for the 1994 Northridge Earthquake (M6.7), along with about 400 persons from the U.S. Army Corps of Engineers. The program became more restrictive after this disaster, only allowing persons with professional licenses or building inspection certifications to become SAP evaluators.

About 30 SAP evaluators were deployed for the 2003 San Simeon Earthquake (M6.5). Damages were examined in the cities of Paso Robles and Atascadero.

California became signatory to the interstate Emergency Management Assistance Compact (EMAC) in 2005, in time to send support in the aftermath of Hurricane Katrina. 84 SAP evaluators and 2 SAP coordinators were sent under EMAC to Hancock County, Mississippi, and St. Bernard and Orleans parishes in Louisiana.

In 2005, the program was modified to use ATC-20 principles to respond to windstorms, floods, fires, and explosions. The Federal Office of Homeland Security approved the Safety Assessment Program for eligibility for Homeland Security Preparedness Grants in that year, after a single review of the program.

About 30 SAP evaluators were deployed for the 2010 Baja Earthquake (M7.2, centered in Mexico). Three SAP coordinators were also deployed. This earthquake affected the cities of Calexico and El Centro in Imperial County.

SAP evaluators were deployed in response to the 2010 natural gas pipeline explosion in San Bruno. This deployment was managed at the county level, and is a good example of how SAP can work when there aren't enough local evaluators to handle the need.

Roughly 30 SAP evaluators were deployed for the 2014 Napa Earthquake (M6.0).

4 SAP evaluators were deployed under EMAC to assist with the 2018 Anchorage, Alaska Earthquake (M7.1).

More recent deployments include to the 2021 Dixie and Caldor Fires, the 2022 Ferndale Earthquake (M6.4), and the 2023 Snow Load Damage Mission in South Lake Tahoe and the Mammoth Lakes area in Mono County.

2.3 – New Changes to the Safety Assessment Program

Digital ID cards are coming soon. This new format will replace the plastic ID cards that the program used since the early 2000s. (Before then, cards were of paper and laminated plastic.) These digital ID cards could be presented on demand to law enforcement on one's cell phone. The digital ID card will be linked through a phone app, whereby one could update information due to changing emails, addresses, and phone numbers. The app could also be part of a deployment and program update communication link to Cal OES. Digital ID cards could also be printed on paper and taken to the field as backup to the digital ID on an electronic device, in case the device runs out of power.

Digital assessment forms are in use by Cal OES. This digital form replaces the paper Rapid Assessment Forms. It is based on Survey 123 GIS application. It is readily available for CalOES use and can be utilized by Local California Jurisdictions with OES preapproval. It has been successful with our small deployments such as the recent 2022 Ferndale Earthquake and the 2023 Snow Load Damage deployments. Local governments can certainly create their own versions of the Rapid Assessment Form on a digital platform like this, it is easy to do. The end product handles the field information rapidly, and allows for geocoding along with capturing digital photos of the damaged structures. The end product is uploaded to a cloud database, where the accumulated data can be shown on a GIS map. (If such means are not locally available, then paper Rapid Assessment Forms can be used.)

Online SAP Evaluator training is in the process of development. One could take this online course instead of an in-person or virtually based class. It is possible that this may be available in 2024.

Other efforts include expanding ATC-20 principles to other non-earthquake disaster types. For example, a new Rapid Assessment Evaluation form was developed for the Snow Load Damage Mission in 2023.

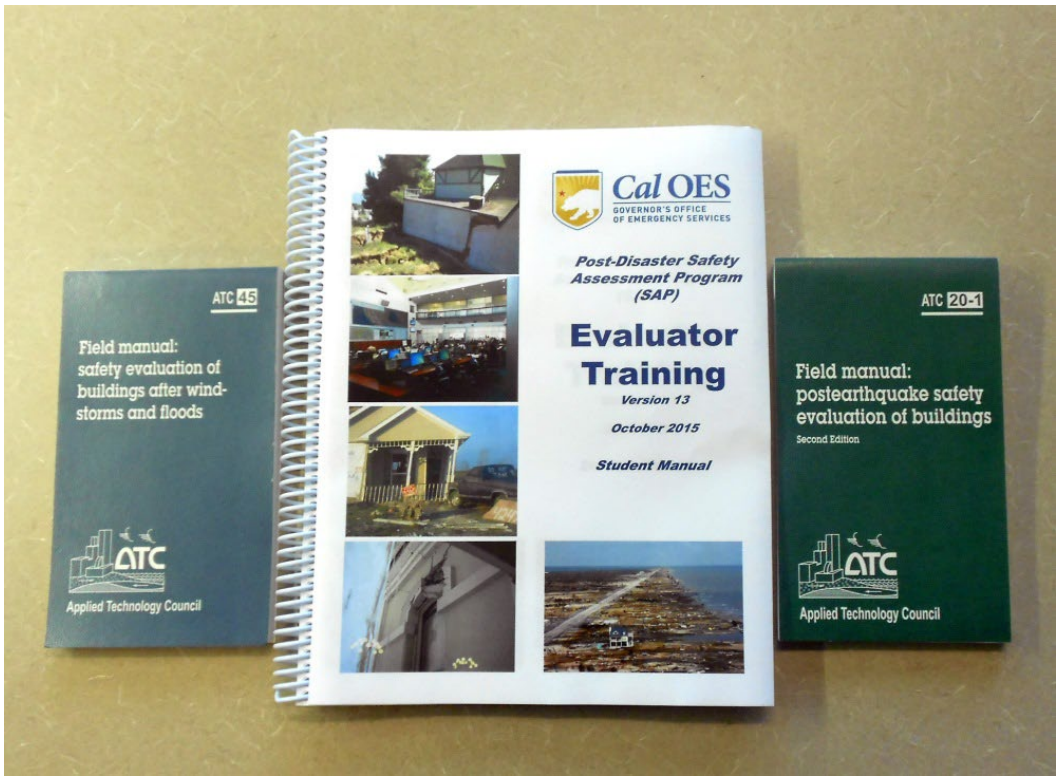


Figure 2.4 – Example of an SAP Evaluator manual, along with ATC-20-1 and ATC=45. Photo courtesy Jim C. Barnes.

2.4 - SAP Program and Deployment Guidance

In addition to the 2023 SAP Evaluator Manual (this book), the program is guided by **ATC-20-1** and **ATC-45**. Both of these are field handbooks.

You are strongly encouraged, as a student, to purchase the ATC handbook that best suits the disaster situation in your local area. You are also encouraged to take it with you and refer to it in the field.

While ATC-20 and ATC-45 are foundational to the Safety Assessment Program, this program is more encompassing than these manuals are put together. SAP includes fire and explosion damage, mudslides, landslide, lahars, and snow load issues. SAP also includes infrastructure assessments, which those manuals do not cover. SAP also covers immunity from liability and workers compensation in California, EMAC, and how deployment is managed. Therefore, someone who took an ATC-20 or ATC-45 class cannot use those classes to become part of the SAP cadre, because the classes are not the same.

The **Emergency Management Assistance Compact**, or EMAC, was mentioned earlier in this manual. This is an agreement between all 50 states and the Territory of Puerto Rico to provide contracted mutual aid in response to a disaster.

The State of California signed onto EMAC in 2005, and can send help to other states, or receive help from other states.

As part of the agreement, the workers compensation and immunity from liability enjoyed in California, travels with the SAP evaluators to the state needing help. The California professional licenses also travel with the evaluators to the other state, so reciprocity in the state being assisted is not needed for the disaster response.

The experiences from the 2014 Napa Earthquake made clear the need to solidify the nature of the in-state mutual aid agreements as they relate to the Safety Assessment Program. This is partly due to the fact that the California Master Mutual Aid Agreement identifies mutual aid as *voluntary.* Volunteer work is not directly compensated under the federal and state disaster recovery regulations, so under the Master Mutual Aid Agreement, SAP work assisted by mutual aid would be ineligible under Category B, Emergency Protective Measures.

For these reasons, the **SAP Memorandum of Understanding (MOU)** was created. This is a contract agreement between Cal OES, who provides the SAP personnel, and the local government, who requests the SAP personnel. The SAP MOU clearly spells out the responsibilities of both parties and establishes some operational framework for carrying out the SAP response.

The SAP MOU must be signed by the requesting local government before SAP personnel are deployed. Preferably, this should be signed in advance of a disaster occurring. Cal OES can then check the SAP MOU files, verify that the requesting local government has a signed version on hand, and then quickly start the dispatch process for SAP evaluators to go there. (It is much more difficult to get the SAP MOU signed off after a disaster, with all the distractions.)

There are two types of SAP deployment:

- **Post-Disaster Response Assessment (PDRA)**
    - Deployment under a State of Emergency
    - Consists of DSW State Employees
    - Cal OES can mission-task various California State agencies to provide SAP-trained personnel from their agency and direct them to respond to a disaster.
    - Does not include volunteers, only utilizes paid State employees. Compensation for PDRA SAP deployed personnel expenses is from Cal OES.
    - PDRA Expedites SAP response, participation is not optional.
    - In a catastrophic event, will be the first group deployed, followed by the Recovery Safety Assessment (RSA) deployment.
- **Recovery Safety Assessment (RSA)**
    - Deployment under a State of Emergency, or once the local government starts the recovery phase of the disaster.
    - SAP MOU needs to be signed off by local government before this deployment takes place.
    - Local governments must request SAP personnel through their Operational Area (county). Operational Area will deploy SAP personnel from county government and from cities within its borders.
    - If Operational Area does not have enough SAP personnel, they make the request for more to Cal OES.
    - Local government's request for SAP personnel is then fulfilled through mutual aid, and by volunteers from the private sector.

- All SAP RSA deployment costs must be compensated by the requesting jurisdiction.

2.5 – Post-Disaster Coordination

2.5.1 – Emergency Management

Once an event occurs, local government must reasonably commit their resources to the response. The local building department must determine their need for SAP personnel and use up their own resources for the effort.

Once that is done, and if they need more assistance, the local government asks the Operational Area for SAP personnel. The Operational Area can then request SAP personnel (SAP-trained building inspectors, engineers, and architects) from other local governments within its borders.

If Operational Area resources are not sufficient, the Operational Area forwards the request to the Cal OES Region of which they are a part, at the Regional Emergency Operational Center (REOC). The REOC acts as a pass-through to provide this request to the State Operations Center (SOC). The SOC then forwards the request to one of the Statewide SAP Coordinators, who starts the deployment process.

Who is in charge of managing the emergency? The local government whose jurisdiction includes the disaster zone is in charge of managing the emergency. This is per the Incident Command System, used universally in emergency management.

Who is the point of contact for deployment of the Safety Assessment Program personnel? The local government Building Official is responsible for coordinating and prioritizing the needs and assessments, and will be the point of contact for SAP deployments.

What happens to the collected data? The evaluation data is owned by the local jurisdiction, and Cal OES receives a copy of it.

Figure 2.5 – Cal OES Mutual Aid Regions

The State of California is divided into three mutual aid regions in order to facilitate response. Cal OES provides oversight of the Coastal, Inland, and Southern Regions, and established the three REOCs in Fairfield, Sacramento, and Los Alamitos, respectively.

Direct management of the disaster incident is handled at the Incident Commander level. The Incident Commander, often a fire or police official, requests aid from the local government that he or she works for. Each successive level of government above this provides assistance to the incident or disaster response.

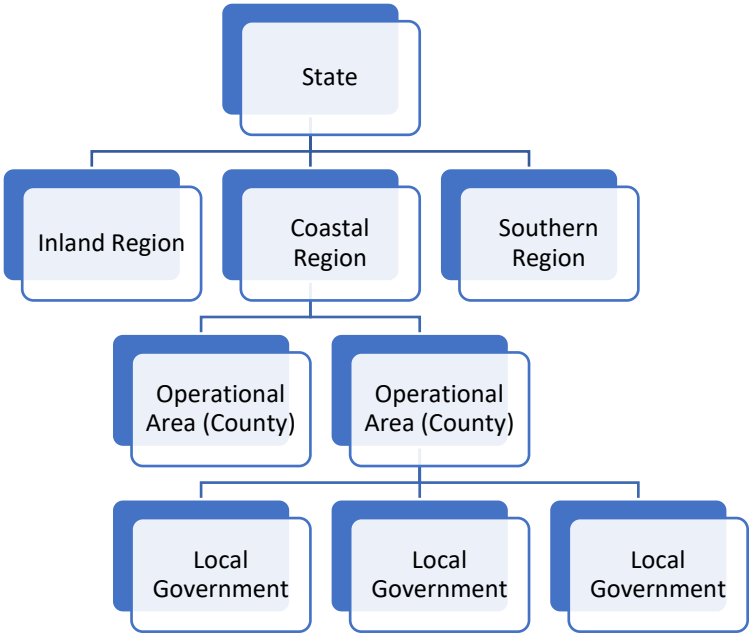


Figure 2.6 – Response hierarchy in California, per Incident Command System (ICS) and the Standardized Emergency Management System (SEMS).

In general, the Operational Areas support the local governments, the Cal OES Regions support the Operational Areas, and the State supports the Regions.

2.5.2 – Local Government Role

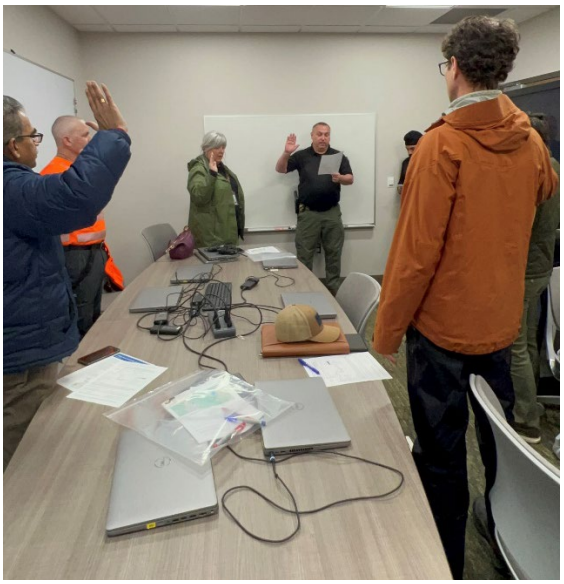


Figure 2.7 – SAP evaluators are deputized in El Dorado County prior to field activity for the South Tahoe Snow Load Damage mission. Photo courtesy Gurbir Singh.

- SAP Coordinator and/or Point of Contact needs to be on scene with the SAP Evaluators.
- Deputizing: The SAP Evaluators must be deputized so that they can legally post local government placards that have the force of law.
- Provide necessary information and supplies to the teams: Local governments must provide the placards, caution tape, and other equipment needed for the assessment effort. They must also provide a briefing packet with key contact numbers of the Building Department, law enforcement, fire, hazmat, utilities, and animal control, to the SAP evaluators.
- Coordination: Local governments must coordinate the assignments of the SAP Evaluator teams, giving them work assignments, and keeping them duly occupied with the work at hand.
- Cover SAP Personnel Costs: Local governments must cover the costs of the SAP Evaluators under the Recovery Safety Assessment (RSA) deployment protocol.
- Local governments need to confirm that the legal authorities exist that allow the Safety Assessment Program to work.
- When all work is done, local governments need to provide Cal OES with the results of the field evaluations, for future historical and analysis reasons.

2.5.3 – Deployment Discussion

Once the request for SAP personnel reaches the Cal OES Statewide SAP Coordinator, Cal OES determines if the SAP personnel request will be using PDRA, using RSA, or using both deployment protocols. If the RSA protocol will be used, the files are checked to confirm that a SAP MOU is in place for that requesting local government.

It should be noted that there are currently no mutual aid arrangements for deployment of SAP-trained U.S. citizens to other countries, with the possible exception of certain northern tier states with their cross-border provincial counterparts in Canada. Other than that, any U.S. citizen who desires to perform safety assessment work in another country does so entirely as a private citizen, at his or her own risk.

2.6 – Disaster Service Workers and SAP ID Badges

Why do we need ID badges? There were a variety of ID cards issued to SAP evaluators before July 2013. In that year, Cal OES was rebranded with its current name, and the cards were redesigned. The current plastic ID cards are two-sided, and have dark bands on a white background.

Figure 2.8 – Examples of SAP Evaluator ID Cards in California

The 2010 Baja Earthquake reinforced why there is a need for SAP personnel to carry ID badges. There were instances of fraud, where persons misrepresented being part of the Safety Assessment Program and were seeking to charge a fee for what is a free service. Property owners, renters, and government officials also want to feel confident that the people they are sending into the disaster zone are genuine and are there to assist, so the ID badges are very necessary.

In the past, when there was an ID badge revision, a new badge was issued to the SAP evaluators who were actually deployed to the field, so there would be consistency. The rest of the cadre would be caught up with the new badge design once they recertified. In the future, when digital ID badges are issued, it will likely be possible to issue all in the SAP cadre a new digital ID badge at the same time.

There are 5 types of ID cards produced for the Safety Assessment Program:

- DSW-State, for California State employees.
- DSW-Local, for California local government employees.
- DSW-Volunteer, for California residents who are in the private sector, retired, or work for the federal government and would need to take time off to assist in the Safety Assessment Program.
- DSW-Coordinator, for those trained as SAP Coordinators.
- Other States, by name of state, for those living outside of California.

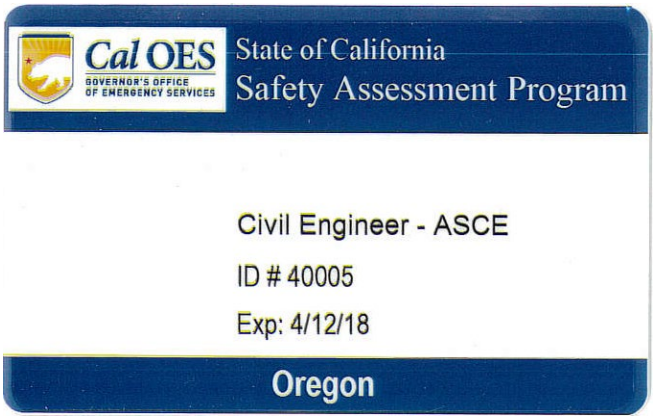


Figure 2.9 – Example of SAP Evaluator ID card from outside California.

Figure 2.10 – Example of SAP Coordinator card

"DSW" stands for Disaster Service Worker. This is a legal definition in California, and signifies someone who can officially assist with disasters. All California State employees, and all California local government employees, are by definition Disaster Service Workers. Volunteers become Disaster Service Workers by signing a Loyalty Oath per the CA Emergency Services Act Section 8580, and the CA Government Code Sections 3102 & 3108.

The "DSW" designation only applies to California residents. Persons residing outside California who are brought into a California disaster under EMAC would be assisting under the legal umbrella that exists in their home states.

Because of the limitations of the card itself, persons living outside California who take the SAP Coordinator class would only have their state's name shown on the ID card. They can carry their Coordinator certificate with them if needed.

DSW-State SAP evaluators work for any one of the state agencies in California. These can be mission-tasked by Cal OES per the Emergency Services Act, and can respond rapidly to a disaster. This is why these are tapped for the more immediate Post Disaster Response Assessment protocol in safety assessment. (The University of California is autonomous from state agencies, and its employees are not mission tasked, but can be requested. Its employees are gathered into the DSW-State group.)

DSW-Local SAP evaluators work for any of the California local governments. These include the 58 counties, the over 400 cities, and the over 2,000 special districts in California. These persons can be building inspectors, civil, structural, or geotechnical engineers, or architects, and are gathered into the California Building Officials (CALBO) organization for deployment purposes.

DSW-Coordinator applies to those California residents who take the additional 2- hour SAP Coordinator training, and are versed in how to prepare for, request, and manage a SAP response to a local government. The SAP Evaluator class is mandatory before one can take the SAP Coordinator class.

SAP Coordinators are used as point persons for SAP deployments. The SAP Coordinator training is separate from this Evaluator training, and can be taught separately, in combination with an Evaluator class, or as part of the Train-the-Trainer class. As already stated, only California residents have the DSW-Coordinator status shown on their ID badges.

DSW-Volunteer evaluators work in the private sector, are retired, or work for the federal government. In the latter case, federal workers would need to take time off from work in order to assist the State of California, so they are classified as volunteers.

DSW-Volunteers are affiliated with a professional partner organization based on their license or certification. These partner organizations include the American Construction Inspectors Association (ACIA), the American Institute of Architects (AIA), the American Society of Civil Engineers (ASCE), and the Structural Engineers Association of California (SEAOC).

Out of state SAP evaluators have ID cards that simply identify which state or U.S. territory they reside in. These are deployed to California through EMAC. They, too, are affiliated with the same professional organizations as the DSW-Volunteers, with the exception of out-of-state building inspectors, who are affiliated with the International Code Council (ICC), rather than CALBO.

2.7 - SAP Qualifications of Membership

Cal OES associates SAP evaluators with a professional organization, whether they are members of the organization or not. This is only for deployment purposes (when you need an architect, AIA would be the likely organization to contact, and so forth).

The exception to this would be when a person works for a State of California agency, in which case, their state agency is shown on their SAP ID badge.

SAP Evaluators in the statewide emergency response cadre must also:

- Meet minimum professional license or building inspection certification requirements.
- Attend an instructor-led training by a Cal OES certified trainer.

- Have a digital picture taken.
- Complete the digital registration form.
- Sign the Loyalty Oath per CA Government Code Section 3102, if a California resident and not a California state or local government employee. (Persons not residing in California do not need to do this.)

Certifying Agency	License or Certification	Designation on Card
50 States + Puerto Rico	Architect	Architect
50 States + Puerto Rico	Civil Engineer	Civil Engineer
50 States + Puerto Rico	Structural Engineer	Structural Engineer
50 States + Puerto Rico	Geotechnical Engineer	Geotechnical Engineer
50 States + Puerto Rico	Professional Geologist	Geologist
50 States + Puerto Rico	Engineering Geologist	Engineering Geologist
50 States + Puerto Rico	State-certified Building Inspector	Building Inspector
CA DGS/Division of the State Architect	DSA School Construction Inspector Classes 1 & 2	Building Inspector
CA Healthcare Access & Information (HCAI)	HCAI Hospital Inspector Class A	Building Inspector
American Construction Inspectors Association	Registered Construction Inspector Division II	Building Inspector
ICC	Building Inspector	Building Inspector
ICC	Commercial Building Inspector	Building Inspector
ICC	Residential Building Inspector	Building Inspector
ICC	Combination Inspector	Building Inspector
ICC	Commercial Combination Inspector	Building Inspector
ICC	Residential Combination Inspector	Building Inspector
ICC	Building Plans Examiner	Building Inspector
ICC	Residential Plans Examiner	Building Inspector

ICC	Combination Plans Examiner	Building Inspector
ICC	Building Code Specialist	Building Inspector
ICC	Building Code Official	Building Inspector
ICC	Certified Building Official	Building Inspector
ICC	Master Code Professional	Building Inspector
American Construction Inspectors Association	Registered Construction Inspector Division IV	Public Works Inspector
City of Los Angeles	Construction Inspector	Public Works Inspector

Figure 2.11 – Safety Assessment Program Approved Licenses and Certifications

The above list shows the approved professional licenses and inspection credentials required for membership in the Safety Assessment Program. Every one of these certifications/licenses requires some understanding of building structural load path. For this reason, one does not find mechanical engineers or electrical inspectors among these. Nor are there specialty inspectors, such as underground storage tank (UST) or welding inspectors. This list of approved licenses and inspection credentials is vetted through the SAP Steering Committee, made of representatives of the partner organizations and state agencies.

SAP ID badges are valid for 5 years from end of the month of the initial class date. (Example: if a class is held on 4/15/23, the badge expiration date would be 4/30/28.) Membership, and the SAP ID badge, can be renewed by attending another SAP Evaluator class, or by taking the online SAP Refresher course, available at the Cal OES SAP webpage.

If a person does not have one of these professional licenses or inspection credentials at the time of taking this SAP Evaluator class, the person has five years to obtain the license or credential. Then they just must let Cal OES know (at sap@caloes.ca.gov) that they now have one of the necessary licenses or credentials.

Cal OES customarily sends an email notification of badge expiration about 3 months before the ID badge expires, so the SAP evaluator can recertify by taking the online course, or attending a SAP Evaluator class.

If the SAP evaluator's ID card expires, they will not be deployed in an activation until their ID card is renewed. The SAP evaluator with an expired ID card has 13 months to renew through the SAP online refresher class, which can take 90 to

120 minutes to complete, after identity confirmation by Cal OES. Their ID card can also be renewed by taking a regular SAP Evaluator class.

If the SAP evaluator fails to renew their SAP ID card 13 months after their ID card expires, that person will need to take an instructor-led class to renew, whether in person or online.

Unit 3: Rapid Evaluations

3.1 – Multi-Hazard Capabilities of the Safety Assessment Program

While the Safety Assessment Program has its roots in earthquake response, the program was expanded starting in the 2000s to include other disaster types. This expansion continues to this day, and now includes:

- Earthquakes
- Floods
- Tsunamis and Seiches (lake tsunamis)
- Windstorms
- Hurricanes
- Tornados
- Debris flows, mud flows, and lahars (flows caused by snowmelt on volcanos)
- Explosions
- Excessive snow loads
- Fires

The procedures for evaluating non-earthquake damage are the same as for those used for earthquakes; you are simply looking for different things. For example, instead of looking for liquefaction from an earthquake, you could be looking for scour around a foundation caused by flooding, or the oversaturation of soils on a hillside that could lead to a landslide or debris flow.

Keep in mind that strong winds can blow out windows, then start working on all interior elements, including storage racks holding hazardous materials. With that, a hazardous materials spill can take place, just as it often occurs with earthquakes.

3.2 – Earthquakes

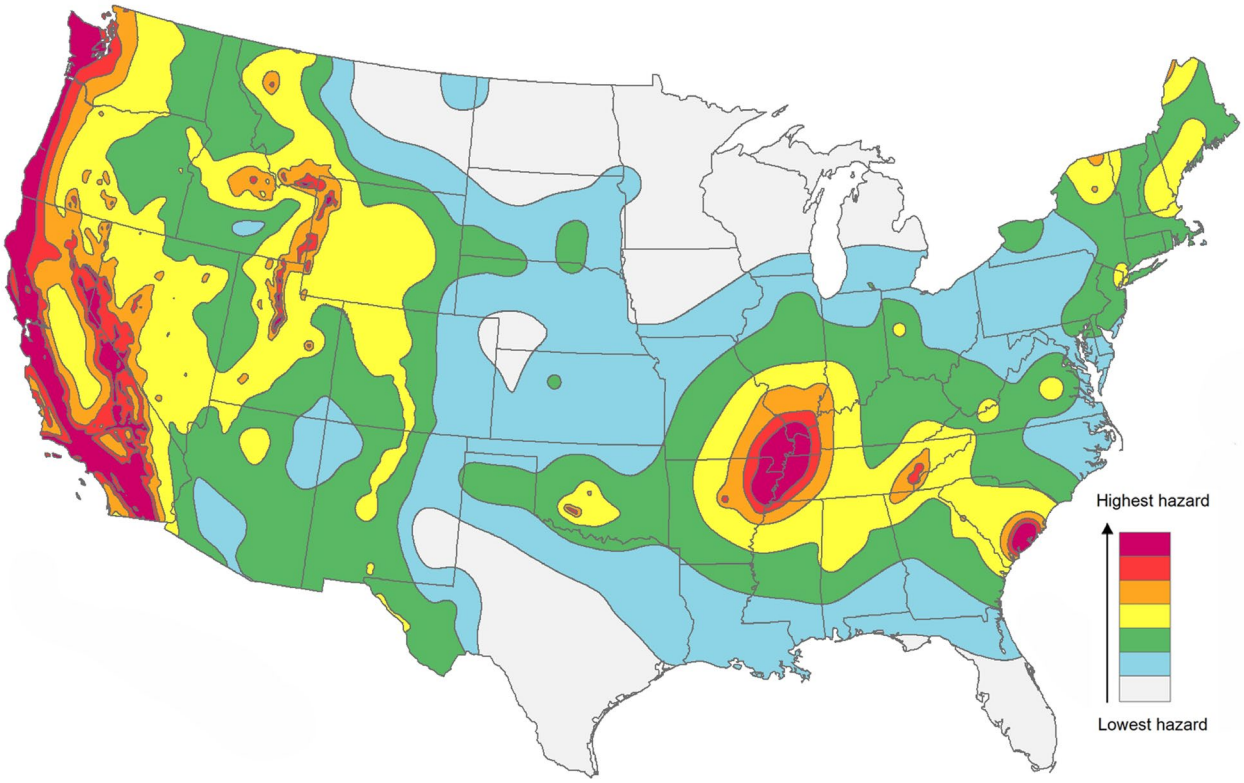


Figure 3.1 – Seismic hazards map for the continental U.S. Image courtesy of USGS.

Map shows the seismic hazards in the continental United States. Besides the seismic hazards found in California, hazards exist in Oregon and Washington with the Cascadia Subduction Zone. In Utah, the Wasatch Fault threatens Salt Lake City and the surrounding area. The Yellowstone Caldera has earthquakes associated with magma displacement. Human-induced earthquakes from fracking practices occur in central Oklahoma. One of the greatest threats to infrastructure in the U.S. is the New Madrid Fault at the juncture of Tennessee, Missouri, Illinois, and Kentucky, where three earthquakes of approximate 7.8 to 8.0 magnitude occurred in 1811 and 1812, one of these reversing the flow of the Mississippi River. Historical earthquakes occurred in Charleston, South Carolina, and in New England. A fault line capable of a magnitude 7 earthquake runs through Knoxville, Tennessee, but it has not delivered an earthquake of that magnitude in historic times.

3.2.1 – Earthquake Effects

- *Faults* are geologic junctions where crustal plates move against one another. The motion itself is called *faulting,* which creates earthquakes. If structures are built on top of a fault line, heavy damage to the structure is inevitable. The Alquist-Priolo law in California requires the identification of nearby fault lines to new construction.
- *Landslides* are unstable geological features on hillsides and mountains. They are associated with slip planes beneath the surface, which allow for movement, especially in an earthquake, or when the soils are saturated.
- Earthquakes will also destabilize saturated soils to cause *mudslides,* and send *rockslides* cascading down mountains to cause further damage.
- *Liquefaction* occurs in sandy soils that have high water tables. The soil temporarily loses its shear strength and resembles a fluid mass. This wreaks havoc on foundations and the buildings attached to them. The earthquake-induced pressures force water through the surface, taking sand with it. This causes sand boils, which resemble sand volcanos. These are a clear sign of local liquefaction.
- *Tsunamis* occur when the ocean floor displaces the water above it with great force. This happens in offshore subduction zone earthquakes with magnitudes greater than 7.2. Tsunamis can also be generated by large landslides, whether from above the water or below the surface.
- *Seiches* are tsunami-like waves that occur in lakes and other inland waters. They are also generated by either earthquakes or landslides.
- *Shaking* occurs with three types of seismic waves. P-waves cause vertical forces, and move more rapidly than the more damaging S-waves, which cause lateral force damage to structures. Both of these wave types mostly damage structures near the fault line ("near field"), and are dampened by rock formations, especially mountains. Long waves have periods of one second or greater, and travel throughout the earth's crust. These waves can cause damage at a great distance, especially to taller buildings.

  Every structure has a fundamental resonance period based on its mass, height, and stiffness. In the near field, shorter buildings will be damaged by the P- and S-waves there, while taller buildings can be damaged by long waves at a distance from the epicenter. One example of this was the 1985 Mexico City earthquake, where concrete buildings 8 to 12 stories in height collapsed from a magnitude 8 earthquake that occurred over 200 miles away.

3.2.2 – Common Damage Types from Earthquakes

- *Shear cracking* is manifested in X-shaped cracks appearing in the walls of structures.
- *Building off foundation* occurs when a building is not properly attached to its foundation (or not attached at all), and the lateral seismic forces push the building off its foundation.
- *Utility cut off* occurs due to rigid utility connections, such as gas, sewer, and water, breaking because of building and ground movement.
- *Racking* is a type of structural failure mode, where the building begins to lean, and the once rectangular building now resembles a parallelogram or rhombus.
- *Pounding* occurs with two buildings that are too close together and are of different heights and/or stiffnesses. The earthquake vibrations cause the buildings to move at different rhythms, and they slam into one another, causing damage.
- *Falling hazards* include building parapet and chimney failure, and porch failure. While not structural, these are life-threatening damages that must be taken very seriously.
- *Soft-story failure* occurs when the first floor of a building has an understory garage and is not properly designed to resist lateral forces. The earthquake causes the structure to fail at the first floor, and the building can end up completely crushing the first floor.
- *Liquefaction* causes tall buildings without adequate foundations to begin tilting, or to fall over. Liquefaction can also damage brittle structures that lack adequate steel reinforcing, regardless of height.

Figure 3.2 – Soft story failure, building severely tilting, 2018 Taiwan Earthquake.

Figure 3.3 – Partial collapse of the O'Higgins Building in Concepcion, Chile.

Figure 3.4 – Shear cracking in masonry infill wall.

Figure 3.5 – Partial soft story failure, 1989 Loma Prieta Earthquake.

Figure 3.6 – Effects of seismic pounding, Chile.

Figure 3.7 – Cracked chimney, 1994 Northridge Earthquake.

Figure 3.8 – Collapsed chimney through roof, 2014 Napa Earthquake.

Figure 3.9 – House slid off its foundation, 1994 Northridge Earthquake.

3.3 – Effects of Floods, Tsunamis, and Seiches

- *Slow moving, or inundation flooding* is the most common type of flooding, when rivers and lakes are beyond capacity, and the waters move through neighboring areas. Hurricanes also drive storm surge waters onshore with similar effects. These can cause:
    - *Structural damage* from the lateral forces of the moving water, as well as from undermining or scouring of the building foundations.

  - *Contamination* from the chemicals and bacteria present in the floodwaters.
  - *Water damage*. This seems obvious, but a primary aspect of flood damage is the presence of post-flood mold. This can make occupying the building dangerous unless proper mold remediation takes place.
  - *Electrocution hazards* can be present if power has not been cut off. The waters can fill electrical outlets and other power features, and cause a path to ground. This is very dangerous for responders and survivors alike.
  - *Debris accumulation* is common with flooding, since woody debris floats, and will find its way to a catching point and stack up. Even objects not inherently buoyant, such as vehicles, will be pushed along by floodwaters and find resting places.
- *Flash flood, or tsunami/seiche:* These flooding types have very different causes, but share the violent, high velocity nature of rapidly moving water. Flash flooding is possible on steep mountain slopes; tsunamis occur near the ocean, while seiches occur near lakes and other water bodies. In addition to the effects noted above for inundation flooding, these flooding types have these effects:
  - Flash floods can bury objects and victims in many feet of debris.
  - Tsunamis cause damage when they come onshore, and cause damage when the waters retreated back to the ocean. There was a case where the 2011 Tohoku Earthquake tsunami weakened a mid-rise building with pile foundations as it came onshore, then tore the building off its pile foundations as the waters retreated. The same may be the case for a seiche.

Figure 3.10 – Inundation flooding

SAP evaluators should **never** try to do safety assessments of buildings while there is still floodwater present! Conditions are too unsafe, and a proper evaluation is not possible without being able to see the building foundation.

Figure 3.11 – Mold impacting residence, 2005 Hurricane Katrina. Photo courtesy Raymond Lui.

As stated above, mold is a common problem caused by flooding. Mold needs organic material, along with warm, dark, and damp conditions, in order to prosper. In view of this, breathing air with a high mold spore count is dangerous, and can be deadly. Protection with at least a National Institute of Occupational Safety and Health (NIOSH) N-95 mask is imperative for entering a structure with

widespread mold contamination. Of course, if one is mold sensitive to begin with, there is no point in entering a mold contaminated structure.

Figure 3.12 – Flood damage to foundation wall, 2012 Hurricane Sandy.

Figure 3.13 – Storm and flood erosion washed away supporting soils from under foundation. House is now UNSAFE.

Figure 3.14 – House floated off its foundation and came to rest destructively on a different foundation. 2005 Hurricane Katrina. Photo courtesy Raymond Lui.

Figure 3.15 – Flooding 22 feet deep floated a home with a concrete post-tension slab right out of the ground. 2005 Hurricane Katrina. Photo courtesy Raymond Lui.

Figure 3.16 – The 2011 Tohoku Tsunami comes over the top of a 30-foot-high tsunami barrier wall.

3.4 – Effects of Windstorms, Hurricanes, and Tornados

- *Lateral loading of structures*: Just as earthquake damage buildings with base shear forces, so windstorms impact buildings with lateral forces, mostly at the higher parts of the building. This can lead to the roofs being torn off, and in more extreme cases, the building being demolished.
- *Removal of structures from inadequate foundations*: Tornados can lift structures not properly attached to foundations and toss them elsewhere. Strong hurricanes can also do this.
- *Partial or complete structural failure*: This was touched on in the 'lateral loading' portion of this discussion.
- *Damage by projectiles*: Shreds of debris can become destructive and life-threatening projectiles in a tornado or hurricane. Tornados can even drive straw into telephone poles, and have driven wood into concrete curbs. Even vehicles can become projectiles in a tornado.

Figure 3.17 – 2021 tornado in New Jersey heavily damaged this house.

Figure 3.18 – Hurricane Katrina winds tore off the back of this house. Photo courtesy Raymond Lui.

Figure 3.19 – Tornado damage in Oklahoma destroyed half of a house, but left the rest in place.

Figure 3.20 – An EF-3 tornado heavily damaged the community of Chapman, Kansas, in 2008.

Figure 3.21 – Hurricane Katrina tore the roof off this building, and began destroying the building's three unreinforced masonry walls. Storm surge flooding filled the building up to about seven feet high, and part of the building above the water line caught on fire. This photo shows that the door is still intact. Photo courtesy Raymond Lui.

Figure 3.22 – High winds snapped a tree, which caused roof damage.

Figure 3.23 – Building survived 2018 Hurricane Michael winds and storm surge in the Florida panhandle, due to being properly mitigated for flood and lateral wind loads.

3.5 – Snow Load Effects

The roofs of buildings are designed for a certain amount of live load, but this will be exceeded if the building does not have a roof that sheds snow, and is not designed for excessive snow loads. This can lead to the following conditions:

- Sagging ceiling tiles or boards
- Sagging roof members
- Roof trusses with sagging lower chords
- Cracked or split wood members
- Structural cracks in walls or masonry
- Severe roof leaks

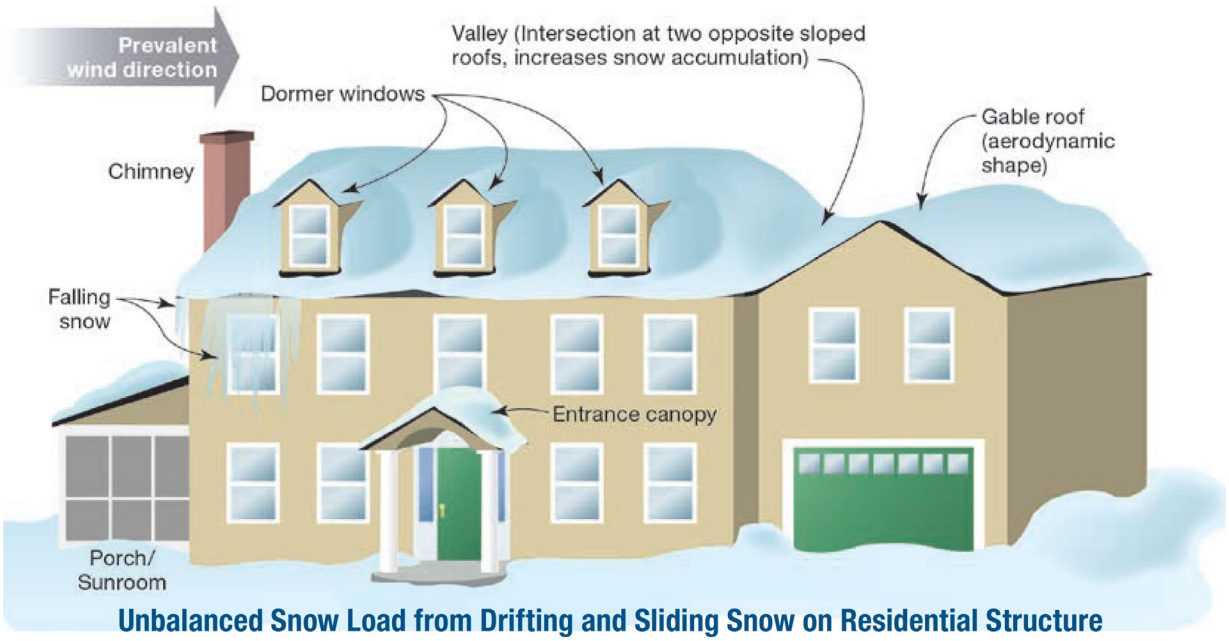


Figure 3.24 – Illustration showing unbalanced snow load issues on a house.

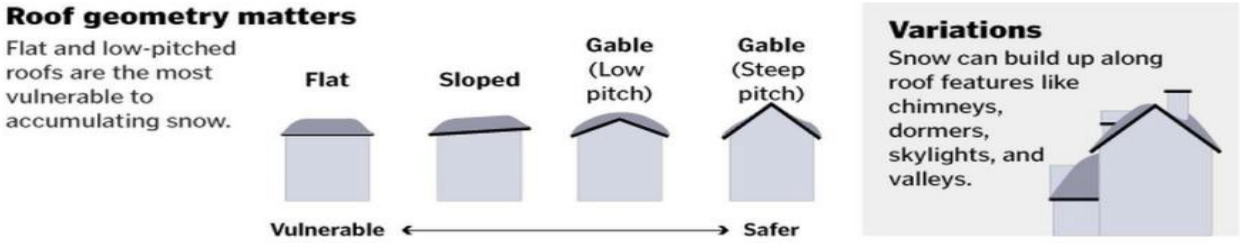


Figure 3.25 – Illustrations showing effect of roof geometry on snow loading.

Roof geometry matters greatly in regard to excessive snow load. A steep roof will naturally shed snow, whereas a lightly sloped roof or flat roof will accumulate excessive snow to dangerous levels. Projections in a roof, such as dormers, are likely to accumulate snow drifts.

Figure 3.26 – Snow load caused failure of apartment roof and endangered structure, which was red-tagged. 2023 South Tahoe Snow Load Damage mission. Photo courtesy Gurbir Singh.

Figure 3.27 – Snow load caused full collapse of roof. 2023 South Tahoe Snow Load Damage. Photo courtesy Gurbir Singh.

Figure 3.28 – Snow load causing beam over garage door to sag. South Tahoe Snow Load Damage. Photo courtesy Brandon Miller.

3.6 – Fires and Explosions

Most fires will not require the services of the statewide Safety Assessment Program, but local SAP-trained building inspectors can use the principles of ATC-20 to evaluate structures damaged by fire.

History shows that the Safety Assessment Program was not mobilized for even the large-scale firestorms that plagued the state, due to the multi-jurisdictional nature of these fires. The local jurisdictions simply did not need assistance; it does not take much time to post an Unsafe placard at a completely destroyed structure.

Two recent exceptions to this observation were the 2022 Dixie and Caldor Fires. Both fires involved widespread damage within a single county jurisdiction, so assistance was requested.

Fire effects on structures include:

- Complete destruction (normal)
- If structure remains, steel beams and columns can be weakened and deformed.

- Thermal damage to concrete, leading to cracking, spalling, and other forms of deterioration.

As for explosions, these can be either accidental, which is the case most of the time, or deliberately done.

In urban settings, explosions can cause racking damage to structures, as well as projectile damage, for some distance from the 'ground zero' or source of the blast. The lateral blast force follows the "four-square" law, where the force of the blast is inversely proportional to the square of the distance from ground zero.

Buildings left standing near the ground zero may become very unstable.

Figure 3.29 – Flour dust explosion destroyed a concrete granary. Fuels for dust explosions also include paper dust, wood dust, and some metal dusts.

Figure 3.30 – The 1947 Texas City, TX, ammonium nitrate explosion. Killed 600 people, caused damage to industrial structures three miles away, caused a tsunami-like surface wave in the harbor, and set on fire another ship carrying ammonium nitrate, which also exploded. One of the worst explosions in U.S. history.

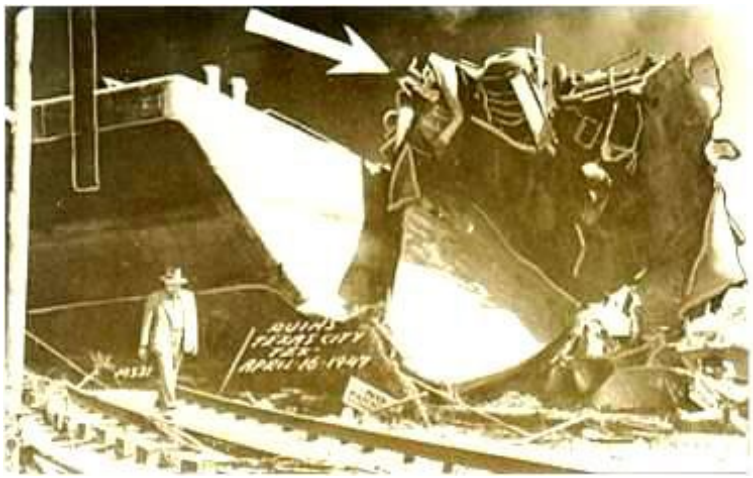


Figure 3.31 – 1947 Texas City explosion. Barge was tossed onshore, while a fire engine landed on the barge as a projectile.

Figure 3.32 – 1995 Oklahoma City bombing of the federal Murrah Building by terrorists.

Figure 3.33 – Loss of an entire floor due to a natural gas explosion in the Humberto Building in Puerto Rico in 1996.

Figure 3.34 – 2020 ammonium nitrate explosion in Beirut, Lebanon. Registered as a M3.3 earthquake by USGS, caused 218 deaths and injured 7,000 people. Shook the entire country of Lebanon, and was felt in Turkey, Syria, Palestine, Jordan, and Israel, as well as parts of Europe. Was heard in Cyprus 240 miles away.

Figure 3.35 – Explosion damage to an apartment building in West, Texas, in 2013. Explosion came from a fertilizer plant.

Figure 3.36 – 1991 East Bay Hills Fire. 3,354 single family residences and 456 apartments destroyed in Oakland and Berkeley. 25 fatalities, 52 injured, and about 10,000 left homeless. Over $1.5 billion in damage.

Figure 3.37 – 2017 Tubbs Fire destroyed the Coffey Park neighborhood in Santa Rosa, CA. At least 22 people died, and around 5,643 buildings were destroyed, half of which were in Santa Rosa.

3.7 – Debris Flows, Mud Flows, Landslides, and Lahars

Debris flows and mud flows are often the result of oversaturation of soils on steel hillsides. Some soil types, such as decomposed shale, are very prone to becoming a mud flow.

Debris flows can also be caused by the conditions prevalent after a wildland fire. The fire vaporizes the waxes found naturally in plants; these condense on the cooler soil in the area. This leads to a water-repellent, or hydrophobic, condition. When rains come, the water is not slowed by plant material and absorbing soils, but instead rockets down hillsides, carrying debris of all sizes with it.

As discussed for earthquakes, landslides are naturally occurring geologically unstable features. Excessive storm water can soak into the landslide and reach the slip plane. This could be a layer of clay that resists water infiltration. In essence, the water lubricates the slip plane. The result is that the mass of soil and rock above the slip plane starts to move, sometimes catastrophically.

A lahar is a debris flow usually caused by a volcanic eruption. Lahar is an Indonesian word describing when a volcanic eruption melts the snow on the peak. This sudden release of water causes a cascading debris flow. The debris flow can bury entire communities.

In California, Mount Shasta and Mount Lassen are two active volcanos with the potential for generating lahars.

Lahars can also develop without a volcanic eruption if the snowmelt conditions are right.

Figure 3.38 – Mudflows damage a home in La Canada Flintridge in 2010.

Figure 3.39 – 2005 La Conchita landslide damaged or destroyed dozens of homes and caused 10 fatalities.

Figure 3.40 – A lahar caused by Mt. Pinatubo in 1991 in the Philippines buried a town.

3.8 – Inspections

3.8.1 – Inspection Types

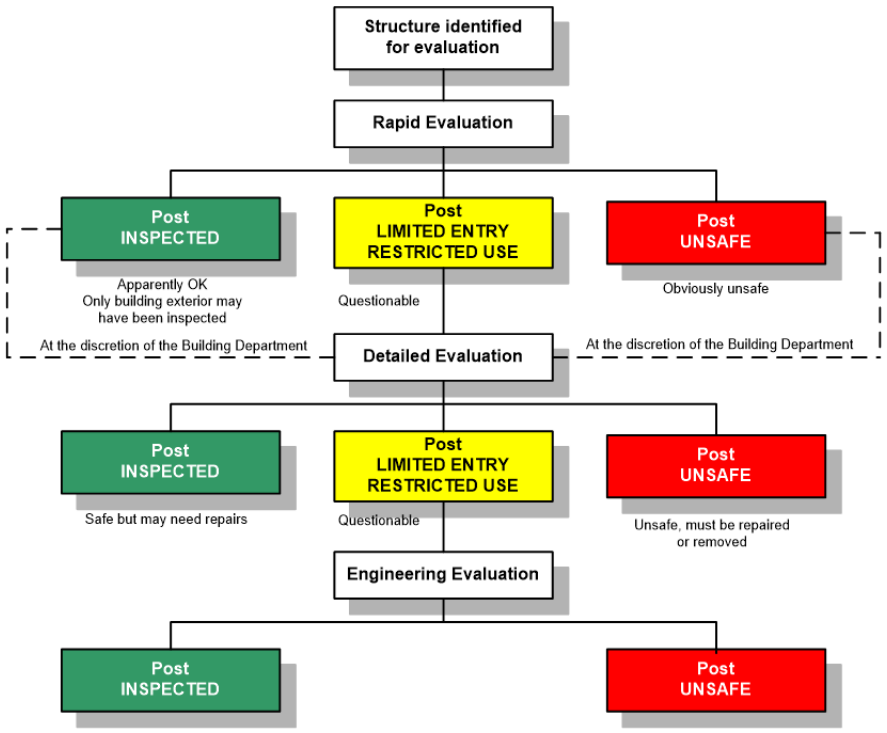


Figure 3.41 – Diagram showing the relationship between Rapid Evaluation, Detailed Evaluation, and Engineering Evaluation.

There are three types of evaluations shown in ATC-20, but only two of them are part of the Safety Assessment Program.

- *Rapid Evaluation* – Buildings are rapidly evaluated for significant or readily apparent damage. The average time per building is about twenty minutes, though this average includes all types of buildings, and all levels of damage. The actual rule of thumb is, "it takes what it takes!" The purpose of rapid evaluations is to quickly identify and post buildings as to whether they are fully usable, partly usable, or unsafe. If access to the interior is possible, and the building is safe enough, it can be entered for a quick walk-through. This allows for the discovery of any serious damage or falling hazards within the building.
- *Detailed Evaluation* – Buildings are evaluated more thoroughly, with more investigation into the framing and load path systems, as well as a closer look at nonstructural elements. Detailed evaluations can take between one and four hours. This level of evaluation is usually used for buildings where the condition is not obvious. Sometimes, a jurisdiction with low-level sporadic damage may want all detailed evaluations of their small number of damaged buildings.
- *Engineering Evaluation* – This level of evaluation is performed by the building owner's own hired engineers or architects, and is not part of the Safety Assessment Program. In an engineering evaluation, buildings are examined using all available data to find the damage, its causes, and how to fix the building. It will likely involve destructive examination, and will likely result in a scope of work together with a rough estimate of how much the project will cost. Engineering evaluations can take anywhere from one full day to several weeks, depending on the size and complexity of the building.

3.8.2 – Supplies

The SAP evaluator needs to bring to the field supplies essential to personal protection and safety. These include:

- Hard hat
- Safety shoes
- Gloves
- Eye protection
- NIOSH N-95 masks
- Cellphone with backup power
- Emergency whistle (wear around neck)

Other recommended items include permanent ink fine point markers. These are for marking the placards. More recommendations can be found in the Evaluator Job Aid in the Appendix of this manual.

Local government needs to supply the following:

- Inspected (green) placards
- Restricted Use (yellow) placards
- Unsafe (red) placards
- Rapid or Detailed Assessment forms, either in paper version, or in an electronic version such as Survey 123 used by Cal OES
- Caution tape (for barricading)
- Packing tape or duct tape (to attach placards to buildings)
- Staple gun (also to attach placards to buildings)
- Map of the area
- Addresses or blocks for the team to evaluate
- Emergency contact numbers for law enforcement, fire, building department, hazmat, utilities, and animal control.

3.8.3 – Inspection Procedure

After arriving at the building site:

- One member of the team remains in a safe location, while the other examines the building. This creates a safety watch, so if the person looking at the building gets into trouble, the other can call for assistance.
- After confirming that the building is safe to approach (in other words, does not seem to be in danger of imminent collapse), survey the exterior of the building. This involves walking completely around the building, examining the exterior from the foundation to the roof.
- If it is possible, and if it is safe to do so, examine the building from the inside.
- Watch for and identify non-structural hazards, such as damaged parapets, chimneys, porches, or awnings.
- Watch for and identify any other types of hazards, such as hazardous material spills, or damaged utilities such as propane, natural gas, or electrical.
- Complete the assessment form, whether electronic or paper version, and use the findings from the form to arrive at which placard to post on the building.
- Complete the placard and post the building. (A single-family residence would likely have one placard posted at the front of the building. A large

office or government building, or an apartment building, would have placards posted at every entrance, so all approaching the building would know the status of the building.)

Keep in mind, every building receives *only one type of placard!* A SAP evaluator must **never** post with two different placards, such as a green Inspected placard at the front door, and a yellow Restricted Use or red Unsafe placard at the back door. The entire building must be consistently identified with a single type of placard. Otherwise, the public will be confused, and will completely disregard what the placards say. This would work against the purpose of the program.

Also, if the SAP evaluator is re-examining a building that is already posted, and the posting needs to change, the old placard must be either taken down and replaced, or covered completely with the new placard. **Never** leave the old, out-of-date placard up and put the new one next to it. That would have the same result as double placarding a building, as noted above; the public would be confused and ignore the placards.

3.8.4 – Rapid Assessment Form

On this form, you will gather all the pertinent information related to the condition of the building that you are examining. Whether a paper or an electronic version, *this form must be completed before the building is tagged;* the form will lead the evaluator to the best placard to tag the building with.

These forms will be handed in to the local SAP Coordinator, so the local building department has a record of what was discovered in the field. The local building department can use these forms as the starting points for any follow-up inspections that need to be done.

An easy-to-read version of the Rapid Assessment Form follows on the next few pages. The one-page version is in the Appendix.

ATC-20 Rapid Evaluation Safety Assessment Form

Inspection

Inspector ID_____ Inspection date & time_____

Affiliation_____ ___ Inspected exterior only

___ Inspected exterior and interior

Building Description

Building name: _____

Building Area: _____ Address: _____

Building contact & phone: _____

Number of stories above ground: _____ below ground: _____

Approximate footprint area in square feet: _____

Number of residential units: _____

Number of residential units not inhabitable: _____

Type of construction (check the appropriate space):

___ Wood frame ___ Concrete shear wall ___ Steel frame

___ Concrete frame ___ Tilt-up concrete ___ Reinforced masonry

___ Unreinforced masonry Other: _____

Primary Occupancy (check the appropriate space):

___ Dwelling ___ Commercial ___ Government

___ Other residential ___ Offices ___ Historic

___ Public assembly ___ Industrial ___ School

___ Emergency services Other: _____

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Observed Conditions:	Minor/None	Moderate	Severe
Collapse, partial collapse	_____	_____	_____
Building off foundation	_____	_____	_____
Building or story leaning	_____	_____	_____
Racking damage to walls	_____	_____	_____
Other structural damage	_____	_____	_____
Falling hazard (chimney, parapet, etc.)	_____	_____	_____
Ground slope movement/cracking	_____	_____	_____
Other:_____	_____	_____	_____

Comments: _____

_____

Estimated Building Damage (excluding contents):

___ None

___ 0 to 1%

___ 1 to 10%

___ 10 to 30%

___ 30 to 60%

___ 60 to 100%

___ 100%

Posting

Choose a posting based on the evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Localized *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Post INSPECTED placard at main entrance. Post RESTRICTED USE and UNSAFE placards at all entrances. Each building gets only one type of placard.

___ INSPECTED (Green placard)

___ RESTRICTED USE (Yellow placard)

___ UNSAFE (Red placard)

Record any use and entry restrictrions for RESTRICTED USE placard exactly as written on the placard: _____

_____

_____

Further Action

___ Barricades needed in the following areas:_____

_____

___ Detailed Evaluation recommended: ___ Structural ___ Geotechnical

Other recommendations: _____

Comments: _____

_____

Instructions for completing the Rapid Assessment Form:

- Inspector ID – use your SAP ID number, and you can put your name on this form. (On the placards, *only use your SAP ID number, not your name!)*
- Affiliation – note the organization (such as ASCE) that you are affiliated with.
- Inspection Date and Time – very important, the Building Official or SAP Coordinator can use this information to see if the building should be re-evaluated if a large aftershock takes place.
- Areas Inspected – identify if you saw just the exterior, or if you examined the exterior as well.
- Building Name – if the building has a name.
- Address – it is very important to have the address of the building.

- Building Contact/Phone – if available, so the building department can easily reach the contact person for the building, if necessary.
- Numbers of Stories Above and Below Ground – this helps eventually with identifying the total square footage of the building.
- Footprint Area – this is the area of the first floor only. Can be approximated by pacing off the building; it is not necessary to use a measuring tape.
- Number of Residential Units and Number of Units Not Inhabited – these items will help the jurisdiction estimate how many displaced persons there are, and the need for long-term shelters or temporary housing.
- Type of Construction – what the building is built of.
- Primary Occupancy – main use of the building.
- Observed Conditions – under "Minor/None," "Moderate," or "Severe," check off the observed conditions related to each of the issues listed on the form. This quick check will help identify how to post the building.
- Estimated Building Damage – use your personal judgment to estimate the percentage range of damage to the structure. Do not include any comments or consideration of the building contents in this.
- At the bottom of the form is where you write in how you posted the building. There is also room for comments; this is where you will need to record the comments on the Restricted Use placards as to how the building was damaged, and how use of the building is restricted.
- In the bottom section, you can also ask for barricades, recommend that a Detailed Evaluation be done, or make other comments on the building hazards.

3.8.5 – INSPECTED Placard

An easy-to-read version of the INSPECTED, or green, placard, is on the next page. The regular placard is found in the Appendix.

All writing on placards must be made with permanent ink, not with ball-point pen, so as to reduce the degree of fading of the writing over time.

It is very important to write the date and time on the placard that the building was evaluated. If a strong aftershock takes place, the Building Official may direct that all buildings evaluated before the aftershock be evaluated again. The date and time of evaluation would make clear if this tagged building must be re-examined.

The building address must also be clearly marked in case the placard gets moved illegally to another building.

(PLACARD EXAMPLE)

INSPECTED

LAWFUL OCCUPANCY PERMITTED

This structure has been inspected (as Indicated below) and no apparent structural hazard has been found.

Date_____

Time_____

(Caution: Aftershocks since inspection may increase risk.)

☐ **Inspected Exterior Only**

☐ **Inspected Exterior and Interior**

Report any unsafe condition to local authorities; reinspection may be required.

Inspector comments:

_____

_____

_____

This facility was inspected under emergency conditions by:

Jurisdiction:_____

Address:_____

Telephone:_____

Facility name and address:

_____

_____

Inspector ID/Agency:

_____

_____

Do Not Remove, Alter, or Cover this Placard until Authorized by the Building Official

(Municipal Code Section XXX)

You can mark in the check boxes to show if the building was just examined on the outside, or if you were able to do an interior examination as well.

Please do not write your name on the placard in the lower right corner, but only write in your SAP ID number. **This is for your protection!** If a phone number is needed on the placard, use the Building Department's phone number.

Keep in mind that the INSPECTED placard, or tag, means that the building can be used without any sort of safety restrictions, just as it was before the incident. If a restriction exists, the building should be tagged RESTRICTED USE (yellow).

The INSPECTED placard only means that the building seems to have survived the last event. It does not guarantee that it will survive the next event!

Figure 3.42 – Manufactured home survived 2022 Ferndale Earthquake. Shifted one inch on its foundation. Tagged INSPECTED. Photo courtesy Gurbir Singh.

Figure 3.43 – House survived the 2023 Ferndale Earthquake. Minor drywall cracks and a minor crack in concrete foundation observed; could have been present before the earthquake. Tagged INSPECTED. Photo courtesy Gurbir Singh.

Figure 3.44 – House survived the 2022 Ferndale Earthquake. Damage to front entrance stairs, damage to stucco and interior plaster, still livable. Tagged INSPECTED. Photos courtesy Gurbir Singh.

3.8.6 – RESTRICTED USE placard

An easy-to-read version of the RESTRICTED USE, or yellow, placard is found on the next page. The regular version of the RESTRICTED USE placard can be found in the Appendix.

The RESTRICTED USE placard covers the wide range of possibilities between a building without serious damage or apparent risk (INSPECTED), and a building that is dangerous to enter (UNSAFE). The building may or may not be habitable; there could be falling hazards, and/or damage to structural elements.

There are two versions of the RESTRICTED USE placard in use. Either of them is acceptable. One uses a text box for the use or restrictions on the property, and the other uses check boxes.

In addition to marking up the placard as described for the INSPECTED placard, it is essential to identify:

- What the damage is to the structure;
- To what extent the building can be used, and what the restrictions for use are.

The restrictions may be minor ones, such as not using the front door, or not using a certain room, all the way to getting important belongings and leaving. The latter example would be with a building that seems stable enough, in your judgment, to quickly retrieve important belongings, but not stable enough to spend the night in it, or otherwise dwell there.

(PLACARD EXAMPLE)

RESTRICTED USE

Caution: This structure has been inspected and found to be damaged as described below:

_____

_____

_____

_____

Entry, occupancy, and lawful use are restricted as indicated below:

_____

_____

_____

_____

Facility Name and Address:

_____

_____

Date _____

Time _____

(Caution: Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions by:

Jurisdiction _____

Address _____

Telephone number _____

Inspector ID/Agency

_____

_____

Do Not Remove, Alter, or Cover this Placard until Authorized by the Building Official

(Municipal Code Section XXX)

Figure 3.45 – Wood beam across front porch cracked due to snow load. House was tagged RESTRICTED USE to prevent use of front door. 2023 Mono County Snow Load Mission. Photo courtesy Gurbir Singh.

Figure 3.46 – 2018 flooding in Montecito, CA, before and after flooding. Buildings tagged RESTRICTED USE due to cleanup and mold abatement before occupancy is possible. Arrows in lower photo point to tags still in place weeks after cleanup began.

3.8.7 – UNSAFE Placard

An easy-to-read version of the UNSAFE, or red placard, is found on the next page. The regular version can be found in the appendix.

The UNSAFE placard is used when there is an immediate life-safety risk associated with entry or occupancy of a building.

The UNSAFE placard further requires written authorization from the 'authority having jurisdiction' before the owner or tenant can enter the building. This allows for supervised entry for *brief* possession retrieval only when it is allowed by the jurisdiction. This permission also allows the building owner to temporarily mitigate the hazard by shoring (or other means acceptable to the building department) so as to gain access to the building.

When the UNSAFE placard was first used in the response to the 1989 Loma Prieta Earthquake, a common view among the public was that this placard was a demolition order. This is not the case! So, the phrase "This Placard Is Not a Demolition Order" was added to the placard.

The decision to either repair or demolish a building is usually driven by economics and good engineering. If a structure is not an imminent threat to other structures or to the public at large, the question of whether to demolish the building usually comes down to the most cost-effective solution for abating the hazard. Often, it is reasonable to repair the building rather than demolish it and start over.

For example, in San Francisco after the Loma Prieta Earthquake, there were 350 buildings tagged UNSAFE. Of these, only 50 had to be demolished; the rest were repaired.

Severe structural damage is not the only reason why a building may be red-tagged. Non-structural issues, such as a hazardous materials spill inside the building, or the threat of another structure collapsing onto the building, can also drive the use of the UNSAFE placard on a building that seems structurally sound.

(PLACARD EXAMPLE)

UNSAFE

DO NOT ENTER OR OCCUPY

(THIS PLACARD IS NOT A DEMOLITION ORDER)

This structure has been inspected, found to be seriously damaged and is unsafe to occupy, as described below:

_____

_____

_____

_____

Do not enter, except as specifically authorized in writing by jurisdiction.

Entry may result in death or injury.

Facility Name and Address:

_____

_____

Date: _____

Time: _____

This facility was inspected under emergency conditions by:

Jurisdiction: _____

Address: _____

Telephone Number: _____

Inspector ID/Agency

_____

_____

Do Not Remove, Alter, or Cover this Placard until Authorized by the Building Official.

(Municipal Code Section XXX)

3.8.7.1 – Structure Collapse Hazard Zones

The danger of building collapse is not limited to seismic events. One of the chief dangers facing fire fighters is a structural collapse that often occurs when structure fires are being fought. When fire fighters switch from attacking the fire to fighting the fire defensively, they will retreat to a radius beyond the collapse hazard of *one and a half times the height of the building.* This is because, once the building starts to collapse, it is too late to move firefighters and equipment to a safe location. The defensive fight must be fought from a position of safety to begin with.

The collapse zone of one and one-half times the height of the building allows for the building or exterior wall to fall over, and to allow for debris from the collapse to fly without causing injury.

This collapse zone safety radius is part of the federal Urban Search and Rescue (USAR) training, and is vigorously promoted by the National Institute of Occupational Safety and Health (NIOSH).

So, a weakened building 50 feet high would have a collapse hazard zone of 75 feet in radius. This federal guideline is used by the Safety Assessment Program.

Clearly, if there are other buildings within the collapse hazard zone, they are in danger of being damaged or destroyed by the collapsing structure and could not be safety occupied by anyone. This situation makes it imperative that they be posted UNSAFE, regardless of the damage they themselves have experienced. Once the collapse hazard is abated, the buildings can be re-examined individually and tagged per their own levels of damage.

Figure 3.47 – Collapsed high-rise building in Taiwan after an earthquake.

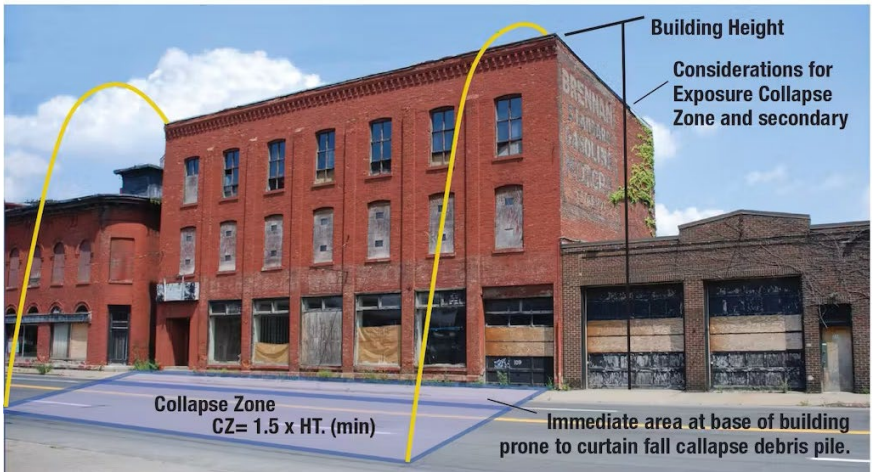


Figure 3.48 – Collapse zone illustration.

Figure 3.49 – El Centro Water Tower was 150 feet tall, and suffered extensive damage at its foundation supports due to base shear forces in the 2010 Baja Earthquake. Collapse zone was (150 ft x 1.5 =) 225 feet in radius. A duplex and an 8-unit apartment building were red-tagged as a result until the tower was removed. Photo courtesy David Karina.

Figure 3.50 – Bolt at pad footing of the El Centro Water Tower was sheared off due to earthquake. Photo courtesy David Karina.

Figure 3.51 – Base plate movement at the El Centro Water Tower spalled the grout on the footing. Photo courtesy David Karina.

Figure 3.52 – Excessive movement in the structure of the El Centro Water Tower caused rivets to pop. Photo courtesy David Karina.

Figure 3.53 – The collapse hazard caused by the El Centro Water Tower was abated by demolition. Photo courtesy David Karina.

3.8.8 – Evaluation Criteria

The examples in Figures 3.54 to 3.59 show where damage is likely to occur at weak points in a building.

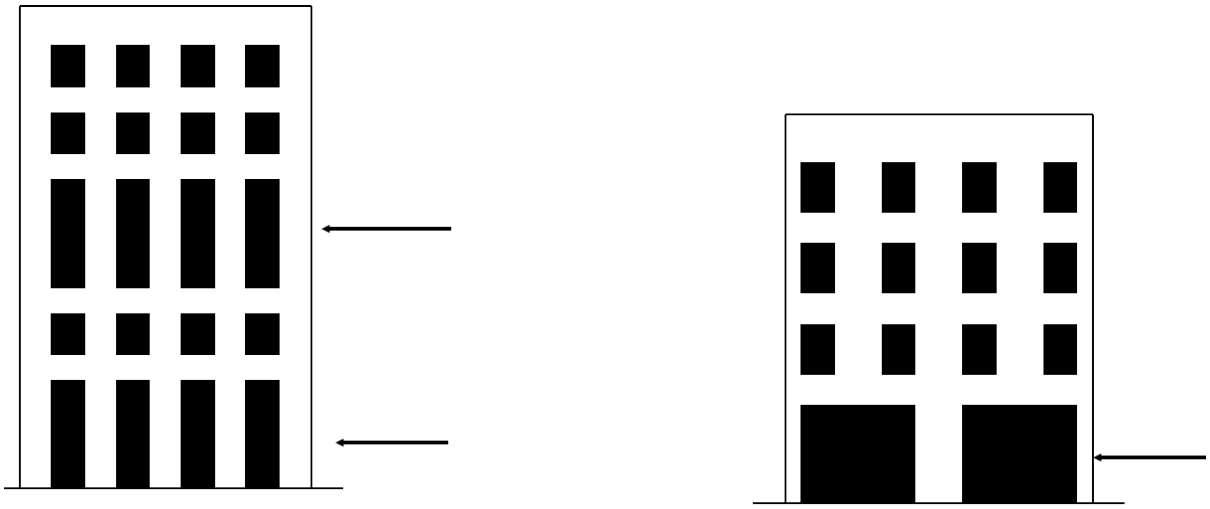


Figure 3.54 – Soft story failure points. Diagrams courtesy ATC.

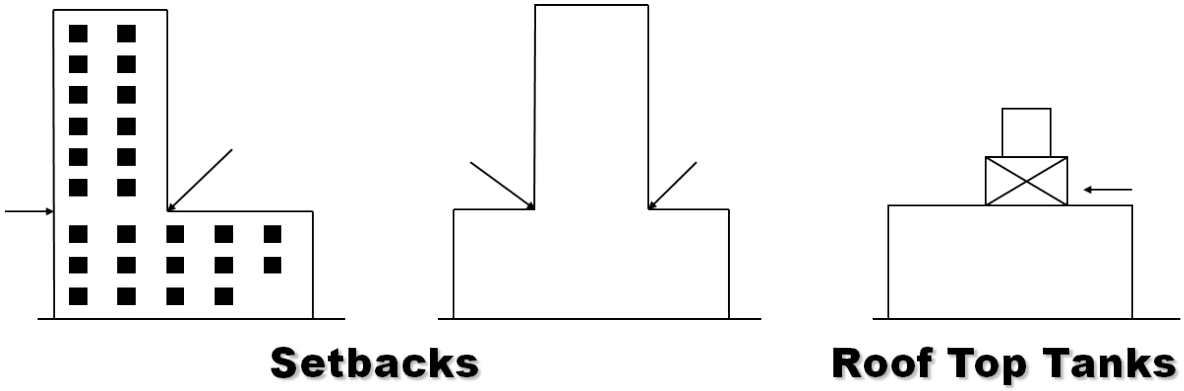


Figure 3.55 – Vertical setback failure points in earthquakes. Diagrams courtesy ATC.

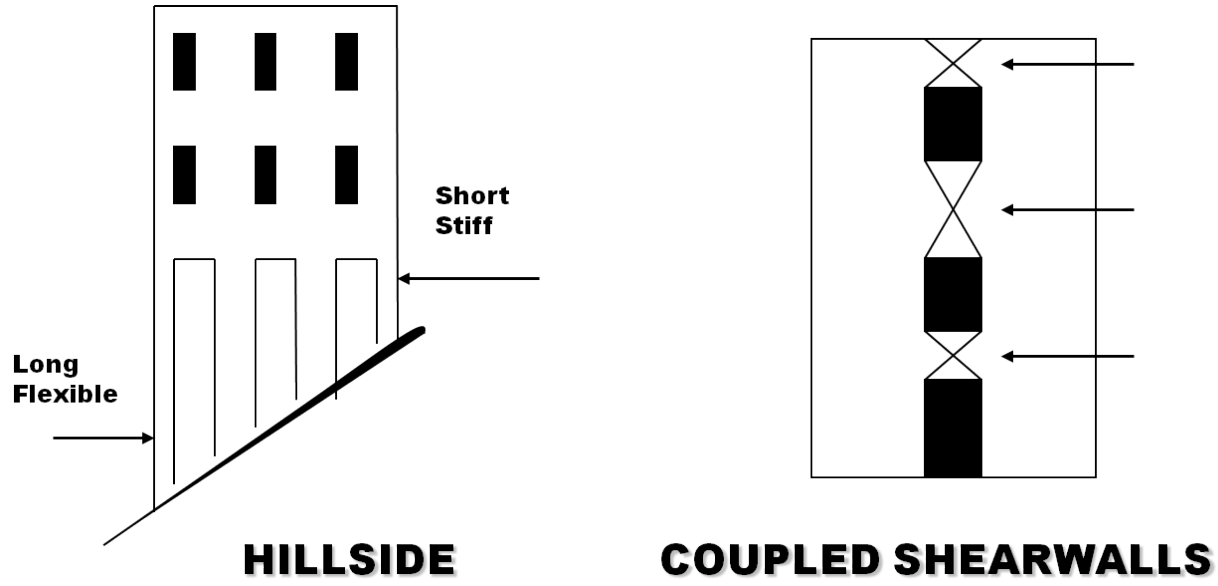


Figure 3.56 – Hillside column illustration, and shear wall failure between wall openings. Diagrams courtesy ATC.

For buildings on hillsides, damage will most likely occur in the short, stiff columns rather than the long, more flexible columns. The longer columns, of course, must also be reviewed, as they may have damage mid-height due to excessive deflection.

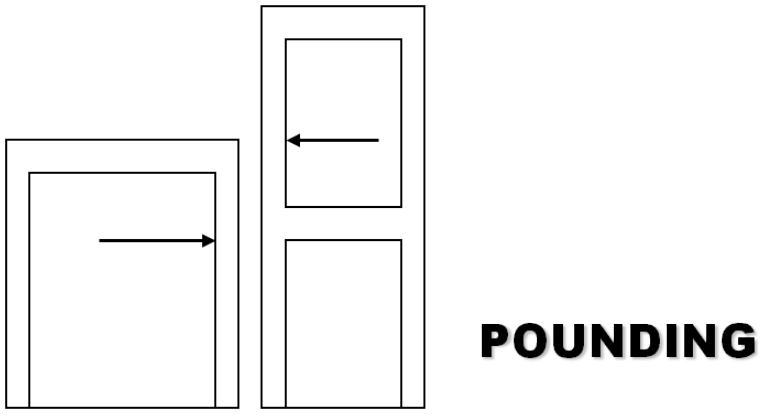


Figure 3.57 – Pounding illustration, courtesy ATC.

Pounding occurs when buildings of different heights and stiffnesses resonate differently to the earthquake, and they pound into each other as they move.

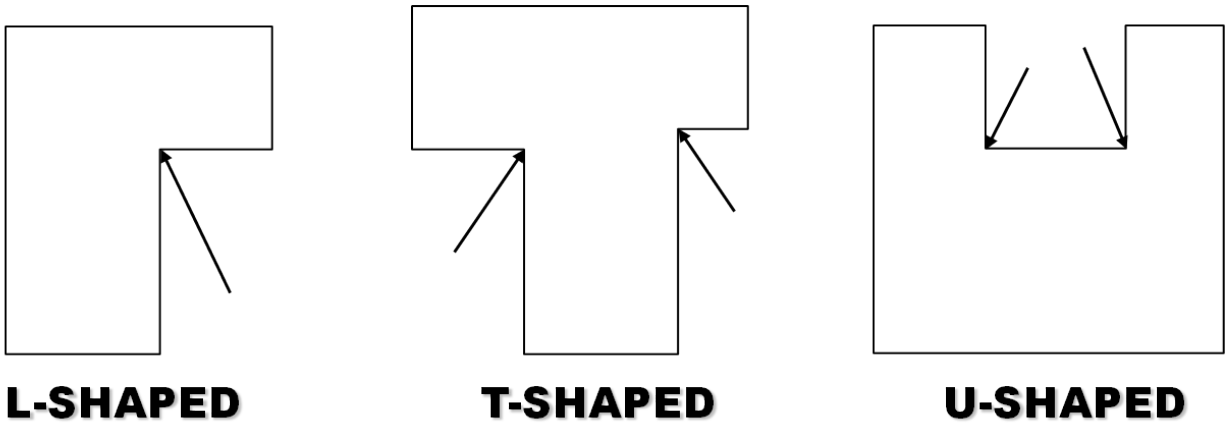


Figure 3.58 – Plan view irregularities, showing likely structural failure points. Courtesy ATC.

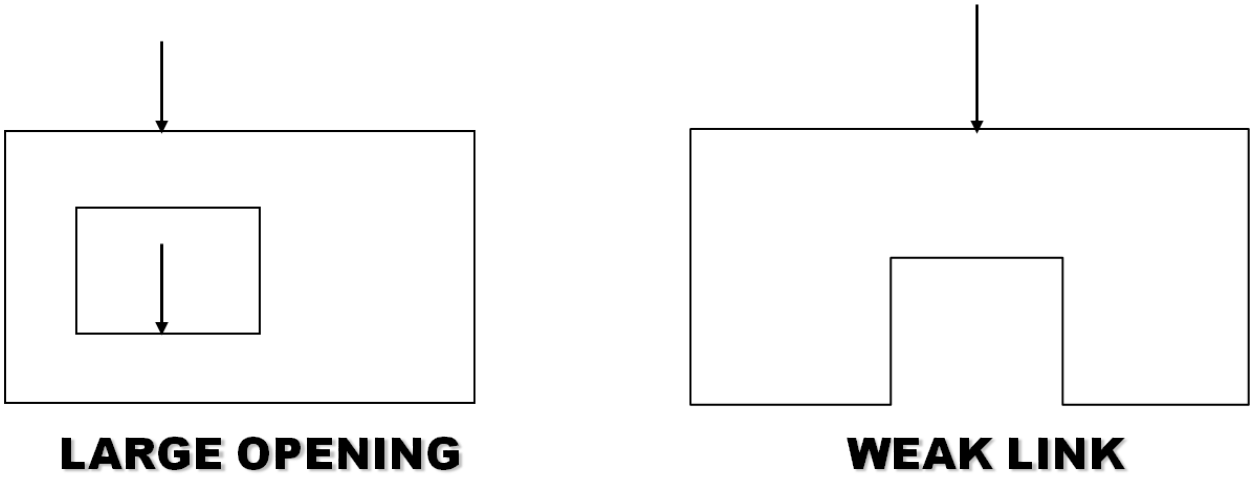


Figure 3.59 – Plan view weak link and large opening diagrams, showing likely structural failure points in earthquakes. Courtesy ATC.

ATC-20 recommends criteria to help evaluators quickly identify UNSAFE placarding conditions, as follows:

For vertical load systems:

- Columns noticeably out of plumb.
- Buckled or failed columns.
- Framing separation from walls or other vertical support.
- Bearing wall, pilaster, or corbel cracking that jeopardizes vertical support.
- Other failure of load-bearing elements.

For lateral load systems:

- Buckled, torn, or displaced diaphragms or horizontal bracing.
- Broken, leaning, or seriously degraded moment frames (look for cracks in welds, or across the center field of the moment frame connection).
- Severely cracked shear walls (ATC-20 identifies 'severely cracked' as being 1/8 inch wide or wider).
- Other failure of lateral load-carrying elements or connections. This includes tension braces in prefabricated buildings.

P-delta effects:

- Individual columns or multi-story frame buildings where the vertical load is translating horizontally. This is also called *residual drift*. Such a condition is very unstable; it may only be a matter of time before the support thus damaged collapses.

Degradation of structural system:

- Cracking, spalling, or local crushing of concrete or masonry.

Falling hazard:

- There may be a non-structural falling hazard that is unavoidable, such as a damaged parapet that threatens to fall at all points around the building.
- A taller building nearby may be a collapse hazard to the building being considered.

Slope or foundation distress:

- Base of the building pulling apart, or differentially settled, fractured foundations, walls, floors, or roof.
- Building is in zone of fault or rupture.
- Suspected major slope movement.
- Building is in danger of being impacted by sliding or falling landslide debris from upslope.

Other hazards:

- Spill of unknown or suspected dangerous material.
- Other hazards, such as downed power lines.

3.8.9 – Make Notes for Possession Retrieval

You will not be involved in possession retrieval yourself, but you can make notes so that others entering the building after you will know what they are up against.

Note if the exits work, and if the corridors and stairways are clear and safe. If the corridors are blocked with debris, do not try to get past the debris. An aftershock could cause the debris to shift, and you could be trapped if you are on the other side of it.

Figure 3.60 – Image of apartment tenant attempting to access his apartment for possession retrieval without supervision. This should NOT be attempted. Photo Credit Los Angeles Daily News.

Be very careful about stairways! They often respond to earthquakes differently from the rest of the building, and so may be precariously damaged or destroyed. A stairway may be completely unusable after an earthquake.

3.9 – Examples of UNSAFE Buildings

Figure 3.61 – Complete collapse of overhead structure due to snow load. 2023 Mono County Snow Load Mission. Photos courtesy Gurbir Singh.

Figure 3.62 – Manufactured home shifted and twisted 4 inches off its foundation piers, which were rendered unstable. 2022 Ferndale Earthquake. Photos courtesy Gurbir Singh.

Figure 3.63 – Home in South Pasadena was undermined by a broken water main, was evacuated due to threat of imminent structural failure.

Figure 3.64 – House heavily damaged by 2005 Hurricane Katrina.

3.10 – Types of Buildings for Rapid Assessment

3.10.1 – Essential Services Buildings

The first buildings that should be examined are the *essential services buildings.* These are buildings whose operations are essential to the disaster response and recovery. They include:

- Emergency services (law enforcement, fire, Emergency Operations Center)
- Key government administration buildings, such as City Hall.
- Shelter buildings
- Pharmacies
- Grocery stores
- Hardware stores

If emergency services and government administration buildings are badly damaged, this needs to be discovered very early in the SAP evaluation process so their functions can be moved to another place.

Shelters need to be cleared for use before crowds of people begin to occupy them.

Pharmacies, grocery stores, and hardware stores need to be cleared so, if they are able to be used, they can service the community with prescriptions, food and water, and building supplies.

3.10.2 – Commercial Buildings

In addition to what you already learned about assessing buildings for safe use, here are some additional things to check for regarding commercial buildings:

- Do an exterior inspection to verify that it is safe to enter the building.
- Watch for any indications of hazmat release situations.
- The roof will need to be inspected, whether by drone or by boom/lift truck.
- If the owner is available, meet with him/her to review the assessment.
- Notify the local building official if there are any concerning damages found.
- On tilt-up concrete buildings, confirm that the roof/purlin ledger connections use concrete-imbedded steel straps, rather than just nails.

Figure 3.65 – Failed parking structure from the 1994 Northridge Earthquake.

Figure 3.66 – Roof diaphragm pulled out from supports in brick wall during the 2010 Baja Earthquake. Photo courtesy David Karina.

3.10.3 – Residential Buildings

Things to watch for regarding residential buildings:

- Building off its foundation.
- Collapse of the building's cripple wall.
- Damage to chimneys, parapets, and porch awnings.
- Racking of the building.
- Soft story failure.
- Sited in a collapse hazard zone from nearby taller buildings.
- Regarding outbuildings such as separate garages, sheds, and barns, these must be looked at and tagged separately.
- Utilities can be damaged. These include natural gas or propane lines, electricity, and water. The evaluator must notify the appropriate authorities immediately if dangerous conditions exist because of utilities.

Figure 3.67 – Example of two homes side by side; left house had no seismic retrofit work and suffered damage, while the right house was completely retrofitted and suffered no damage.

Figure 3.68 – Full collapse of soft story. Apartment building completely crushed the parking floor underneath it, including cars.

Figure 3.69 – Earthquake destroyed chimney.

Figure 3.70 – Example of shear cracking in masonry wall house.

Loss of habitable homes after an earthquake can create severe strains on buildings and temporary housing. So, what is required for a house to be fit for habitation?

The California Health and Safety Code requires:

- Enclosure from the elements.
- Potable water system.
- Working sanitary sewer system.

Some buildings collapse on their cripple walls in an earthquake. This causes the building to break the water and sewer lines. Such damaged homes will not be

inhabitable unless local governments make arrangements for potable water stations and portable toilets.

If provisions are made for water and sewer alternative facilities, such damaged homes can be tagged RESTRICTED USE. They can be lived in under the conditions that the public water and sewer facilities are available, or that the damage to the home is repaired.

3.10.4 – Manufactured Homes

An agreement between the California Department of Housing and Community Development (HCD) and CALBO allows local building departments to evaluate the safe use of manufactured homes after a disaster. (Otherwise, all inspections would need to be done by HCD's own inspectors.)

The most common problem observed with manufactured homes after an earthquake is with the manufactured home falling off its foundation, or otherwise sliding on its foundation. Before 1992, manufactured homes were often set on piers, blocks, or jack stands. Per the current code, new manufactured housing must be permanently anchored to the ground.

Things to check for in a manufactured home, besides what has already been covered in this unit:

- Stability of the foundation elements (piers, blocks, jack stands, etc.).
    - Evidence of instability includes: jacks leaning, cracked or unstable blocks or piers, and displaced skirts.
    - Piers penetrating the interior floor decking.
- Safety of accessories, awnings, etc.
- Condition of utilities
    - Damaged or turned off.
    - Water heater movement affecting venting and/or gas supply.
- Safe home ingress and egress.
- Any additional structural concerns.

Figure 3.71 – Manufactured home damaged in an earthquake. Collapsed on foundation piers. Tagged UNSAFE.

Figure 3.72 – Manufactured home damaged in a hurricane.

Figure 3.73 – A double-wide manufactured home split apart in a hurricane and a section rolled over.

Figure 3.74 – A manufactured home was damaged in 2005 Hurricane Katrina. Photo courtesy Raymond Lui.

Figure 3.75 – This manufactured home was damaged in an earthquake. The steel frame shifted and is shown resting on the decorative but fragile brick skirting. The marriage line of this double-wide seems to be ready to pull apart at the bottom. Home was tagged UNSAFE and barricaded with caution tape.

Figure 3.76 – Manufactured home was destroyed in a fire. Was tagged UNSAFE to keep people out of the dangerous conditions within.

Figure 3.77 – Manufactured home collapsed on its supports. Stairs are now partway up in the door, and the side awning is unstable. Was tagged RESTRICTED USE, likely for possession retrieval.

3.10.5 – Adobe Buildings

Adobe is a low-strength building material made from sun-dried bricks of clay and straw, often protected by stucco. Adobe is found in Spanish colonial era buildings in California, and in some modern structures.

Adobe has had a significant role among the materials used historically for building construction. SAP evaluators in California and the Southwest could eventually be looking at adobe structures for post-disaster safety assessment.

Figure 3.78 – Historic Romulo Pico Adobe, built during the Spanish Colonial period.

Construction began on the historic Romulo Pico Adobe in Mission Hills, CA, in 1834. Additions were made in the 1870s. A new owner restored and expanded the structure in the 1930s. The City of Los Angeles bought it in 1965, and the building was listed on the National Registry of Historic Buildings in 1966. It was damaged in the 1971 Sylmar Earthquake and was repaired.

Figure 3.79 – Example of a modern adobe structure.

Adobe construction often uses thick walls. This design is stronger than thin walls and affords greater insulation properties against heat or cold. Modern adobe construction often uses barbed wire between brick courses to provide some lateral tension strength to the structure.

Post-disaster adobe wall failure issues include:

- Water damage structurally weakening the adobe.

- Pre-existing cracks that allow for wall failure.
- Poor brick bonding from original construction.
- Lack of buttressing at corners, which leads to structural failure at the building corners.
- Lack of seismic mitigation.

Figure 3.80 – Adobe bricks drying in the sun.

3.10.6 – Historic Buildings

Many historic buildings were constructed long before the advent of building codes in California in the 1930s, and well before current concepts of seismic hazard mitigation. Therefore, they are often more fragile than modern buildings regarding seismic forces. It can be said that earthquakes tend to find historic structures; it is very likely that a good number of the buildings damaged in an earthquake will be older or historic in nature.

Temporary shoring is important for immediately mitigating the hazards caused by dangerous conditions. This is not part of the Safety Assessment Program, but having awareness about shoring can be useful. One publication that addresses temporary shoring is *Temporary Shoring & Stabilization of Historic Buildings* by Roy W. Hawthorn, published by CALBO. This document was developed with a grant from the U.S. Department of the Interior, and the grant was administered by the State of California Office of Historic Preservation.

To clarify, a building must be at least 45 years old before it is normally examined for historic qualities. Then it might be discovered that it is not historic, it's just old!

Additionally, a building must meet one of four National Historic Preservation Act criteria in order to be considered historic:

- A place where a historic event occurred, or that is associated with a historic person.
- An example of the work of a master, such as Frank Lloyd Wright (Marin Civic Center) or Julia Morgan (Hearst Castle).
- An example of a period architecture, such as Craftsman, Victorian, or Art Deco.
- A location with cultural or architectural significance.

Also, a building does not necessarily have to be on the National Registry of Historic Places in order to be historic; it only has to be eligible for the National Registry.

This information is being presented for awareness purposes since safety assessment is done in the same way for historic buildings as it is for other structures.

Figure 3.81 – A Craftsman style home suffered heavy damage in an earthquake.

Figure 3.82 – Liquefaction causes tilting of these Victorian homes.

Figure 3.83 – Damage to the Goodman Library Building in Napa due to the 2014 Napa Earthquake.

Figure 3.84 – Soft story failure in the San Francisco Marina District due to the 1989 Loma Prieta Earthquake.

Figure 3.85 – Parapet failure in a historic building in downtown Santa Cruz, due to the 1989 Loma Prieta Earthquake.

Figure 3.86 – Partial collapse of a brick wall in a historic building in downtown Santa Cruz due to the1989 Loma Prieta Earthquake.

Figure 3.87 – Historic building's façade was preserved by steel girding and shoring. Then the earthquake damaged interior was demolished and removed. A new interior structure and roof was built and attached to the façade. The building is now in use. This building was damaged in downtown Santa Cruz in the 1989 Loma Prieta Earthquake.

3.11 – Evaluator Safety Considerations

3.11.1 – Safety Awareness

As you approach buildings to inspect them, always approach with caution, and be aware of potential hazards. Never take your surroundings for granted! The disaster theater is very dangerous, and things that look safe at first might not be. Inspect for structural, non-structural, utility, and hazardous materials hazards.

Always work in teams of at least two persons. Use of this 'buddy system' is imperative! If a member of the team becomes injured or trapped, the other can call for help, then provide whatever assistance can be safely rendered.

Always wear a hard hat and safety shoes, and bring your own. Never assume that local governments will have these for you!

Before you enter a building, make sure that the exit doors are fully operable, exit pathways are clear, and that there are no falling hazards. In essence, make sure that you can get out!

3.11.2 – Warnings

Evaluators do not perform cost estimates, or give recommendations for repair.

Be aware of hanging or exposed electrical wiring, and treat all wiring as if they were live, regardless of the general condition of the community utilities.

Do not enter obviously unsafe buildings. Don't let curiosity get the better of you! Tag the building UNSAFE, and live another day. Move on!

Do not go into buildings, or parts of buildings, that are located on unstable slopes, or where a falling hazard exists that could block you in.

If the building is leaning and significantly out of plumb, do not enter it. It doesn't take much racking to render a building unstable!

If you are on a Detailed Evaluation team, you may be asked to take another look at a building that is already tagged UNSAFE. Your purpose would be to confirm the placarding, or to find good reasons why the placard should be changed to something else. In any case, you must take great care to act in a safe manner!

- Only consider going into a building posted UNSAFE if there is no collapse hazard, and you have confirmed that all hazardous materials issues are cleared. (A hazardous materials spill might have been the reason the building was tagged UNSAFE, if there no apparent structural issues.)
- If building collapse seems likely, do not enter the building unless it is made safe by shoring, if possible.
- If there was a hazardous materials spill in the building, do not enter it until the spill is cleaned up and the building cleared for use.
- Again, one member of the team always stays outside as a safety watch while others go in. The safety watch can call for help if there is trouble.
- As you work through the building, verify the stability of every room or part of the structure before you enter it.

Figure 3.88 – Soft story damage to apartment building on hillside from the 1984 Morgan Hill Earthquake. Note the man entering the structurally compromised understory area of this building; do not do this! Also, stepping onto the second story porch could be dangerous; it might be simply leaning against the building, rather than attached to it, considering that the first story porch is no longer attached.

Unit 4: Detailed Evaluations

4.1 – Introduction

This unit will cover:

- The difference between rapid and detailed evaluations in general
- Geotechnical detailed evaluations
- Infrastructure detailed evaluations
- Evaluation exercises

As the name would suggest, the major difference between a rapid evaluation and a detailed evaluation is the level of detail. Gathering more detail about a building's damage requires more time; while a rapid evaluation might take 20 minutes for the average house, a detailed evaluation will take much longer. These may run from 30 minutes to 2 hours, maybe more in the case of a large, complex building.

A detailed evaluation would be requested by the Building Official or the SAP Coordinator for questionable structures, where the rapid evaluation team was not certain of how to tag the building. A detailed evaluation would also be requested if damage in a community seems to be scattered, and only a few evaluations are necessary. In such a case, the building department benefits from having a more careful look at the damaged structures, so they can follow up on necessary repairs.

All geotechnical and infrastructure evaluations are detailed evaluations. These issues are too complex for a rapid evaluation to accomplish much good.

4.2 – Detailed Assessment Form

The easy-to-read version of the Detailed Assessment Form starts on the next page. The two-page version of the form can be found in the Appendix.

As described in Unit 3, the Rapid Assessment Form gathers all information on a one-page form so a good conclusion on how the building should be tagged is arrived at. This form is the property of the local jurisdiction, and can be used by them for follow-up on the issues identified therein.

ATC-20 Detailed Evaluation Safety Assessment Form

Inspection

Inspector ID_____ Inspection date & time_____

Affiliation_____ ___ Inspected exterior only

___ Inspected exterior and interior

Building Description

Building name: _____

Building Area: _____ Address: _____

Building contact & phone: _____

Number of stories above ground: _____ below ground: _____

Approximate footprint area in square feet: _____

Number of residential units: _____

Number of residential units not inhabitable: _____

Type of construction (check the appropriate space):

___ Wood frame ___ Concrete shear wall ___ Steel frame

___ Concrete frame ___ Tilt-up concrete ___ Reinforced masonry

___ Unreinforced masonry Other: _____

Primary Occupancy (check the appropriate space):

___ Dwelling ___ Commercial ___ Government

___ Other residential ___ Offices ___ Historic

___ Public assembly ___ Industrial ___ School

___ Emergency services Other: _____

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Overall Hazards	Minor/None	Moderate	Severe
Collapse/partial collapse	_____	_____	_____
Building or story leaning	_____	_____	_____

Other _____	_____	_____	_____
<u>Structural Hazards</u>			
Foundations	_____	_____	_____
Roofs, floors re: vertical loads	_____	_____	_____
Columns, pilasters, corbels	_____	_____	_____
Diaphragms, lateral bracing	_____	_____	_____
Walls, vertical bracing	_____	_____	_____
Precast connections	_____	_____	_____
Other_____	_____	_____	_____
<u>Nonstructural hazards</u>			
Parapets, ornamentation	_____	_____	_____
Cladding, glazing	_____	_____	_____
Ceilings, light fixtures	_____	_____	_____
Interior walls, partitions	_____	_____	_____
Elevators	_____	_____	_____
Stairs, exits	_____	_____	_____
Electric, gas	_____	_____	_____
Other_____	_____	_____	_____
<u>Geotechnical hazards</u>			
Slope failure, debris	_____	_____	_____
Ground movement, fissures	_____	_____	_____
Other_____	_____	_____	_____

<u>General Comments:</u> _____

_____

Estimated Building Damage (excluding contents)

___ None

___ 0 to 1%

___ 1 to 10%

___ 10 to 30%

___ 30 to 60%

___ 60 to 100%

___ 100%

Posting

If there is a posting from a previous evaluation, check the appropriate placard:

Previous posting: ___ INSPECTED ___ RESTRICTED USE ___ UNSAFE

Inspector ID number _____ Date _____

If necessary, revise the posting based on the new evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe placard. Local *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Indicate the current posting below and at the top of page one of this form.

___ **INSPECTED** (Green placard) ___ **RESTRICTED USE** (Yellow placard)
___ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on the Restricted Use placard. _____

_____

_____

Further Actions Check the subjects below only if further actions are needed.

___ Barricades needed in the following areas: _____

_____

Other recommendations: _____

_____

_____

Comments: _____

_____

There is a place on the second page of the 2-page form for a sketch, if needed.

The "Posting" section on page 2 notes the prior tagging, and shows how you will be tagging the building based on your detailed evaluation.

There is also a Recommendations section for requesting barricades, requesting a geotechnical evaluation, or to suggest anything else that is not already discussed on the form.

4.3 – Lifeline Systems and Facilities

The lifeline infrastructure and facilities discussed in the unit are critical to the viability of the stricken community, and can be very complex. For these reasons, only detailed evaluations will be performed on infrastructure, and only evaluators with professional experience in the design or operation of these systems will perform these assessments.

The local jurisdiction is encouraged to assign first responders to the detailed evaluation team for these infrastructure assessments, so that information can be quickly relayed to close down or barricade infrastructure. This is especially important because infrastructure is not placarded, but the jurisdiction must take action to close down hazardous roads, bridges, or other features.

4.3.1 – Geotechnical Evaluation

The geotechnical evaluation is universal to all types of situations where damage was caused or is aggravated by unstable soil conditions.

Many times, geotechnical evaluations may be done on sites where the facilities already had a safety evaluation performed on them.

The geotechnical evaluation begins at the location identified in the request, then expands beyond the original site until a thorough understanding of the instability threat is obtained.

Some of the situations that can trigger a geotechnical evaluation include:

- Liquefaction
- Lateral spreading
- Expansive soils
- Landslides
- Differential settlement

The geotechnical form allows the evaluator to note what needs to be monitored on a regular basis. The monitoring request should include:

- What needs to be monitored.
- Why it needs to be monitored.
- Where the 'tipping point' is that could cause a change in the geotechnical findings.

Figure 4.1 – 2008 rockslide head scarp in San Francisco is far enough away from the mid-rise towers so as not to be a threat to them.

Figure 4.2 – This slope failure was caused by the "New Year's Eve" storm of December 2005 through January 2006. Excessive soil saturation led to this failure condition called "block failure", where the soil fails in large block sections.

Figure 4.3 – Scarp developed between two apartment buildings in Taiwan, possibly due to faulting.

Figure 4.4 – Example of lateral spreading. The earthquake caused the soils to move in the uncontained direction of the body of water nearby.

The easy-to-read version of the Geotechnical Evaluation Form is found on the next pages. The two-page version can be found in the Appendix.

On the Geotechnical Evaluation form, as in all of the infrastructure detailed evaluation forms, a damage scale of 0 to 6 is used to mark the extent (or magnitude) of the condition, as well as to indicate the effect of the condition on infrastructure.

For example, there may be a large landslide with an 'extent' rating of 4 or 5, but because the landslide is in the remote countryside, the 'effect' rating is 0, since no infrastructure was affected. Conversely, there may be a small landslide with an 'extent' rating of 2, but because of its precise placement, its 'effect' is a 5 due to its destroying important infrastructure items.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

GEOTECHNICAL EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

Monitor _____

Other_____

_____

C. COMMENTS _____

_____

_____

DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

D. OBSERVED GEOTECHNICAL CONDITIONS WITH EFFECT ON FACILITY

Observed Condition	**Extent of Condition (D.O.)**	**Effect of Condition (D.O.)**
Ash flows	_____	_____
Avalanches	_____	_____
Collapsed soils	_____	_____
Cut	_____	_____
Differential settlement	_____	_____
Displacement	_____	_____
Dried springs	_____	_____
Erosion	_____	_____
Faulting	_____	_____
Fill	_____	_____
Flooding	_____	_____
Landslides/mudslides	_____	_____

Lava flows	_____	_____
Liquefaction	_____	_____
Lurching	_____	_____
New springs	_____	_____
Ponded water	_____	_____
Sand boils	_____	_____
Tsunamis/seiches	_____	_____
Soil shear/failure	_____	_____

E. CONTINUING HAZARDS TO LIFE/PROPERTY (Please describe) _____

_____

_____

To complete the Geotechnical Evaluation Form:

Recommendations – This section of the form can be used to request regular monitoring of the site, to watch for continued ground movement that may cause additional damage to the facility. Ideally, the evaluator will indicate what needs to be monitored, why, and if there is a point where the condition could point to a re-evaluation of the facility for safety, or some other necessary action. The second part of this section allows the evaluator to provide information about the posting decision that would be important for the jurisdiction to know. This section can also be used to elaborate on monitoring conditions.

Comments – This section is used to explain anything that needs additional explanation. If there is not enough room in the provided area on the form, the evaluator can write "Over" in the remaining space and continue on the back of the form.

Damage Observed (D.O.) – The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Section D – Observed Geotechnical Conditions with Effect on Facility – Using the Damage Observed, the evaluator will look at all the conditions and describe the effect of the condition. This lets the jurisdiction know how bad the geotechnical

conditions are at the site. The second part of the evaluation describes the impact of that condition. Remember, the two evaluations can be very different. For items not involved in the disaster (such as ash flow in a flood event) write in NA (Not Applicable).

Section E – Continuing Hazards to Life and Property – This section will be used to describe the conditions at the site that may be a threat to life safety and to property. The description should relate some detail on the relationship between the geotechnical conditions and the original posting of the facility if such exists. Remember, evaluators are not performing an engineering evaluation, so the description should be commensurate with the evaluation performed. Mapping the area of liquefaction is useful if time permits. Such a sketch would show the location and size of cracks and sand boils, and an estimate of the direction and amount of lateral movement.

Upon completing the evaluation, the team will recommend the posting. If the facility is already posted with a placard, the SAP team will update the existing placard with the new information. If the recommendation changes the posting (for example, from RESTRICTED USE to UNSAFE), change the placard and add the appropriate information explaining why the posting changed). If the geotechnical conditions do not have an impact on the facility, DO NOT change the existing placard. If a comment on the existing placard mentions the geotechnical issues, amend the placard with an update and add the SAP team's identification to it. Naturally, if there is no existing placard, then post the facilities and/or alert the jurisdiction as appropriate.

4.3.2 – Airport Evaluation

Large international airports have their own engineering staff, and so would not be likely to ask for help from the Safety Assessment Program. However, the smaller general aviation airports could. These smaller airports can become important for staging people and equipment in response to the disaster.

The easy-to-read version of the Airport Evaluation Form is found on the next few pages. The two-page version can be found in the Appendix.

To complete the Airport Evaluation Form:

Recommendations – This section can be used to request monitoring of damaged features and to elaborate on monitoring requirements. For example, a runway with cracks in it may be further damaged over time by repeated aftershocks. The cracks could become wider, or in the worst-case scenario, end up separating vertically. The evaluator can describe in this section of the form what features of the airport needs to be monitored, why, and if there is a point

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

AIRPORT EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

Monitor _____

Other _____

_____

C. COMMENTS _____

_____

_____

D. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None (0%)	Slight (1-10%)	Moderate (11 - 40%)	Severe (41 - 60%)	Total (over 60%)	Not Applicable	Not Observed

1. SURFACE DISPLACEMENT

	D.O.	Amount in inches	
		Horizontal	Vertical
Runway pavement	_____	_____	_____
Taxiway pavement	_____	_____	_____
Aircraft aprons	_____	_____	_____
Car parking areas	_____	_____	_____
Access roadways	_____	_____	_____
Bridges	_____	_____	_____
Liquefaction	_____		

Bridge Report Attached: ____ Geotechnical Report Attached ____

2. UNDERGROUND UTILITIES

	D.O.
Water mains	_____
Water services	_____

Gas mains _____

Large storm drains _____

Aircraft fueling systems _____

Airfield lighting _____

Underground electrical _____

Sewer: collapsed _____ displaced _____

3. BUILDINGS D.O.

Control tower structure _____

Passenger terminal buildings:

Structural _____

Mechanical _____

Electrical _____

Utility plant buildings:

Equipment _____

Piping _____

Emergency generator building

Equipment _____

Fuel supply _____

E. REMARKS

_____

_____

To complete the Airport Evaluation Form:

Recommendations – This section shows the typical recommendations where the condition could point to a re-evaluation of the facility for safety, or some other necessary action. The second part of this section allows the evaluator to

provide information about the posting decision that would be important for the jurisdiction to know.

Comments – This section is used to notate anything that needs additional explanation. If there is not enough room in the provided area on the form, the evaluator can write "Over" in the remaining space and continue on the back of the form. If the airport needed to be posted RESTRICTED USE, it is here that the evaluator would indicate the restrictions. If the posting is UNSAFE, the reasons for that choice would be provided here.

Damage Observed (DO) – The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Section D1 - Surface Displacement – This section is used to note the vertical and horizontal displacement of the various parts of the airport's paved areas. The first line is used to indicate the level of damage using the Damage Observed scale. The second and third lines are used to record the actual displacements measured at the time of the evaluation. There are rare occasions when runways pass over streets; these structures are considered bridges, and the Bridge Evaluation form should be used for these. The same holds true for pedestrian bridges, viaducts, or overpasses. If Bridge Evaluation forms are used, they should be attached to the Airport Evaluation form.

Section D2 - Underground Utilities – For each of the utilities listed, the SAP team will estimate the level of damage using the Damage Observed scale. If any of these utilities are damaged, it could constitute grounds for a RESTRICTED USE posting for the airport. For example, if the sewer system has failed, the damage might not be enough to warrant an UNSAFE posting, but there would certainly be restrictions on using the airport restrooms until the sewer system was fixed. This would especially be a concern if the airport was being used as a disaster response staging area. In this case, the restrooms would be closed and locked, and portable toilets brought in, if necessary, until the sewer system was repaired.

Section D3 - Buildings – For each of the buildings, either a Rapid Evaluation or a Detailed Evaluation form should be filled out. The results of those assessments will be used to provide more background information on determining the overall level of damage and use of the airport. The building evaluation forms should be attached to the Airport Evaluation form.

Section E - Remarks – This section of the form allows for expanding upon the safety assessment results of the various parts of the airport facility. Further, this is a good place to cross-reference to either the Bridge or the building evaluation forms, if these are used.

Figure 4.5 – Airport runway in Alaska rendered unusable due to lateral spreading caused by the 2002 Denali Earthquake. (Do not step into a crevasse, as this man has done!)

Figure 4.6 – Damaged aircraft control tower.

4.3.3 – Bridge Evaluation

The Safety Assessment Program can be used to evaluate bridges that are not part of the federal highways program. (Those bridges are usually inspected by the state Department of Transportation.)

The easy-to-read version of the Bridge Evaluation Form is found on the next few pages. The two-page version can be found in the Appendix.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

BRIDGE EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

____ Monitor
____ Use for public transportation
____ Use for pedestrians
____ Use for two-way traffic
____ Use off-site detour
____ Use underpass only
____ Barricade
____ Use for emergency vehicles
____ Close to truck traffic
____ Use for private passenger vehicles only
____ Use for one-way traffic
____ Use for on-site detour
____ Use for overpass only
____ Shore and brace

C. COMMENTS _____

_____

_____

D. BRIDGE DESCRIPTION

1. <u>Type</u> **<u>Material</u>**

	Concrete		**Steel**	**Composite**	**Timber**
	Prestr.	Reinf.			
Arch	____	____	____	____	____
Box	____	____	____	____	____
Cantilever	____	____	____	____	____
Girder	____	____	____	____	____
Slab	____	____	____	____	____
Suspension	____	____	____	____	____
Truss	____	____	____	____	____
Other	____	____	____	____	____

2. <u>Foundation</u> Caisson____ Pile ____ Spread footings ____

3. <u>Internal Support</u> Number of spans Height (ft)

	One	Two	Number	
Bents (frames)	____	____	____	____
Columns	____	____	____	____
Piers	____	____	____	____

4. <u>Abutments</u> High _____ ft.

Low _____ ft.

5. <u>Road Dimensions</u> Length _____ ft.

Curb to curb _____ ft.

E. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

1. FOUNDATION

D.O.

_____ Earth movements/gaps

_____ Piles at abutments

_____ Piles at piers

_____ Spread footings at abutments

_____ Spread footings at piers

2. ABUTMENTS

_____ Disturbance or erosion

_____ Wall movement (____ inches)

_____ Backfill settlement (_____ inches)

3. WINGWALLS

_____ Damage

_____ Movement

_____ Separation

4. APPROACHES

_____ Damage

_____ Operational

_____ Roadway settled (_____ inches)

_____ Off bridge seat

5. BEARINGS

_____ Integral

_____ Contact

_____ Rocker

_____ Elastomeric Pad

6. INTERMEDIATE SUPPORTS

_____ Settlement

_____ Damage

_____ Near top

_____ Near bottom

_____ Near middle

_____ Moment failure

_____ Shear failure

_____ Compression failure

_____ Support lost

7. SUPERSTRUCTURE

_____ Girder

_____ Shear cracks

_____ Moment cracks

_____ Deck

_____ Longitudinal joints enlarged

_____ Expansion joints

_____ Truss

_____ Upper Chord

_____ Lower Chord

_____ Diagonals

_____ Suspenders

8. GEOTECHNICAL

_____ Liquefaction

_____ Landslide

_____ Faulting

_____ Other

F. REMARKS

_____

_____

_____

The damage types that can occur with bridges includes:

- Support columns failing in shear mode.
- Spans falling off their abutments and piers.
- Bridge deck approaches settling, resulting in an offset at the abutment.

If it is determined that the bridge is UNSAFE, alert the jurisdiction at once so that the bridge can be barricaded.

To complete the Bridge Evaluation Form:

Recommendations – This section shows the typical recommendations that would apply to bridges, though not necessarily the only ones. The overall recommendations of the SAP team are noted here by checking the appropriate circles, after the evaluation is complete. If the monitor circle is checked, the evaluator must be sure to note in the Comments section the conditions that need to be monitored and the criteria. Also, if another action must be taken when a threshold is reached during the monitoring, that must be noted as well. For the other recommendations, add information in the Comments section

when appropriate. If the "shore and brace" box is checked, add the location for this action in the Comments section.

Comments – This section is used to provide explanations regarding any part of the evaluation that the SAP team believes requires an explanation. When a bridge will be identified for RESTRICTED USE, the evaluator would note the restrictions if they were not checked off in the Recommendations section. If the bridge is to be posted UNSAFE, the reasons for that posting are provided here. If there is not enough room for all the comments, simply note "Over" at the bottom of the form and continue on the back side.

Section D - Bridge Description – In this section of the form, the evaluator will describe the structural system of the bridge, its configuration, and the description of the foundation system. Dimensions asked for on the form should be either estimated or paced off; the evaluator should not take the time to tape measure or chain all the dimensions requested on the form.

Damage Observed (D.O.) - The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Sections E 1 through 8 – These sections are for the individual components of the bridge structure. For each component, the evaluator must estimate the level of damage using the damage scale. For areas not seen, write in NO (Not Observed). Remember, as with buildings, do not perform destructive investigation. The SAP team must evaluate based on what they see by walking around, over, and under the bridge, if it is safe to do so. The SAP team must remember not to endanger themselves if the bridge is in imminent failure! In Section L, if any one of the noted conditions exist, a geotechnical evaluation should be requested. This can be noted in the Remarks section.

Section F- Remarks – This section allows for further remarks on the details of the evaluation. As with the Comments section, if there is not enough room, simply mark "Over" at the bottom of the section and continue on the back side of the form.

Upon completing the evaluation, the team will recommend the posting. If it is found that the bridge is seriously damaged and needs to be removed from service, the jurisdiction needs to be informed at once. The jurisdiction will then send either their public works or law enforcement staff to barricade the road and redirect traffic. If no jurisdiction representative can be quickly located, the SAP team must contact the SAP coordinator to report their findings. In cases where recommendations are not time sensitive, the team can wait until they turn in their findings to the SAP coordinator in the evening.

Bridges will not be physically posted. The placards are too small for motorists see or to understand as they approach a bridge. Barricades are the best and most likely method to be used for closing bridges.

Figure 4.7 – Bridge span fallen from intermediate support. Taiwan. Photo courtesy Dave Swanson, EERI.

Figure 4.8 – Midspan bridge deck collapse, Bay Bridge, 1989 Loma Prieta Earthquake.

Figure 4.9 – Interstate 10 column collapse, 1994 Northridge Earthquake.

4.3.4 – Road and Highway Evaluations

The Safety Assessment Program can be used to evaluate roads and highways that are not part of the federal highways program. (Those roads and highways are usually inspected by the state Department of Transportation.)

The easy-to-read version of the Road & Highway Evaluation Form is found on the next few pages. The two-page version can be found in the Appendix.

It is likely that the local first responders will find the damaged roads inadvertently as they try to respond to incidents.

Types of road damage can include:

- Collapse debris from bridges and overpasses.
- Debris from buildings and landslides.
- Slip-outs.
- Settlements.
- Washouts.

Additional evaluations may be needed due to aftershocks. Like the Bridge Evaluation Form, the Road and Highway Detailed Evaluation form can be used to identify how the road can be used, what traffic is allowed, and what traffic is not allowed.

There is much detail in the Road and Highway Evaluation form about the nature of the road damage, and any damage to in-road infrastructure such as utility pipes.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

ROAD AND HIGHWAY EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

____ Monitor

____ OK for emergency vehicles

____ OK for public transportation

____ OK for private vehicles

____ OK for pedestrians

____ OK for one-way traffic

____ OK for two-way traffic

____ Install barricades

____ Use detour(s)

____ Aftershocks potentially dangerous to traffic

____ Traffic in danger due to adjacent unstable or unsafe structure

C. COMMENTS _____

_____

_____

D. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None (0%)	Slight (1-10%)	Moderate (11 - 40%)	Severe (41 - 60%)	Total (over 60%)	Not Applicable	Not Observed

1. ROADBED

D.O.	Location	Extent
____Fills	_____	_____
____ Cuts	_____	_____
____ Subgrade	_____	_____
____ Slip-outs	_____	_____
____ Slides	_____	_____
____ Washouts	_____	_____

2. PAVEMENTS

D.O.

_____ Longitudinal cracks

_____ Transverse cracks

_____ Vertical displacement

Amount_____

Side up (N, S, E, W) _____

Pavement type: ____ AC ____ PCC ____ Other
Describe _____

3. TRAFFIC CONTROL FACILITIES

D.O.
____ Condition
____ Operating
____ Critical regulatory signs standing
Exceptions and conditions: _____
_____

4. UTILITIES

D.O.
____ Drainage
____ Gas lines
____ Petroleum lines
____ Underground power lines
____ Aboveground power lines
____ Sewers
____ Water lines
____ Other _____

5. OBSTRUCTION/ HAZARDS

D.O.
____ Bridges
____ Buildings/structures
____ Debris
____ Joint poles
____ Mud
____ Power lines
____ Rocks
____ Trees
____ Mud
____ Other _____

E. REMARKS _____
_____

Roads can also be damaged or destroyed from storm and flood disasters. Roads along streams, or with culvert crossings, can be washed out. In hilly country, roads can fail due to slip outs or activated slides. Evaluators should use caution in approaching the edge of any washout, slide, or slip out, as the edge could be very fragile and can give way if walked upon, leading to injury or death.

To complete the Roads and Highways Evaluation Form:

Recommendations - This section shows the typical recommendations that would apply to roads, though not necessarily the only ones. The overall recommendations of the SAP team are noted here by checking the appropriate circles, after the evaluation is complete. If the monitor circle is checked, the evaluator must be sure to note in the Comments section the conditions that need to be monitored and the criteria. Also, if another action must be taken when a threshold is reached during the monitoring, that must be noted as well. If the "Traffic in danger due to adjacent unstable/unsound structure" circle is marked, the SAP team must make sure to describe the condition in the comments section.

Comments – This section is used to provide explanations regarding any part of the evaluation that the SAP team believes requires an explanation. When a road will be identified for RESTRICTED USE, the evaluator would note the restrictions if they were not checked off in the Recommendations section. If the road is to be posted UNSAFE, the reasons for that posting are provided here. If there is not enough room for all the comments, simply note "Over" at the bottom of the form and continue on the back side.

Damage Observed (D.O.) - The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Sections D 1 through 5 – These are the individual components of the road that should be assessed. For each component, estimate the level of damage using the damage scale; use the 'NO" (Not Observed) rating for areas not seen. Remember, as with buildings, do not perform destructive investigation. Evaluate only what can be seen by walking around and over the roadway. Work safely – do not get too close to the edges of slip-outs or other road failures where a fall could cause injury.

Section E – Remarks – This section lets the evaluator expand in some detail on the damage assessment of the various road components. As with the comments section, if there is not enough room, simply mark "Over" at the bottom of the page and continue on the back side of the form.

Upon completing the evaluation, the team will recommend the posting. If it is found that the road is seriously damaged and needs to be removed from service, the jurisdiction needs to be informed at once. The jurisdiction will then send either their public works or law enforcement staff to barricade the road and redirect traffic. If no jurisdiction representative can be quickly located, the SAP team must contact the SAP coordinator to report their findings. In cases

where recommendations are not time sensitive, the team can wait until they turn in their findings to the SAP coordinator in the evening.

Roads will not be physically posted. The placards are too small for motorists to see or to understand as they approach an unsafe road. Barricades are the most likely method used for closing roads.

Figure 4.10 – Road slip out due to oversaturation of soil. Photo courtesy Cal OES.

Figure 4.11 – Road scarp damage. Photo courtesy Cal OES.

Figure 4.12 – Road damage due to the 2010 Baja Earthquake. Photo courtesy Fred Turner, EERI.

4.3.5 – Pipeline Evaluations

The easy-to-read version of the Pipeline Evaluation Form is found on the next few pages. The two-page version can be found in the Appendix.

SAP evaluators will be asked to evaluate water and sewer lines. It is likely that the jurisdiction will assign a segment of their system to the team to evaluate; the team must be prepared to look at pump stations and reservoir tanks in addition to piping systems. These are covered in upcoming units.

Usually, the team will observe surface conditions to see if there are any reasons for concluding that the pipe in the ground is damaged. In the case of pressurized pipes, the clues may be obvious; these often scour away the soil and open up a large crater. Other clues could include lateral spreading.

Types of damage for pipelines include:

- Joint damage or separation.
- Bursting.
- With water systems, a pipe break can cause the loss of pressure in an entire area, while water ends up bubbling up out of the ground.
- Sewer pipelines may collapse, causing backup and possible overflow.
- In liquefiable soils, sewers and manholes will float, making them hydraulically inoperable.

In most cases with sewer line damage, only specialized equipment, such as an in-pipe camera, can reveal the nature and the extent of the damage.

The Pipeline Evaluation form allows for recommendations as to the use of the pipeline segment being evaluated.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

PIPELINE EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

____ Monitor ____ Continue in service
____ Remove from service ____ Check water quality/safety
____ Unblock entrance ____ Divert flow
____ Install temporary above-ground line
____ Provide temporary alternate service

C. COMMENTS _____
_____

D. PIPELINE DESCRIPTION

1. Type of pipeline: ____ Pressure ____ Gravity ____ Storm drain
   ____ Water _____ Sanitary Sewer ____ Other _____
2. Pipe nominal diameter_____
3. Proximity to water/sewer/gas line: _____

	Bell & Spigot	Butt	Caulked	Comp. Ring	Riveted	Welded	Unknown
AC							
CI							
CMP							
DI							
PVC							
RC							
Steel							
VC							
WI							
Other							
Unknown							

4. Describe the failure mode:
   ____ Circumferential crack
   ____ Burst pipe barrel
   ____ Sheared pipe barrel
   ____ Sheared service connection

____ Pulled joint
____ Broken joint
____ Other _____
____ Liquefaction – describe: _____
_____

E. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

SURFACE OBSERVATIONS

D.O.
____ Ground surface disturbed
____ Visible leakage
____ Service connection broken
____ Headwall damaged
____ End wall damaged
____ Manhole damaged
____ Soffit damaged
____ Invert displacement
____ Horizontal displacement
____ Trash rack blocked/damaged
____ Leakage at valves.
____ Leakage continuing
____ Leakage rates _____
Nearest valve (if less than ¼ mile) _____
_____

F. Remarks _____
_____

The Pipeline Evaluation form goes into a great deal of detail about the type of pipe, and the nature of the damage to it.

To complete the Pipeline Evaluation Form:

Recommendations - This section shows the typical recommendations that would apply to pipelines, though not necessarily the only ones. The overall recommendations of the SAP team are noted here by checking the appropriate circles, after the evaluation is complete. If the monitor circle is checked, the

evaluator must be sure to note in the Comments section the conditions that need to be monitored and the criteria. Also, if another action must be taken when a threshold is reached during the monitoring, that must be noted as well. If the "Divert Flow" box is marked, the SAP team must make sure to describe the condition in the comments section.

Comments – This section is used to provide explanations regarding any part of the evaluation that the SAP team believes requires an explanation. When a pipeline will be posted RESTRICTED USE, the evaluator would note the restrictions if they were not checked off in the Recommendations section. If the pipeline is to be posted UNSAFE, the reasons for that posting are provided here. If there is not enough room for all the comments, simply note "Over" at the bottom of the form and continue on the back side.

Damage Observed (D.O.) - The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Section D - Pipeline Description – In this section of the evaluation form, the evaluator will describe the construction and materials of the pipeline, along with the materials carried. The dimensions requested can be either estimated, or measured with a measuring tape.

Sections E (D.O) Surface Observations– These are typical conditions that show the pipeline is damaged. For each element, the SAP evaluator must estimate the level of damage using the damage scale. For areas not seen, use the NO (Not Observed) rating. As with the rest of the Safety Assessment Program, do not perform destructive investigation. Evaluate only what can be seen by walking around, over, and under the pipeline. If the pipeline is buried, look for conditions on the surface will indicate that these types of damage have occurred. If none are observed, mark the line with NO. In item Q, if leakage is found, make the "best estimate" on the leakage rate. In Section R, the closest manhole can be estimated or paced. The evaluator can indicate somewhere on the form the direction to the nearest manhole.

Section F Remarks – This section lets an evaluator expand in some detail the results of the evaluation. As with the Comments section, if there is not enough room, simply mark "Over" at the bottom and continue on the back side of the form.

Figure 4.13 – Large asbestos-concrete (AC) pipe damaged by flotation and liquefaction. 2011 Canterbury Earthquake, New Zealand.

Figure 4.14 – Pipe damaged by reverse faulting in the 1990 Manjil Earthquake in Iran.

4.3.6 – Pump Station Evaluations

The easy-to-read version of the Pump Station Evaluation Form is found on the next few pages. The two-page version can be found in the Appendix.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

PUMP STATION EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

____ Monitor ____ Continue in service
____ Remove from service ____ Check pump-motor alignment
____ Check filter basket ____ Recheck after power restored
____ Brace structure before using

C. COMMENTS _____

_____

D. PUMP STATION DESCRIPTION

____ Water ____ Wastewater ____ Sewage ____ Other _____
____ Wet well ____ Dry well

Number of Motors:

	Electrical	Natural Gas	Gasoline	Diesel
Centrifugal				
Reciprocal				
Horizontal				
Vertical				

Number of Operable Motors:

	Electrical	Natural Gas	Gasoline	Diesel
Centrifugal				
Reciprocal				
Horizontal				
Vertical				

Pump Station Building Type:

Str. Type	Buried	Above Grade
Concrete		
Masonry		
Frame		
Other		

_____ Building Evaluation Attached

E. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

1. STRUCTURE

D.O.
_____ Access
_____ Crane runway
_____ Fixed hoist
_____ Floor
_____ Fore bay
_____ Foundation
_____ Roof
_____ Walls
_____ Hatches

2. PUMPS

_____ Anchors
_____ Casing
_____ Connected piping
_____ Supports
_____ Valving

3. MOTORS/ENGINES

_____ Anchors
_____ Connected piping
_____ Couplings to pumps
_____ Power supply
_____ Transformer(s)

4. CONTROLS

_____ Internal Power
_____ Supports
_____ Wiring
_____ Valving

5. EXTERNAL PIPING

	Inlet	Outlet
Pipping	_____	_____
Leaked	_____	_____
Leaking	_____	_____

Leakage Rate, GPM _____

6. **EXTERNAL POWER**
   _____ Electrical continuity
   _____ Fuel lines
   _____ Fuel storage
7. **AUXILIARY EQUIPMENT**
   _____ Charts
   _____ Lighting, exterior
   _____ Lighting, interior
   _____ Meters & gauges
   _____ Overhead crane
   _____ Small diameter piping
   _____ Electrical cabinets

F. REMARKS _____
_____
_____

SAP evaluators will most likely be asked to look at water and wastewater pump stations.

Water pumping stations are usually at grade level. Wastewater pumping stations are also called 'lift stations,' and may have components as deep as 10 feet below grade.

Types of damage to pumping stations include:

- Loss of power.
- Damage to the emergency power system.
- Misalignment of pump and motor.
- Damage to piping.
- Wastewater pumping stations are often found in liquefiable soils, and they can become buoyant in an earthquake, breaking the connection piping.

To complete the Pump Station Evaluation Form:

Recommendations - This section shows the typical recommendations that would apply to pump stations, though not necessarily the only ones. The overall recommendations of the SAP team are noted here by checking the appropriate circles, after the evaluation is complete. If the monitor circle is checked, the evaluator must be sure to note in the Comments section the conditions that need to be monitored and the criteria. Also, if another action must be taken when a threshold is reached during the monitoring, that must be noted as well. If the "Brace Structure" circle is marked, the SAP team must make sure to

describe the condition in the comments section. For other circles, add information in the Comments section when appropriate.

Comments – This section is used to provide explanations regarding any part of the evaluation that the SAP team believes requires an explanation. When a pump station will be posted RESTRICTED USE, the evaluator would note the restrictions if they were not checked off in the Recommendations section. If the pump station is to be posted UNSAFE, the reasons for that posting are provided here. If there is not enough room for all the comments, simply note "Over" at the bottom of the form and continue on the back side.

Section D - Pump Station Description – In this section, the evaluator describes the type of pump, and the construction and materials of the station.

Damage Observed (D.O.) - The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Sections E 1 through 7 – These sections provide the evaluation of the various components of the station. If the station is above ground and inside a structure, a small note in this section regarding the building safety assessment would be appropriate. For each element, estimate the level of damage using the damage scale. For areas not seen, use the "NO" (Not Observed) rating. Remember, as with buildings, do not do destructive testing. In Item K, if leakage is found, make a "best estimate" on the leakage rate.

Section F – This section allows the SAP team to expand in some detail the results of the assessment. As with the Comments section, if there is not enough room, simply mark "Over" at the bottom and continue on the back side of the form.

Upon completing the evaluation, the team will recommend the posting. If it is found that the pump station is seriously damaged and needs to be removed from service, the jurisdiction needs to be informed at once. The jurisdiction will then contact Public Works to ensure that the proper actions are taken. If no jurisdiction representative can be quickly located, the SAP team must contact the SAP coordinator to report their findings. In cases where recommendations are not time sensitive, the team can wait until they turn in their findings to the SAP coordinator in the evening. If the pump station is in an above ground building and a building evaluation has been performed as well, the building must be posted based on the *building's safety assessment.* If the building itself has a RESTRICTED USE or UNSAFE posting placed on it, the evaluator is to note on the placard the reasons for the posting.

Figure 4.15 – Centrifugal pump with diesel motor.

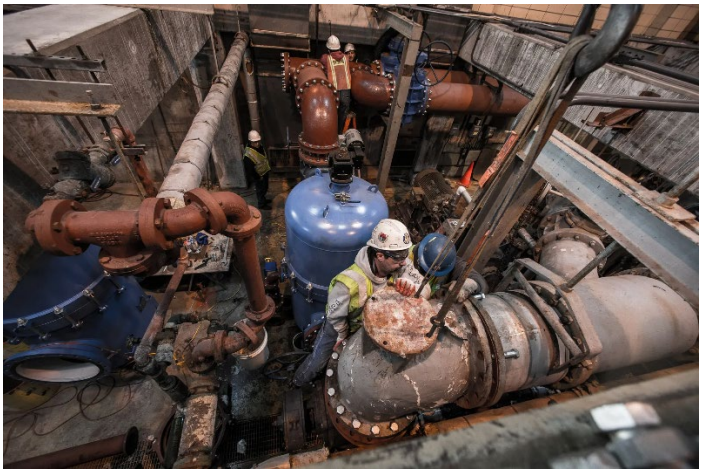


Figure 4.16 – Pump room damaged in 2012 Hurricane Sandy.

4.3.7 – Reservoir (Tank) Evaluations

The easy-to-read version of the Reservoir Evaluation Form is found on the next few pages. The four-page version can be found in the Appendix.

There are two types of tank reservoirs considered in this program; steel tanks, and cable-wrapped concrete tanks.

Tanks are very susceptible to damage from an earthquake. Tanks are important to the community infrastructure, as they hold drinking water and firefighting water.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

RESERVOIR (TANK) EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

_____ Monitor

_____ Continue in service, repair ASAP

_____ Remove from service

_____ Drain and repair

_____ Continue in service

_____ Lower water level to ____ ft., and continue service

C. COMMENTS _____

_____

_____

STEEL RESERVOIR

D. RESERVOIR DESCRIPTION

Capacity: ____ Million Gallons Wall Height _____ ft. O/S Diameter _____ ft
Roof Type: ____ Wood ____ Steel ____ Flat
____ Conical ____ Knuckled Edge
Shell: ____ Welded ____ Bolted ____ Riveted
Floor Support: ____ Footing ring ____ Oiled sand ____ A.C.
____ Other _____
Footing: ____ Concrete ring ____ Other _____
____ None
Pipe Anchorage: ____ Rigid ____ Flexible
Anchorage to Foundation: _____ Diameter _____ Spacing

E. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

1. SHELL

D.O.
____ Elephant's foot (height _____ ft., circumferential extent ____ ft.)
____ Other buckling
____ Horizontal joints broken
____ Vertical joints broken
____ Plate split
____ Seismic anchors

____ Rocking of reservoir evidenced
____ Sliding of reservoir evidenced
____ Leaks evident. Rate: _____ gpm
____ Unexplained wet spots on adjacent ground
____ Shell penetrations damaged
____ Other attachments to shell damaged
____ Pipe connections to tank

2. VALVE PIT

____ Access
____ Control Piping
____ Gauges
____ Hatches
____ Inlet-outlet piping
____ Pit flooded
____ Roof
____ Walls
____ Charts
____ Valves

3. ____ ROOF
4. ____ FOOTING
5. ____ FLOOR
6. ____ ABOVEGROUND PIPING
7. ____ UNDERGROUND PIPING

F. REMARKS _____
_____
_____

<u>PRESTRESSED CONCRETE RESERVOIR</u>

G. RESERVOIR DESCRIPTION

<u>Wire or Strand Wrapped</u>

TENDONS:

____ 220 ksi – 0.142" or 0.172" diameter
____ 270 ksi – 3/8" diameter

WALL CONSTRUCTION:

____ Cast-in-place
____ Shotcrete
____ Shotcrete with steel diaphragm
____ Precast
____ Precast with steel diaphragm

Buttress Type using individual Tendons, usually inside wall:

____ Strands
____ Wires
____ Bars
____ Cast-in-place
____ Precast

Bar Tendons on Tank Surface:

____ Bars with prop. couplers
____ Cast-in-place
____ Shotcrete

TENDON PROTECTION SYSTEMS:

____ Shotcrete
____ Corrosion inhibiting grease
____ Grout
____ Galvanizing protected by plastic sheath

Tank Restraints

____ Seismic cables
____ Curb (restraining sliding)

Tank capacity: _____ million gallons
Wall height: _____ ft.
O/S diameter: _____ ft.

Roof Type:

____ Flat
____ Dome
Exposed: ____ yes ____ no
Fill depth: _____ ft
Surface usage: _____

H. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

1. SHELL

D.O.
____ Shell or shotcrete cracked
____ Vertical cracks more than 2 feet long
____ Unexplained excessive loss of contents
____ Bulging observed
____ Visible construction joints
____ Wall leaking
____ Wet spots
____ Spouts
____ Horizontal cracks more than 25% of perimeter
____ Corrosion at horizontal cracks
____ Shotcrete delaminated at cracks
____ Attachments to shell loose
____ Leaks at rust stains
____ Major leaks at shell/foundation joint
____ Unexplained wet spots on adjacent ground
____ Corrosion at manholes or other penetrations

2. HORIZONTAL PRESTRESSING

Wrapping
____ Corrosion
____ Corrosion at horizontal cracks

Individual tendons

____ Corrosion products
____ Leaks at tendon locations
____ Leaks at tendon anchorages
____ Tendon anchorage distressed
____ Tendon anchorage disrupted or loose
____ Cracking in vicinity of tendon anchorage
____ Tendon location visually observable
____ Discoloration of concrete in line with tendons

Bar tendons on surface:
____ Tendons failed
____ Tendons sound loose
____ Evidence of rust

I. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

1. ROOF

Flat or Conical

____ Displaced with respect to wall
____ Sagging
____ Cracked at edges
____ Cracked at interior supports
____ Supporting column spalled

Dome Shell

Type: Shotcrete ____ CIP Concrete ____ Precast concrete ____
____ Construction joints
____ Cracks
Crack damage show reinforcements or corrosion ____
Crack damage is increasing with time ____
____ Delaminating
____ Misalignment of surface
____ Rust lines at top of soffit over rebars
____ Dome ring
____ Corrosion
____ Distress at shell/ring juncture
____ Shotcrete loose/hollow-sounding
____ Vertical cracks
____ Wire (strand) exposed/corroded

2. OTHER

____ **FOOTING**
____ **FLOOR**
____ **ABOVEGROUND PIPING**

3. VALVE PIT

____ Access
____ Control piping
____ Gauges
____ Hatches (equipment)
____ Inlet-outlet piping
____ Pit flooded (depth _____ ft.)
____ Roof
____ Walls

____ Charts
____ Valves

J. REMARKS _____
_____
_____

The types of damage that can occur to steel tanks include:

- Uplift of the tank, causing the breaking or damage of connecting piping.
- Tank wall wrinkling, also referred to as 'elephant's foot' buckling.
- Bursting of the vertical wall-floor welded seam.
- Damage to the roof due to water sloshing in the tank. This is actually the most common kind of disaster damage in earthquakes, although this is not likely to result in a loss of service.

Damage to cable-wrapped concrete tanks can include:

- Sliding off their floor slab foundations (usually a problem with older tanks).
- Damage to the roof due to sloshing in the tank.

Two types of reservoir tanks are included in the evaluation form: steel, and reinforced concrete. The SAP team should identify at once which type of reservoir being evaluated, and disregard or discard the form used for the other type. If the team is unsure about any part of this form, the item should be noted "NO" (Not Observed) or indicate unsure.

To complete the Reservoir Evaluation Form:

Recommendations - This section shows the typical recommendations that would apply to reservoirs, though not necessarily the only ones. The overall recommendations of the SAP team are noted here by checking the appropriate circles, after the evaluation is complete. If the monitor circle is checked, the evaluator must be sure to note in the Comments section the conditions that need to be monitored and the criteria. Also, if another action must be taken when a threshold is reached during the monitoring, that must be noted as well. For other circles, add information in the Comments section when appropriate.

Comments – This section is used to provide explanations regarding any part of the evaluation that the SAP team believes requires an explanation. When a reservoir will be posted RESTRICTED USE, the evaluator would note the restrictions if they were not checked off in the Recommendations section. If the reservoir is to be posted UNSAFE, the reasons for that posting are provided here. If there is not enough room for all the comments, simply note "Over" at the bottom of the form and continue on the back side.

Section D – Description – This section is only used if the reservoir is of steel construction. In this section, the SAP team describes in a fair amount of detail the construction of the steel reservoir. The capacity, height, and diameter of the tank should be estimated if not known.

Damage Observed (D.O.) - The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Sections E 1 through 7 – These sections are where the safety assessments of the various components of the reservoir are recorded. Areas where rocking or sliding exist are noted, with the direction and distance noted in the Remarks section. For each element, estimate the level of damage using the damage scale. For areas not seen, use the "NO" (Not Observed) rating. Remember, as with buildings, do not perform destructive testing. Rate only what can be seen by walking around the reservoir. If there is a leak, provide an estimate of the leakage rate at the bottom of the page.

Section F – Remarks – This section allows the SAP team to expand upon the results of the evaluation. As with the Comments section, if there is not enough room, simply mark "Over" at the bottom of the page and continue on the back side of the form.

Section G – Prestressed Reservoir Description – This part of the form is only used if the reservoir is of concrete construction. In this section, the evaluator describes the construction of the reservoir in a fair amount of detail. The capacity, height, and diameter should be estimate if not known. Provide the size and strength of the steel tendons only if this information is known. This information about the steel tendons can be found on construction drawings if these are available.

Sections H1 and H2 and Section I 1 through 3- These sections are where the safety assessments of the various components of the reservoir are recorded. Areas where rocking or sliding exist are noted, with the direction and distance noted in the Remarks section. For each element, estimate the level of damage using the damage scale. For areas not seen, use the "NO" (Not Observed) rating. Remember, as with buildings, do not perform destructive testing. Rate only what can be seen by walking around the reservoir. If there is a leak, provide an estimate of the leakage rate at the bottom of the page.

Section J – Remarks - This section lets an evaluator expand in some detail the results of the evaluation. As with the Comments section, if there is not enough room, simply mark "Over" at the bottom and continue on the back side of the form.

Upon completing the evaluation, the team will recommend the posting. If it is found that the reservoir is seriously damaged and needs to be removed from service, the jurisdiction needs to be informed at once. The jurisdiction will then contact Public Works to ensure that the proper actions are taken. If no jurisdiction representative can be quickly located, the SAP team must contact the SAP coordinator to report their findings. In cases where recommendations are not time sensitive, the team can wait until they turn in their findings to the SAP coordinator in the evening.

Figure 4.17 – Steel tank wall buckling, called 'elephant's foot,' caused by the tank structure failing while resisting seismic overturning forces.

Figure 4.18 – Steel fermentation tank with earthquake-induced damage to tank wall at base.

4.3.8 – Wastewater Treatment Plant

The easy-to-read version of the Wastewater Treatment Plant Evaluation Form is found on the next few pages. The three-page version can be found in the Appendix.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

TREATMENT PLANT (WASTEWATER) EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

_____ Monitor
_____ Remove from service
_____ Chlorinate and bypass
_____ Continue in service
_____ Check effluent quality/safety

C. COMMENTS: _____

_____

_____

D. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

1. PROCESS COMPONENT (D.O.)

	Structural	**Mechanical**	**Electrical**
Screening/grinding	_____	_____	_____
Influent pumping	_____	_____	_____
Grit removal	_____	_____	_____
Primary treatment	_____	_____	_____
Secondary treatment	_____	_____	_____
Tertiary treatment	_____	_____	_____
Quaternary treatment	_____	_____	_____
Effluent disinfection	_____	_____	_____
Solids digestion	_____	_____	_____
Solids dewatering	_____	_____	_____
Solids disposal	_____	_____	_____

2. TRIBUTARY PUMPING PLANTS/FORCE MAINS

Pumping Plant Name:			
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

3. TRIBUTARY GRAVITY SEWER SYSTEM

Briefly summarize your assessment of the condition of the gravity sewer system (recognizing the limitations of time and resources during this initial inspection period).

E. **Check**: Electrical power (control panel, emergency generator)
Telemetry
Disinfection process (chemical containers, feeder, piping)
Broken pipes, flooding, leaking
Chemical feed (splits)
Unit Processes

OBSERVATIONS

RAW SEWAGE

SCREENING/GRINDING

INFLUENT PUMPING

GRIT REMOVAL

PRIMARY TREATMENT

SECONDARY TREATMENT

TERTIARY TREATMENT

QUATERNARY TREATMENT

EFFLUENT DISINFECTION

SOLIDS DIGESTION

SOLIDS DEWATERING

SOLIDS DISPOSAL

These are complex chemical and biological systems made up of many components. As a result of their complexity, a disaster can adversely affect a wastewater treatment plant in many different ways. Just a few of the damage possibilities include:

- Underground and above-ground pipes.
- Cast-in-place concrete basins and galleries.
- Buildings
- Chemical, gas, mechanical, and electrical systems.

It is very important to maintain the operation of the primary headworks, primary sedimentation basins, and disinfection systems, in order to maintain public health.

The Wastewater Treatment Plant Evaluation form can be used to make recommendations on future use of the facility, as well as repair of the components of the facility, and how these were damaged.

To complete the Wastewater Treatment Plant Evaluation Form:

Recommendations - This section shows the typical recommendations that would apply to wastewater treatment plants, though not necessarily the only ones. The overall recommendations of the SAP team are noted here by checking the appropriate circles, after the evaluation is complete. If the monitor circle is checked, the evaluator must be sure to note in the Comments section the conditions that need to be monitored and the criteria. Also, if another action must be taken when a threshold is reached during the monitoring, that must be noted as well. For other circles, add information in the Comments section when appropriate. If the "Chlorinate and by-pass" or "Check effluent quality/safety" circles are checked, these instructions are directed to the plant operator. These are only recommendations, and the plant operators will follow their standard operating procedures.

Comments – This section is used to provide explanations regarding any part of the evaluation that the SAP team believes requires an explanation. When a plant will be posted RESTRICTED USE, the evaluator would note the restrictions if they were not checked off in the Recommendations section. If the plant is to be posted UNSAFE, the reasons for that posting are provided here. If there is not enough room for all the comments, simply note "Over" at the bottom of the form and continue on the back side.

Damage Observed (D.O.) - The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Sections D1 and D2 – These sections provide the evaluation of the various structural, electrical, and mechanical components of the plant. For each element, estimate the level of damage using the damage scale. For areas not seen, use the "NO" (Not Observed) rating. As with buildings, SAP evaluators are

not to perform destructive testing. Provide the information for Section E only if the SAP team has access to the information. If there is no access to the information, note that the information is Not Available. Do not use "NA," as that can mean that the section is Not Applicable.

Section D3 – Tributary Gravity Sewer System – This section allows the team to summarize their evaluation of the condition of the gravity sewer system. This should be a brief statement, as the team is not performing an engineering evaluation.

Section E- Check – This section records the team's observations regarding overall plant operation in dealing with these processes. At the top of the page is a checklist to assist with performing the evaluation.

Upon completing the evaluation, the team will recommend the posting. If it is found that the plant is seriously damaged and needs to be removed from service, the jurisdiction needs to be informed at once. The jurisdiction will then contact Public Works to ensure that the proper actions are taken. If no jurisdiction representative can be quickly located, the SAP team must contact the SAP coordinator to report their findings. In cases where recommendations are not time sensitive, the team can wait until they turn in their findings to the SAP coordinator in the evening.

If the team has performed building evaluations at the facility, the team must be certain to post the buildings accordingly. If the buildings are posted RESTRICTED USE, list the restrictions on the space provided on the placard. If the buildings are posted UNSAFE, note the conditions leading to the UNSAFE posting. The SAP team must attach the Rapid or Detailed (building) Evaluation forms to the Wastewater Treatment Plant form accordingly.

Figure 4.19 – In 2017, Hurricane Harvey caused a 31.6-million-gallon raw sewage release from this wastewater treatment plant.

4.3.9 – Water Treatment Plant Evaluations

The easy-to-read version of the Water Treatment Plant Evaluation Form is found on the next few pages. The three-page version can be found in the Appendix.

There are certain superficial similarities between wastewater treatment plants and water treatment plants. Water treatment plants are likewise complex systems involving many stages, mechanical, chemical, and electrical systems, concrete basins, and so on. A disaster can wreak havoc on these sensitive systems and components, so much can go wrong.

The Water Treatment Plant Evaluation form can be used to make recommendations on future use of the facility, as well as repair of the components of the facility, and how these were damaged.

To complete the Water Treatment Plant Evaluation Form:

Recommendations - This section shows the typical recommendations that would apply to water treatment plants, though not necessarily the only ones. The overall recommendations of the SAP team are noted here by checking the appropriate circles, after the evaluation is complete. If the monitor circle is checked, the evaluator must be sure to note in the Comments section the conditions that need to be monitored and the criteria. Also, if another action must be taken when a threshold is reached during the monitoring, that must be noted as well. For other circles, add information in the Comments section when appropriate. If the "Chlorinate and by-pass" or "Check effluent quality/safety" circles are checked, these instructions are directed to the plant operator. These are only recommendations, and the plant operators will follow their standard operating procedures.

STATE OF CALIFORNIA

SAFETY ASSESSMENT PROGRAM

TREATMENT PLANT (WATER) EVALUATION

Assessment Report Number _____

Facility Name_____ SAP ID numbers _____

Address _____ Other Reports _____

County/City/Vicinity _____ Number of Photos_____

Date _____ Time _____ Number of Sketches _____

Type of Disaster _____ Reference Drawings _____

Estimated Damage in Percentage ____ Facility Status _____

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise on the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None_____ Recommended: Green_____

Green____ Yellow_____

Yellow____ Red_____

Red_____

Posted at this assessment: Yes____

No____

B. RECOMMENDATIONS

____ Monitor
____ Remove from service
____ Chlorinate and bypass
____ Continue in service
____ Check effluent quality/safety

C. COMMENTS: _____

_____

D. DAMAGE OBSERVED (D.O.)

Damage Scale

0	1	2-3-4	5	6	NA	NO
None	Slight	Moderate	Severe	Total	Not	Not
(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

1. PRETREATMENT

D.O.
____ Raw water channels
____ Aerators
____ Rapid mix
____ Flocculation
  _____ basins
  _____ baffles
  _____ paddles
  _____ scrapers
____ Sedimentation
  _____ basin
  _____ troughs
  _____ scrapers

2. FILTRATION

____ Structure
____ Troughs
____ Beds
____ Backwash systems
____ Surface wash system

3. CHEMICAL TREATMENT

____ Chlorine piping
____ Chlorine cylinders
____ Chlorine feeders
____ Other chemical piping

____ Other chemical storage

4. CONTROL SYSTEMS

____ Mechanical
____ Electrical
____ Pneumatic
____ Hydraulic
____ Manual
____ Automatic

5. HEAD HOUSE

____ Bearing walls
____ Nonbearing walls
____ Frame (general conditions)
____ Structural members
    ____ Structural connections
    ____ Roof
    ____ Floors
    ____ Stairs
____ Elevators
____ Glass
____ Mechanical equipment
____ Electrical equipment
____ Filter gallery
    ____ Piping
    ____ Piping gallery

6. CLEARWALL

____ Tank type (use Reservoir Assessment Form)
____ Containment structure
____ Influent piping
____ Effluent piping

7. WASHWATER RECLAMATION

____ Settling basin
____ Mechanical equipment
____ Electrical equipment
____ Piping
____ Detention basin
____ Sludge discharge

E. REMARKS

_____

_____

F. Check: Electrical power (control panel, emergency generator)
Telemetry
Disinfection process (chemical containers, feeder, piping)
Broken pipes, flooding, leaking
Chemical feed (splits)
Unit Processes

OBSERVATIONS

RAW WATER _____

_____

PRECHLORINATION _____

_____

AERATION _____

_____

RAPID MIX _____

_____

FLOCCULATION _____

_____

SEDIMENTATION _____

_____

FILTRATION _____

_____

DISINFECTION _____

_____

FLOURIDATION _____

_____

CLEARWELL _____

_____

DISTRIBUTION SYSTEM _____

_____

Comments – This section is used to provide explanations regarding any part of the evaluation that the SAP team believes requires an explanation. When a plant will be posted RESTRICTED USE, the evaluator would note the restrictions if they were not checked off in the Recommendations section. If the plant is to be posted UNSAFE, the reasons for that posting are provided here. If there is not enough room for all the comments, simply note "Over" at the bottom of the form and continue on the back side.

Damage Observed (D.O.) - The damage observed scale runs from 0 to 6, and is used to rate the damages that are found. Damage rates run from 0=None, to 3=Moderate, to 6=Total. This scale gives the evaluator and the jurisdiction a toll

to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

Sections D 1 through 7 – These are the individual components of the plant that should be evaluated for safety. For each component, estimate the level of damage using the damage scale. For areas not seen, use the "NO" (Not Observed) rating. As with buildings, the evaluators are not to perform destructive testing. Rate only what can be seen by walking around the plant.

Section E – Remarks – This section lets the team expound in some detail on the evaluation of the various components. As with the Comments section, if there is not enough room, simply mark "Over" at the bottom and continue on the back side of the form.

Section F – This section records the team's observations regarding overall safety of the plant. At the top of the page is a checklist to assist with this effort.

Upon completing the evaluation, the team will recommend the posting. If it is found that the plant is seriously damaged and needs to be removed from service, the jurisdiction needs to be informed at once. The jurisdiction will then contact Public Works to ensure that the proper actions are taken. If no jurisdiction representative can be quickly located, the SAP team must contact the SAP coordinator to report their findings. In cases where recommendations are not time sensitive, the team can wait until they turn in their findings to the SAP coordinator in the evening.

If the team has performed building evaluations at the facility, the team must be certain to post the buildings accordingly. If the buildings are posted RESTRICTED USE, list the restrictions on the space provided on the placard. If the buildings are posted UNSAFE, note the conditions leading to the UNSAFE posting. The SAP team must attaché the Rapid or Detailed (building) Evaluation forms to the Water Treatment Plant form accordingly.

Figure 4.20 – A typical water treatment plant.

4.4 – Evaluation Exercises

The purpose of this activity is to familiarize you with the safety assessment process while using the principles discussed in class. This exercise will also help you see the importance of consensus among team members, while allowing for some diversity of opinion as long as the interests of public safety are served.

If this class is virtual: We will be going over a set of exercises to test your evaluation skills by reviewing a set of photos, and providing information regarding the case study. When we've provided all the information, please use the Microsoft Teams poll that will pop up, to choose the green/yellow/red tagging you'd like to give the building. Depending on how the response to the exercise goes, we may ask for volunteers to provide the reasons why they chose the tagging that they did. Feel free to raise your hand if you would like to provide input directly.

If this class is in-person: In a few minutes, you will break up into small teams of ideally 2 to 4 persons. Each team will select a spokesperson who can present to the whole class the team's discussions and decisions.

Carefully review the photos and descriptions of the buildings. Each group of photos includes a complete write-up of the details needed to evaluate the building. Once your team has read the descriptions and studied the photos, complete the appropriate placard. At the end of the exercise, each team will present their conclusions, including any discussions they had.

4.4.1 – Exercise #1

Figure 4.21 – Front view of damaged apartment building with soft story failure. Photo courtesy Fred Turner, EERI.

Figure 4.22 – Large crack between rigid and failed parts of upper story. Photo courtesy Fred Turner, EERI.

Figure 4.23 – Slight rotation out of plane along back of apartment building. Photo courtesy Fred Turner, EERI.

Figure 4.24 – Rigid end of apartment building shows no damage. Photo courtesy Fred Turner, EERI.

1. This is a private apartment building with earthquake damage at 1996 River Street in Doverton, CA. There are seven apartment units - five units upstairs and two on the first floor. Footprint area is 4,500 square feet, building is wood frame construction.

2. Earthquake damage is in evidence at this site. Figure 4.21 shows the soft story failure of the ground level parking area. Figure 4.22 shows that a large crack has developed across the middle of the building, and Figure 4.23 shows the rear of the building has rotated out of plane. Figure 4.24 shows no damage on the back end of the building.
3. Complete the Rapid Assessment Form adjacent to this building description and prepare the proper placard for this building.

4.4.2 – Exercise #2

Figure 4.25 – Adobe URM damaged in earthquake. Photo courtesy Fred Turner, EERI.

Figure 4.26 – Collapsed porch awning. Photo courtesy Fred Turner, EERI.

Figure 4.27 – Cracks in archway of adobe house. Photo courtesy Fred Turner, EERI.

Figure 4.28 – Crack in wall over archway of adobe house. Photo courtesy Fred Turner, EERI.

Figure 4.29 – Crack in wall over archway of adobe house. Photo courtesy Fred Turner, EERI.

Figure 4.30 – Spalling of exterior stucco, showing adobe wall construction. Photo courtesy Fred Turner, EERI.

1. This is a 1300 square foot adobe unreinforced masonry house at 492 Cypress Street in Doverton, CA.
2. Earthquake damage includes cracking above three of the arches, spalling that reveals the adobe wall, and a wood porch awning that collapsed. The exterior lights are flickering intermittently, and water is also flooding the back yard from a broken pipe.
3. Perform a Rapid Evaluation and post the building accordingly.

4.4.3 – Exercise #3

Figure 4.31 – Shear cracking in URM building. Photo courtesy Cal OES.

Figure 4.32 – Shear cracking in URM building. Photo courtesy Cal OES.

1. Cabana Bob's Pool Supply, located 1675 Fourth Street, Doverton, CA, is a 3500 square foot unreinforced masonry building. The photos show the north and south walls of this long, narrow building. The alley is located on the east side of the building. The west side faces the street and is the storefront to this business. The front third of the building contains the retail sales department, while the back two-thirds (towards the alley) is used as a warehouse for pool supplies.
2. The roof rafters span between the north and south walls. The rafters are full-size 2 x 12s with no ceiling in the warehouse space. The building has a parapet on all four sides, with the parapet height being 3 feet above the roofline on the north and south walls.

3. About 25 percent of the parapet has fallen on the south and north facing walls. There are large cracks in the southeast and northeast corners of the building that resulted from excessive diaphragm movement. While looking through the windows, it is seen that several of the pool supply storage racks have fallen over, and the stored materials are dumped all over the floor. There is also a small puddle of liquid on the floor. There is no other apparent damage to the building.
4. Perform a Rapid Evaluation.

4.4.4 – Exercise #4

Figure 4.33 – House floated off foundation. Photo courtesy Raymond Lui.

1. The town of Wonder Creek, CA had a flood that overwhelmed the east portion of the town. The above residence is at 145 Salamander Court, and is a two-story wood frame structure with a footprint area of 850 square feet.
2. The damage to the structure includes being floated off its foundation. The water, sewer, and gas lines have been snapped. The flood line on the house is up to the bottom of the windows, and water has soaked up the interior sheetrock walls to about seven feet above the floor. Mold has been observed growing on the interior walls and the furnishings.
3. A ten-gallon drum marked "pentachlorophenol" was found in the back yard that floated there from upriver. Power lines are also seen hanging about four feet above the ground on the side of the house.
4. Perform a Rapid Evaluation and complete the appropriate placard for this building.

Unit 5: Field Deployment

5.1 – What to Expect Regarding a Field Deployment

Generally, the Safety Assessment Program deployment starts when the Governor proclaims a state of emergency. There may be situations when a state of emergency is not proclaimed by the Governor, and a request comes to Cal OES for SAP personnel, but these are the exception rather than the rule.

If an Operational Area (county) opens its Emergency Operations Center (EOC) and has an extreme incident on its hands needing state assistance, or if two Operational Areas open their EOCs, then the Regional Emergency Operations Center (REOC) opens, and the State Operations Center (SOC) opens. Requests for SAP personnel are sent to the SOC.

At the direction of Cal OES executive leadership, one of the Cal OES Statewide SAP Coordinators is deployed to the SOC to manage the requests for SAP personnel. Relevant state agencies also send liaison representatives to the SOC as well.

If the Operational Areas request SAP resources during the time that the SOC is activated, the Statewide Coordinator works on obtaining SAP personnel. The timeframe for deployment of SAP personnel to the field is usually 48 to 72 hours.

If the disaster is of sufficient magnitude, Cal OES may determine that SAP DSW-State resources are necessary in order to meet the immediate life safety issues at hand. If DSW-State resources are not sufficient to meet the need, then requests from Cal OES will include DSW-Local mutual aid resources and DSW-Volunteer resources. This would be the case for a catastrophic earthquake, for example.

If the Operational Areas request SAP resources after the SOC is no longer activated, then the Statewide SAP Coordinator will rely on DSW-Local mutual aid resources, and DSW-Volunteer resources.

Before DSW-Local resources can be activated to assist a city or county, the local government requesting assistance must sign the SAP Memorandum of Understanding. This contract establishes the basis for reimbursement of the SAP personnel for necessary expenses; without it, FEMA regards mutual aid in California as free labor, and will not reimburse any related expenses. (The need for the SAP MOU became evident after the 2014 Napa Earthquake.) The SAP MOU also clarifies the responsibilities of Cal OES and local government regarding the Safety Assessment Program.

5.2 – SAP Resource Procurement

5.2.1 – Post-Disaster Response Assessment (PDRA)

When the SOC is activated, the type of SAP deployment used is called the Post-Disaster Response Assessment, or PDRA.

The SOC Mission Task section works with the Statewide SAP Coordinator to identify the resources required, and the state agencies that these can be requested from.

Once a state agency receives the Mission Task request, they do outreach within their own departments to fill the request. The agencies most likely to be mission-tasked for this purpose, at the time of this writing, are: Department of General Services (DGS), Department of Transportation (Caltrans), and the Department of Health Care Access and Information (HCAI, formerly OSHPD). If geologists are needed, then the Department of Conservation would likely be Mission-Tasked.

Once the state agencies identify the personnel that can be activated for the disaster, these are deployed in response to the Mission Task request. The FEMA reimbursement process is straightforward, since mission-tasking involves other state agencies. The mission task process also results in a rapid and comprehensive response to the disaster.

5.2.2 – Recovery Safety Assessment (RSA)

Once the SOC is no longer activated, and a request for SAP resources reaches one of the Statewide SAP Coordinators, Cal OES works with the partner organizations (California Building Officials, or CALBO; American Institute of Architects, or AIA; American Society of Civil Engineers, or ASCE; Structural Engineers Association of California, or SEAOC; and the American Construction Inspectors Association, or ACIA) to do a callout for the availability of individuals.

In an RSA activation, if you are aligned with one of these partner organizations, they will contact you, likely by email, to see if you are available for deployment.

If you are available for a deployment, you can contact your organization to let them know that you can be readily deployed.

5.2.3 – After Activation

Once SAP personnel are activated, their organization coordinates with Cal OES for all logistic details.

Below is a list of recommended items to bring with you. Do not neglect the protection and safety gear! Other items can be brought if desired.

Protection and safety gear

- Hardhat
- Safety vest
- Clothes appropriate for the weather
- Cellphone or tablet with charger
- Battery bank (charged!)
- Safety shoes
- NIOSH N-95 mask or respirator
- Gloves
- Safety glasses (snow goggles if deployed to snow country)
- Earplugs
- Safety whistle (wear around your neck)
- Hand sanitizer
- Flashlight with extra batteries
- Insect repellant
- Sunscreen
- Small first aid kit
- Water container
- Water purification tablets

Necessary Personal Items

- Credit card, traveler's checks, and/or cash.
- Extra clothing
- Personal hygiene supplies
- Personal identification (such as driver's license)
- Prescription medicine for at least the length of the deployment, plus 2 days
- Sleeping bag and inflatable mattress, if the situation warrants it.

Field Work Tools

- Lockable backpack (most things can be stored in this)

- Clipboard, if paper forms are anticipated in the field
- Field manuals: ATC-20-1 and ATC-45 (if you do not have these, they can be purchased from the Applied Technology Council, www.atcouncil.org)
- Notebook (waterproof, if possible; can search online for this)
- Professional ID card, such as wallet card for professional license or certification
- SAP ID (if plastic card, have on a lanyard or clip; if electronic, have it on your electronic device, or carry a printed version on you)
- SAP identifying clothing, if available
- Waterproof permanent marking pens
- Waterproof writing pens or pencils

Other Items (depending on field conditions)

- Binoculars (to observe conditions too high or remote to see easily)
- Swiss army knife or multi-tool
- Tape measure
- Magnetic compass
- Knee pads
- Shower slippers, if staying in a camp setting
- Small battery-powered radio with extra batteries (for after-hours)
- Reading materials (for after-hours)

SAP Evaluators must arrange for their own travel and lodging, unless local government has predetermined lodging arrangements.

A four-wheel drive vehicle may be ideal for the deployment, but such a vehicle is not required.

You need to inform your organization of when you leave on your deployment, and when you return home. You can reply to the email that requested your services to accomplish this.

You will report to the staging area described in the deployment email. This will be at the local government requesting the assistance; you will be reporting to the local SAP Coordinator, whether that is the Building Official or another person. You will sign in, obtain a briefing packet from them, and watch a refresher video. The refresher video is a short review of things to do and things to avoid in the field, and will help you remember your SAP training.

The briefing packet should have a map of the area, forms to submit to the local government for travel expense reimbursement, and a list of important phone

numbers. These phone numbers will include law enforcement, fire, hazmat, utilities, and animal control. (The latter may not seem obvious, but in one disaster, roving packs of dogs created problems for SAP evaluators. More commonly, a large dog trapped behind a fence will not allow you to do your evaluation of a home.)

You will receive a work assignment, including being assigned to a team. **Note: you will always be assigned to work on a team. Never go out into the disaster theater alone! It is too dangerous.**

The local SAP Coordinator will also assign you to a territory to work. This may be a group of blocks, or could be a list of street addresses in the case of sporadic damage. In the latter case, the local government might assign a vehicle with a local driver to your team to facilitate your efforts.

5.2.4 – Deputizing

Figure 5.1 – Deputizing of SAP evaluators prior to field deployment in the 2003 Mono County Snow Load event. Photo courtesy Gurbir Singh.

Figure 5.2 – Deputizing of SAP evaluators prior to deployment in the 2023 Donner-Tahoe Snow Load event. Photo courtesy Gurbir Singh.

Before your team leaves to start posting placards, you must be deputized by the local government. This action grants you the authority to post official placards that have the force of law behind them. You are also authorized to take other vital actions on behalf of the local building department, such as recommendations for barricades.

If you are not deputized, then you can only post unofficial, generic placards that legally are only suggestions, at best, and can be ignored by the community without legal repercussions. (There may be life safety repercussions for ignoring these placards, but that is another subject.) Then a local building inspector who is deputized would need to come behind you and replace the generic placards with the official ones. This would be redundant, difficult, or impractical. Another idea would be for a local building inspector to be present on every team, which is not a likely scenario in the event of extensive damage. For these reasons, it is strongly recommended by Cal OES that local governments deputize SAP evaluators so their work can proceed unhindered.

The local government does not encumber any additional liability by deputizing you, and is not thereby responsible for your worker's compensation.

SAP personnel can be deputized by the Building Official, the City Manager, or an appointee.

5.2.5 – Immunity from Liability

There is liability protection available for those responding to disasters in the State of California. This is a major issue in other places around the country in regard to post-disaster safety assessment of structures; in California, there are several ways in which protection covers those assisting in the Safety Assessment Program here.

California's **'Good Samaritan' Law** provides general immunity from liability for persons helping others; this law was not originally intended for disaster situations, but still provides some liability protection.

> 1799.102. (a) No person who in good faith, and not for compensation, renders emergency medical or nonmedical care at the scene of an emergency shall be liable for any civil damages resulting from any act or omission. The scene of an emergency shall not include emergency departments and other places where medical care is usually offered. This subdivision applies only to the medical, law enforcement, and emergency personnel specified in this chapter.
>
> (b) (1) It is the intent of the Legislature to encourage other individuals to volunteer, without compensation, to assist others in need during an emergency, while ensuring that those volunteers who provide care or assistance act responsibly.

Private sector engineers, architects, and building inspectors who are California residents are registered by Cal OES as Disaster Service Workers (DSWs). This liability protection applies when Cal OES officially deploys volunteers into the field. In accordance with the **California Emergency Services Act**, Section 8657:

> "(a) Volunteers duly enrolled or registered with the California Governor's Office of Emergency Services or any disaster council of any political subdivision, or unregistered persons duly impressed into service during a state of war emergency, a state of emergency, or a local emergency, in carrying out, complying with, or attempting to comply with, any order or regulation issued or promulgated pursuant to the provisions of this chapter or any local ordinance, or performing any of their authorized functions or duties or training for the performance of their authorized functions or duties, shall have the same degree of responsibility for their actions and enjoy the same immunities as officers and employees of the state and its political subdivisions performing similar work for their respective entities."

In 1977, the California State Attorney General issued a response to a series of questions presented by Cal OES regarding the liability protection afforded by the **California Emergency Services Act.** The following are extracts of that response:

Question: May structural engineers who are registered as Disaster Service Workers be utilized to assess the extent of damages incurred by buildings in an area struck by earthquakes?

Answer: Structural engineers who are registered as Disaster Service Workers may be utilized to perform post-earthquake damage assessments following the proclamation of a State of Emergency or a Local Emergency.

Question: Would the appointment of such engineers as Deputy Building Inspectors, without pay, affect their eligibility for state worker's compensation?

Answer: The appointment, without pay, of structural engineers who are registered Disaster Service Workers as Deputy Building Inspectors by government entities would not affect the engineer's entitlement to State Disaster Workers' Compensation Benefits, which would remain the exclusive remedy for physical injuries suffered by them while performing related activities.

Question: Would such engineers be required to be "fully conversant" with local building safety codes?

Answer: Volunteer Engineer/Disaster Service Workers would not be required to be fully conversant with local building and safety codes.

Question: If a local engineer, building inspector, or volunteer engineer certifies a structure is safe for occupancy and, when occupied, it collapses and individuals are injured, would the local entity, the state, or the certifying engineer be liable?

Answer: No liability would attach to a public entity, its employees, or a Disaster Service Worker under the circumstances presented.

Additional liability protection exists for California registered architects and engineers through the **State of California Business and Professions Code,** Chapter 30, Section 5536.27 for architects and Section 6706 for engineers (both cited below). After the Loma Prieta Earthquake of 1989, many architects volunteered their services to the City of Oakland, assisting with the safety assessment of buildings there. Concerned about their future liability, they championed Senate Bill 46X that passed in 1990. This legislation modified the Business and Professions Code to provide liability protection for professionally registered engineers and architects.

Quotation of Section 5536.27 (architects) for reference: "(a) An architect who voluntarily, without compensation or expectation of compensation, provides structural inspection services at the scene of a declared national, state, or local emergency caused by a major earthquake, flood,

riot, or fire at the request of a public official, public safety officer, or city or county building inspector acting in an official capacity shall not be liable in negligence for any personal injury, wrongful death, or property damage caused by the architect's good faith but negligent inspection of a structure used for human habitation or a structure owned by a public entity for structural integrity or nonstructural elements affecting life and safety. The immunity provided by this section shall apply only for an inspection that occurs within 30 days of the declared emergency. Nothing in this section shall provide immunity for gross negligence or willful misconduct. (b) As used in this section: (1) 'Architect' has the meaning given by Section 5500. (2) 'Public safety officer' has the meaning given in Section 3301 of the Government Code. (3) 'Public official' means a state or local elected officer."

Quotation of Section 6706 (engineers) for reference: "(a) An engineer who voluntarily, without compensation or expectation of compensation, provides structural inspection services at the scene of a declared national, state, or local emergency at the request of a public official, public safety officer, or city or county building inspector acting in an official capacity shall not be liable in negligence for any personal injury, wrongful death, or property damage caused by the engineer's good faith but negligent inspection of a structure used for human habitation or owned by a public entity for structural integrity or nonstructural elements affecting life and safety. The immunity provided by this section shall apply only for an inspection that occurs within 30 days of the declared emergency. Nothing in this section shall provide immunity for gross negligence or willful misconduct. (b) As used in this section: (1) 'Engineer' means a person registered under this chapter as a professional engineer, including any of the branches thereof. (2) 'Public safety officer' has the meaning given in Section 3301 of the Government Code. (3) 'Public official' means a state or local elected officer."

Local government employees who are dispatched to another jurisdiction under the **California Master Mutual Aid Agreement** have their liability protection from their home jurisdiction transferred with them. Once they are **deputized** so they can post locally adopted placards, they also receive the same immunity from liability that employees of the assisted jurisdiction have. This also holds true for volunteers and state workers who are deputized by the assisted jurisdiction. The immunity from liability holds for the length of the deputizing, which is normally up to 30 days from the date of the disaster declaration.

As the California Emergency Services Act states, liability protection also attaches to persons, registered or not, who are "duly impressed into service" by the authorities having jurisdiction. This practice of 'commandeering' dates back to Roman times, and has been used in recent disasters in California as well.

Under the **Emergency Management Assistance Compact (EMAC)**, persons from outside the State of California who are sent through EMAC to help with a disaster in California have whatever immunities from liability that they would have in their home state. Conversely, persons sent by the State of California under EMAC to help communities in other states have the same protections from liability that they enjoy within California.

Of course, these liability protections **do not cover** malicious acts (such as red-tagging a building because the owner is argumentative) or gross negligence (such as green-tagging a building without any assessment).

5.2.6 – Workers Compensation

State of California employees and California local government employees are Disaster Service Workers by definition. State of California employees are covered with workers' compensation from the State of California. Local government employees are covered with workers' compensation from their respective local governments.

As stated in the previously mentioned California Attorney General's Opinion, private sector volunteers are covered for workers compensation by the State of California, and this is the only source of workers' compensation available to them. However, private sector volunteers must become California Disaster Service Workers in order to be eligible for workers' compensation from the State of California. This in accord with Section 8580 of the California Emergency Services Act, which states:

> "The Emergency Council shall establish by rule and regulations various classes of disaster service workers and the scope of the duties for each class. The Emergency Council shall also adopt rules and regulations prescribing the manner in which disaster service workers of each class are to be registered. All of the rules and regulations shall be designated to facilitate the payment of workers' compensation."

Private sector residents of California become Disaster Service Worker volunteers by completing the Loyalty Oath or Affirmation on the SAP Registration Form (hereafter referred to as the "Loyalty Oath").

State of California employees, as well as employees of local governments in California, are not required to sign the Loyalty Oath, as they are already Disaster Service Workers.

Persons who are not residents of California do not need to sign the Loyalty Oath. If they are dispatched to California under EMAC, then they would be covered by whatever workers' compensation arrangement exists for them in their home state.

If an injury occurs to a Disaster Service Worker, the injury must be reported at once to the SAP Coordinator! State and local government Disaster Service Workers must also ***report the injury to their regular supervisor at once!*** The injured person will need to complete an injury report provided either by the SAP Evaluator, and/or by their immediate supervisor, if they are a government worker.

5.2.7 – Reimbursement and the SAP MOU

Housing, meals, reasonable travel costs, and other necessary expenses incurred by SAP evaluators are reimbursed by the local government that requested the SAP evaluator's services.

The California Master Mutual Aid Agreement makes clear that mutual aid is rendered between local governments *without cost.* FEMA views this arrangement as free labor, and so will not reimburse local governments in a federal disaster unless there is another agreement that spells out a clear line of financial responsibility. This is why the SAP Memorandum of Understanding (SAP MOU) was created.

The experiences from the 2014 Napa Earthquake made clear the need to solidify the mutual aid agreements regarding safety assessment, so all parties are aware of their responsibilities, and so eligible reimbursement from state and federal disaster programs for SAP expenses can proceed. Therefore, Cal OES created the SAP MOU that spells out the terms of mutual aid for the Safety Assessment Program, and that also supplies some operational framework for implementing this mutual aid. A copy of the SAP MOU can be found in the Appendix.

Cal OES strongly recommends that local governments have a SAP MOU in place before an emergency happens that requires safety assessment assistance! If no signed agreement is in place when a request for assistance is made, Cal OES will seek to have the document signed by the Receiving Agency prior to dispatching SAP personnel.

Responding volunteers may have to pay up front for hotel and meal expenses, as well as other reasonable travel costs, but these costs are to be reimbursed by the local government that requested their assistance. Some local governments may have a pre-arrangement with a hotel and restaurant so the out-of-pocket expenses by the volunteers are greatly reduced.

In addition to these things, there are two other reimbursement issues that all should be aware of:

- DSW Volunteers will not be able to receive wages while activated for the Safety Assessment Program. They must be on their own time, either on vacation or on unpaid leave, while working as a volunteer. This is so the

workers' compensation coverage from the State of California will apply. (If a company were to pay wages to private sector employees while they worked doing safety assessment, the company would be responsible for the workers' compensation, and their people would also not have the protection from liability that the State of California provides for volunteers.)

- Local government employees might be operating on their home jurisdiction's funding until the Governor proclaims a state of emergency for the incident. As stated before, these costs can be reimbursed eventually through the state and federal public assistance programs.

Cal OES and FEMA guidelines provide reimbursement for SAP work under the conditions noted above, namely, if there is a SAP MOU in place that clearly establishes the financial responsibility for their expenses. FEMA's guidance on this is found in the Public Assistance Program and Policy Guide, pages 110 and 127. The SAP evaluator work fits in the Public Assistance program under Category B, Emergency Protective Measures.

However, this reimbursement opportunity is only for the review of buildings for safe use. If the local government tries to have SAP evaluators come up with repair estimates, this is NOT eligible for FEMA reimbursement.

FEMA requires local governments to come up with their own repair or replacement estimates. This process is called 'damage assessment.' The local governments are solely responsible for this activity. So, if FEMA finds that local governments included safety assessment and damage assessment costs in the same request for reimbursement, FEMA will deny all of it.

Cal OES does not want local governments to end up not being reimbursed for eligible work, so it is imperative that SAP evaluators *never* provide costs estimates for the repair or replacement of damaged structures. That work is up to the local governments themselves to come up with.

5.3 – Field Safety

5.3.1 – Critical Incident Stress

Critical Incident Stress Disorder (CISD) can affect emergency workers after working long hours over a number of days. SAP evaluators are only deployed for five days in the field so as to reduce exposure to this problem. However, the local government staff have been working the disaster since it started, and they may be exhibiting symptoms of CISD. This disorder can also creep into the mindset of SAP evaluators also, if stress relieving measures are not taken. Knowing the causes and symptoms will help SAP evaluators to better understand what others are feeling. This will also help SAP evaluators to avoid getting CISD themselves.

Critical Incident Stress Disorder can be caused, in whole or in part, by the following:

- Long hours, working 12-to-14-hour shifts, or performing heavy manual work for long periods of time.
- Emotional turbulence incurred in dealing with the disaster. People encountered in the disaster are frightened, exhibiting high emotional states, encouraging the same high level of emotions in the disaster workers.
- Loss – a sense of loss when looking around and taking stock of the damage. 'Will the community ever recover?'
- Destruction – the sense of utter devastation associated with large events such as powerful earthquakes.
- Injuries and death – working with and dealing with a large number of injured or dead is a constant reminder of the horrific incident. This can lead to feelings of futility, survivor's guilt, and frustration.
- Lack of sleep or food – this is probably the most common cause of CISD. The mind and body are starved as dedicated staff work single-mindedly on the disaster, forgoing proper food and rest. At the end of the shift, disaster workers are still keyed up, and it is difficult to sleep.
- Separation from family and setting aside one's own needs – this is probably more prevalent among local government emergency workers, or those who are directly involved in care and shelter. However, separation from one's family could affect an evaluator if one is worried about issues at home, especially if home life was affected by the same disaster the SAP evaluator is responding to.

CISD will manifest itself by any one or more of the following symptoms:

- Inability to make decisions – One's mind is blank, and the 'deer in the headlights' syndrome is in evidence, despite how many people are waiting for a decision.
- Slowness of thought and confusion – One doesn't have a clue as to what the information or data coming in means, and doesn't know what to do with the information.
- Inability to express oneself – frustration arises as evaluators try to speak, but can't say what they mean.
- Depression, irritability, and anxiety – these can result in feelings of futility, such as 'why am I doing this?' or 'what difference does this make, anyway?'
- Exhaustion, loss of energy – The stress generated by working the disaster can take its toll physically as well as mentally. Persons can feel physically ill, with no energy to do anything. It becomes an effort to continue with one's duties. There is no desire to eat; the thought of eating food becomes almost too much to contemplate. In many cases, sleep eludes persons, who continue worrying about the operation despite being exhausted.

There are several simple steps that can be taken to be protected from suffering the effects of CISD, as follows:

- Take frequent breaks – pace oneself so as to be working at a constant level.
- Eat good meals at regular times – stay away from junk food and eat well, the mind and body need it! Schedule time for several good meals a day.
- Drink plenty of fluids and keep hydrated. Consider carrying a canteen or water jug. Avoid alcoholic beverages during the deployment, as they dehydrate the body and interfere with deep sleep.
- Freely talk about the experiences encountered. After work, join with fellow SAP evaluators and freely discuss the things seen and heard that day, along with how it made one feel. In turn, be a good listener.
- Get plenty of sleep, do not stay up all night talking. Set a time for sleep and keep to it.

Awareness of CISD is one of the key preventative measures for avoiding CISD for oneself and others. Watch for the signs and take action to minimize the impact. If CISD symptoms are observed in a fellow SAP evaluator, take him or her aside and take a break. Try to get them to rest, drink water, and talk about their feelings.

5.3.2 – Hazardous Materials

The world we live in is surrounded by hazardous materials that are properly contained. Disasters have the potential to release these dangerous materials into the environment, exposing disaster workers and the populace to their often-deadly effects. Floods can carry toxins and corrosives in solution for great distances, while earthquakes, fires, and explosions can disable containment and cause releases. Moreover, released chemicals can react with one another in ways never dreamed of by their day-to-day users. Awareness of these risks can truly improve one's safety profile and prolong life!

This section will look at some basic information regarding the posting of hazardous materials that can be used to increase safety while evaluating building damage. This information is strictly to help improve the safety of SAP evaluators, and is not intended to make anyone an expert in this difficult field.

Understanding the hazardous materials placard systems for buildings and for individual containers will give evaluators a better idea of the kinds of materials being dealt with in a very general sense. One of the first rules to remember is to use one's common sense; it is possible, for example, for a building to have a changed use, but the new owners forgot to take down the old hazardous material diamond-shaped placard when they changed the use of the building. A drum of material may have had its contents changed to something else, and no one bothered to change the hazardous material sticker on the drum. This can lead to situations that are less dangerous or more dangerous than the placards may indicate.

The placards also don't say what can happen if the stored materials become mixed. The level of hazard can become significantly greater when containers are leaking, and the materials come together.

One should never be asked to identify hazardous materials; leave this work for those specially trained and equipped to do so.

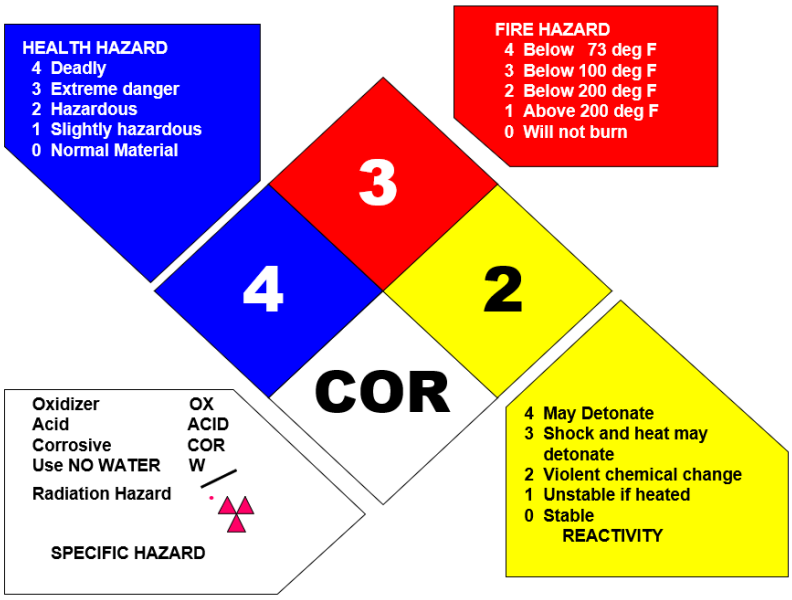


Figure 5.3 – NFPA Hazardous Materials 704M signage.

Figure 5.4 – Department of Transportation (DOT) hazardous materials signage. Numbers indicate hazardous material descriptions found in the Emergency Response Guidebook (ERG).

Figure 5.5 – American Coating Association Hazardous Materials Identification System (HMIS) placard. Used on drums of stored chemicals.

There are more hazardous materials labeling systems than can be presented in the scope of this manual. Three labeling systems that are commonly used throughout the United States are mentioned here. They are:

- National Fire Protection Association (NFPA) 704M system used for identifying hazards of materials within facilities that manufacture, process, store, or use hazardous materials.
- Federal Department of Transportation (DOT) system used to label hazardous materials during transport.
- American Coatings Association's Hazardous Materials Identification System (HMIS) used to label hazardous materials within manufacturing plants and facilities.

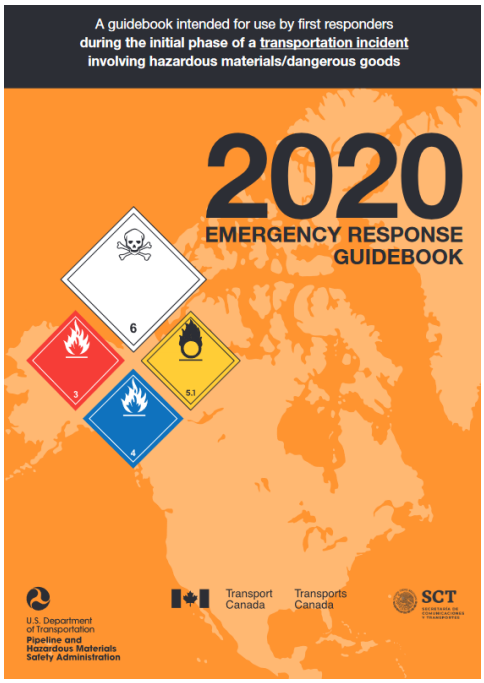


Figure 5.6 – Department of Transportation Emergency Response Guidebook.

The *Emergency Response Guidebook (ERG)* covers the hazardous materials designations as applied to transported hazardous materials in North America and their hazards. It can be downloaded for free as a .pdf file from the following website, as of this 2020 version:

https://phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg

ERG number designations are found on DOT placards in addition to the information shown in Figure 7-10. For example, gasoline's ERG number is 1203, and this is seen clearly on the placards on the back of gasoline tanker trucks. These numbers key into information found in the ERG on how to handle these materials and what their risks are.

Figure 5.7 – OSHA Biohazard symbol.

A door or a container marked with the OSHA Biohazard symbol must be treated with great respect! An unsafe release could lead to serious injury or death.

5.3.3 – Safety Awareness (Reiteration)

As you approach buildings to inspect them, always approach with caution, and be aware of potential hazards. Never take your surroundings for granted! The disaster theater is very dangerous, and things that look safe at first might not be. Inspect for structural, non-structural, utility, and hazardous materials hazards.

Always work in teams of at least two persons. Use of this 'buddy system' is imperative! If a member of the team becomes injured or trapped, the other can call for help, then provide whatever assistance can be safely rendered.

Always wear a hard hat and safety shoes, and bring your own. Never assume that local governments will have these for you!

Before you enter a building, make sure that the exit doors are fully operable, exit pathways are clear, and that there are no falling hazards. In essence, make sure that you can get out!

Figure 5.8 – Flies multiplied out of control after the 2005 Hurricane Katrina event. Photo courtesy Raymond Lui, SEA.

Bring insect repellant to the disaster response. Flies, mosquitos, and ticks can become serious health hazards after a disaster. Other creatures such as mice and rats may have population explosions due to increased food supply and fewer humans to control them. Snakes and other reptiles may seek higher ground in flood events, such as where you are, or may be swimming in the flood waters.

Figure 5.9 – A person gets too close to a shed that is perched on a fence. Photo courtesy Raymond Lui, SEA.

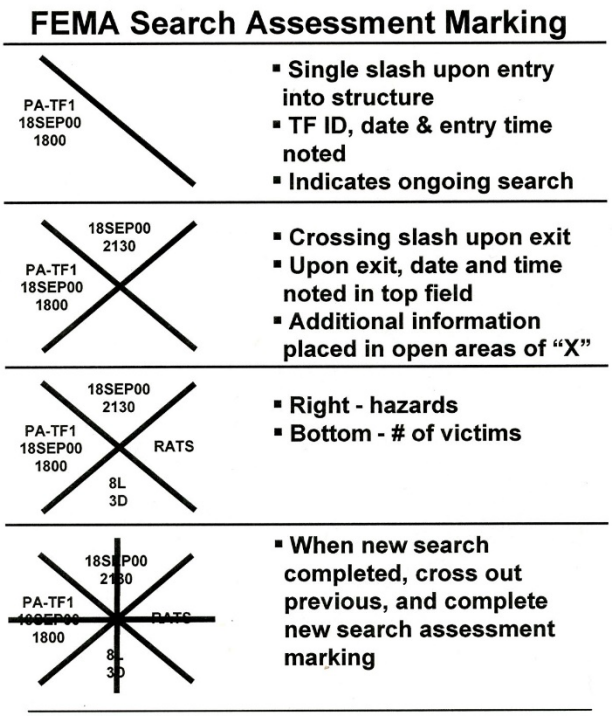


Figure 5.10 – Search Assessment Marking used by Urban Search and Rescue (USAR) teams.

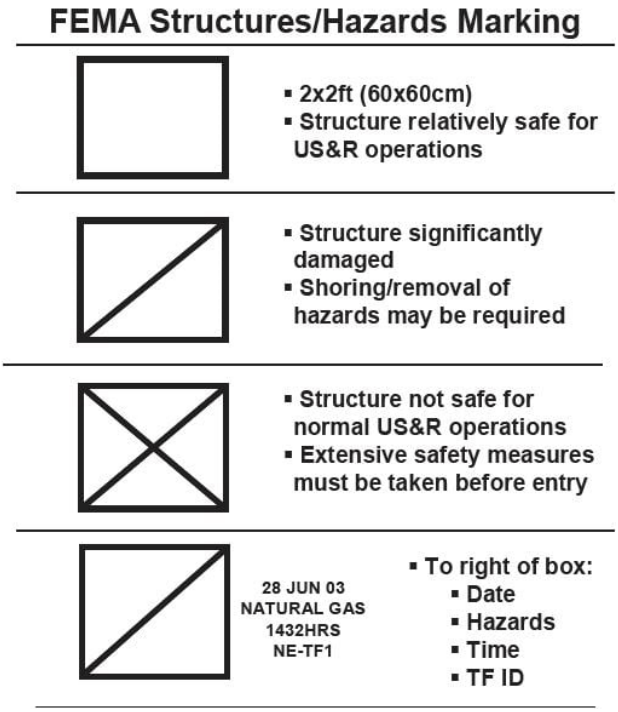


Figure 5.11 – Structures and Hazards Marking used by USAR teams.

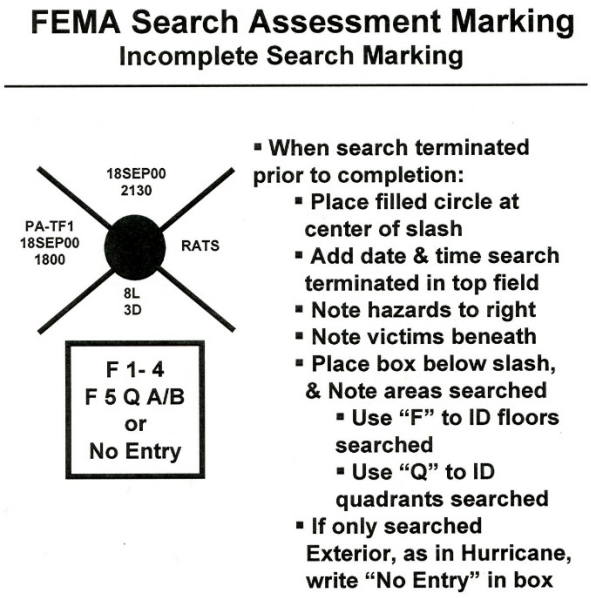


Figure 5.12 – USAR team marking when a search is left incomplete.

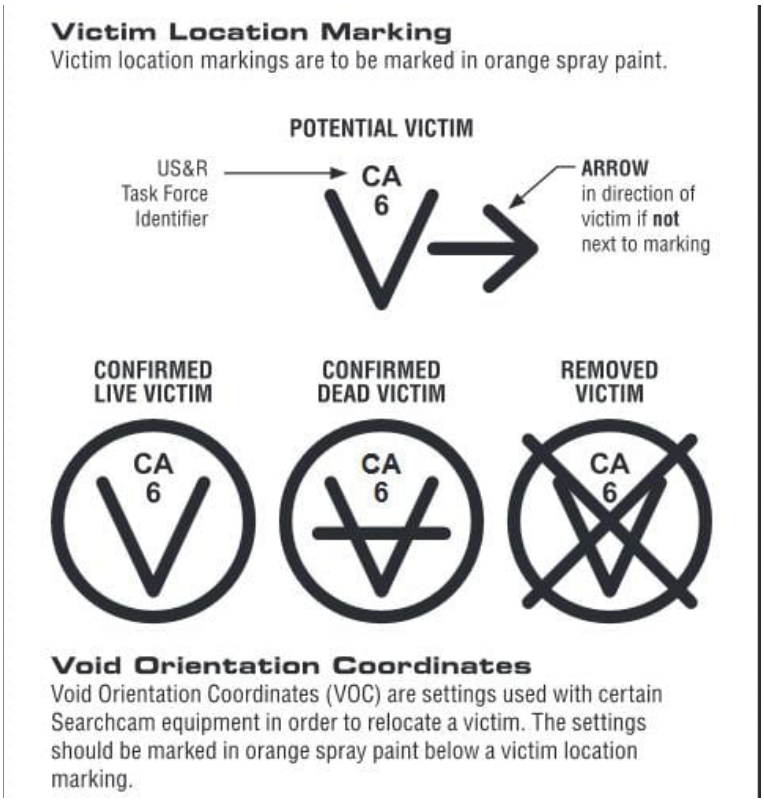


Figure 5.13 – USAR Victim Location Markings

Figure 5.14 – An inspector casually sits under an overhanging roof fragment. Courtesy Raymond Lui, SEA.

Figure 5.15 – A motor home floated onto a roof during the 2005 Hurricane Katrina event. Photo courtesy Raymond Lui, SEA.

Figure 5.16 – Mold infestation after a flood disaster. Photo courtesy Raymond Lui, SEA.

Figure 5.17 – Deep mud in street is a slipping hazard. Photo courtesy Raymond Lui, SEA.

5.3.4 – Warnings

Evaluators do not perform cost estimates or give recommendations for repair.

Be aware of hanging or exposed electrical wiring, and treat all wiring as if they were live, regardless of the general condition of the community utilities.

Do not enter obviously unsafe buildings. Don't let curiosity get the better of you! Tag the building UNSAFE, and live another day. Move on!

Do not go into buildings, or parts of buildings, that are located on unstable slopes, or where a falling hazard exists that could block you in.

If the building is leaning and significantly out of plumb, do not enter it. It doesn't take much racking to render a building unstable!

If you are on a Detailed Evaluation team, you may be asked to take another look at a building that is already tagged UNSAFE. Your purpose would be to confirm the placarding, or to find good reasons why the placard should be changed to something else. In any case, you must take great care to act in a safe manner!

- Only consider going into a building posted UNSAFE if there is no collapse hazard, and you have confirmed that all hazardous materials issues are cleared. (A hazardous materials spill might have been the reason the building was tagged UNSAFE, if there no apparent structural issues.)
- If building collapse seems likely, do not enter the building unless it is made safe by shoring, if possible.
- If there was a hazardous materials spill in the building, do not enter it until the spill is cleaned up and the building cleared for use.
- Again, one member of the team always stays outside as a safety watch while others go in. The safety watch can call for help if there is trouble.
- As you work through the building, verify the stability of every room or part of the structure before you enter it.

APPENDIX

MOU

MEMORANDUM OF UNDERSTANDING
BETWEEN
[REQUESTING JURISDICTION]
AND
THE CALIFORNIA GOVERNOR'S OFFICE OF EMERGENCY SERVICES OF THE STATE OF CALIFORNIA OF THE UNITED STATES OF AMERICA

The [Requesting Jurisdiction ("Requesting Jurisdiction")] and the California Governor's Office of Emergency Services (Cal OES) of the State of California of the United States of America, hereinafter referred to as "the Participants";

WHEREAS, the safety of the people of the State of California is of the utmost importance at all levels of state and local government;

WHEREAS, the State of California and the Federal Emergency Management Agency (FEMA) recognize the importance of written mutual aid agreements to facilitate response, recovery, and reimbursement;

WHEREAS, the Safety Assessment Program (SAP) utilizes volunteers and mutual aid personnel to provide licensed professional engineers, architects, geologists, certified building inspectors, certified public works inspectors, and SAP Coordinators, hereinafter referred to as "SAP personnel", to assist local governments in safety evaluation of their built environment in the aftermath of a disaster;

WHEREAS, SAP is intended to help local governments perform facility safety evaluations as quickly as possible; and

WHEREAS, the Participants seek to enter into this Memorandum of Understanding to request or provide SAP resources and personnel from each other in the event of a disaster.

Therefore, the Participants have reached the following understanding:

SECTION I
Objective

To establish a framework between the Participants for the provision of SAP personnel, managed by Cal OES, to be provided to [the requesting jurisdiction] for the purpose of conducting safety assessments.

SECTION II
Specific Activities

Responsibilities of each Participant and specific provisions regarding worker's compensation and immunity are set forth as follows.

A. Requesting Jurisdiction Responsibilities

1. Provide Cal OES with the number of SAP evaluators Cal OES is requesting and their preferred expertise, such as the number of licensed civil, structural, or geotechnical engineers, licensed architects, or certified building inspectors being requested;
2. Provide Cal OES with the number of days the SAP personnel will be needed, the date and time of arrival, and reporting location
3. Be responsible for reasonable lodging, travel, and per diem costs for meals not provided of the volunteer SAP personnel deployed by Cal OES in response to the disaster or emergency, if applicable;
4. Be responsible for the hourly wages and overtime of local government SAP personnel deployed by Cal OES in response to the disaster or emergency, in addition to their reasonable lodging, travel, and per diem costs, if applicable;
5. Not be required to reimburse State SAP personnel;
6. The SAP personnel will be under the authority of the Requesting Jurisdiction once deputized by the Requesting Jurisdiction as deputy building inspectors, after which time the SAP personnel will be permitted to post official placards under the authority of the local jurisdiction;
7. Utilize SAP personnel only to evaluate building and/or infrastructure viability;
8. Maintain daily activity of all who participate in the SAP deployment on an ICS 214 Activity Log, including time of arrival and time of departure for the duration of the deployment and to provide copies of the ICS 214's to the state and federal disaster recovery specialists upon request;
9. Track and document costs to conduct safety assessments and support SAP personnel;

10. Upon completion of the SAP mobilization, all SAP personnel will be safely demobilized in accordance with standard emergency management best practices;
11. Upon completion of the SAP mobilization, pay all outstanding costs;
12. Not use SAP personnel to estimate building damage repair costs;
13. Not use SAP personnel for retrieval of possessions from privately or publicly owned buildings;
14. Keep records of the hours that the volunteers spent in the field, the normal hourly wage of each volunteer, and the volunteers' names, if it chooses to use the donated labor of SAP volunteers to offset their non-federal cost share; and
15. Will immediately report any injuries of SAP personnel to the Statewide Safety Assessment Program Coordinator.

B. Cal OES Responsibilities

1. Make reasonable efforts to provide SAP personnel to the Requesting Jurisdiction;
2. Coordinate contacting SAP personnel and consolidating names to provide to the [Requesting Jurisdiction]; and
3. For the purpose of deploying SAP personnel, provide all deployment information furnished by the [Requesting Jurisdiction] to SAP personnel, including but not limited to [Requesting Jurisdiction] Points of Contact, lodging location(s), and initial location to report for work.

B. Worker's Compensation and Immunity

1. To the extent permitted under California law, State SAP personnel and volunteers will be covered for worker's compensation by the State of California worker's compensation law, and local jurisdiction SAP personnel will be covered for worker's compensation through their own jurisdiction.
2. To the extent permitted by law, SAP personnel may have immunity from liability in accordance with the California Emergency Services Act Government Code section 8657(a), and the California Business and Professions Code sections 5536.27 and 6706. SAP personnel will also obtain immunity from liability by virtue of being deputized by the

Requesting Jurisdiction. Nothing in this section shall provide immunity for intentional acts, gross negligence or willful misconduct, or any conduct outside the course and scope of official duties, or wherever else immunity is prohibited under California law.

SECTION III
Points of Contact

The [Requesting Jurisdiction] and Cal OES will also serve as the respective contact points for communication and information exchange, as well as any notice required to be submitted under this Memorandum of Understanding.

Cal OES: Alora Franco, Statewide Safety Assessment Program Coordinator
Email: SAP@CalOES.ca.gov
Phone: (916) 328-7711 OR Mobile: (916) 539-5245

Gurbir Singh, Statewide Safety Assessment Program Coordinator
Email: SAP@CalOES.ca.gov or Gurbir.Singh@caloes.ca.gov
Mobile: (916) 823-6790

Jim Barnes, Statewide Safety Assessment Program Coordinator
Email: Jim.Barnes@CalOES.ca.gov Mobile: (916) 856-9922

[Requesting Jurisdiction]: [Specific Point of Contact]

SECTION IV
No Legal Obligations, Rights, or Remedies

This Memorandum of Understanding is a voluntary initiative. It does not create any legally binding rights or obligations and creates no legally cognizable or enforceable rights or remedies, legal or equitable, in any forum whatsoever. In addition, the pledges in this Memorandum of Understanding are not conditioned upon reciprocal actions by other Participants; each Participant retains full discretion over implementation of its pledges in light of the Participant's individual circumstances, laws, and policies; and each Participant is free to withdraw from the Memorandum.

SECTION V
Availability of Personnel and Resources

This Memorandum of Understanding does not involve the exchange of funds, nor does it represent any obligation of funds by either Participant. All costs that may arise from activities covered by, mentioned in, or pursuant to this Memorandum

of Understanding will be assumed by the Participant who incurs them, unless otherwise stipulated and decided pursuant to a future written arrangement. All activities undertaken pursuant to this Memorandum of Understanding are subject to the availability of funds, personnel, and other resources of each Participant.

The personnel designated by a Participant for the execution of this Memorandum of Understanding will work under the orders and responsibility of the Participant and any other organization or institution to which they belong, at all times maintaining any preexisting employment relationship with the Participant and such organization or institution. Their work will not create an employer-employee relationship with another Participant or any other organization or institution, so in no case will that other Participant, or other organization or institution, be considered as a substitute or joint employer of the designated personnel.

SECTION VI
Compliance with Applicable Laws

All activities undertaken pursuant to this Memorandum of Understanding, and all personnel designated by the Participants for the execution of those activities undertaken pursuant to this Memorandum of Understanding are subject to all laws applicable in the jurisdiction where the activities are performed. Such personnel, if visiting the other Participant to participate in an activity pursuant to this Memorandum of Understanding, will not engage in any activity detrimental to this Memorandum of Understanding.

SECTION VII
Interpretation and Application

Any difference that may arise in relation to the interpretation or application of this Memorandum of Understanding will be resolved through consultations between the Participants, who will endeavor in good faith to resolve such differences.

SECTION VIII
Final Provisions

This Memorandum of Understanding is effective from the date of its signature, for a two (2) year period, unless renewed or extended by the Participants in the same manner that the Participants may otherwise modify this Memorandum of Understanding.

This Memorandum of Understanding may be modified at any time by mutual consent of the Participants. Any modification shall be made in writing and specify the date on which such modification is to become effective.

Any of the Participants may at any time, withdraw from this Memorandum of Understanding by providing a written notice to the other Participant 30 days in advance.

The termination of this Memorandum of Understanding shall not affect the conclusion of the cooperation activities that may have been initiated during the time this Memorandum of Understanding is in effect, unless the Participants mutually decide otherwise.

Signed in [Location] on [Date], in two original copies English. Both texts are equally valid.

FOR THE [AGENCY NAME] OF [PARNTER NAME]	**FOR THE CALIFORNIA GOVERNOR'S OFFICE OF EMERGENCY SERVICES OF THE STATE OF CALIFORNIA OF THE UNITED STATES OF AMERICA (CAL OES)**
[Name] **[Title]**	**[Name]** **[Title]**

Job Aid

JOB AID – SAFETY ASSESSMENT PROGRAM EVALUATOR

ACTIONS AFTER REGISTRATION WITH CAL OES, PRIOR TO DEPLOYMENT

- Ensure that Cal OES and your professional organization has your correct contact information, including cell phone, email address, and mailing address. Your professional organization is identified on your SAP ID card.
- Be sure to have available your hard hat and safety shoes for the field.
- Prepare a go-kit; most items in the list below will be useful in all sorts of disasters, while some may not be necessary. For example, there may be hotels available to stay in, or the rooming arrangements might involve tents. Please use your good judgment.
- Contact your professional organization, or your State of California agency, if you hear about an event and wish to be deployed. You may also contact Cal OES directly by email. In any case, knowing that there are willing persons ready and able to assist will be useful.

Go-Kit Items

Protection and safety gear

- Hardhat
- Safety vest
- Clothes appropriate for the weather
- Cellphone or tablet with charger
- Battery bank (charged!)
- Safety shoes
- NIOSH N-95 mask or respirator
- Gloves
- Safety glasses (snow goggles if deployed to snow country)
- Earplugs
- Safety whistle (wear around your neck)
- Hand sanitizer
- Flashlight with extra batteries
- Insect repellant
- Sunscreen
- Small first aid kit
- Water container
- Water purification tablets

Necessary Personal Items

- Credit card, traveler's checks, and/or cash.
- Extra clothing
- Personal hygiene supplies
- Personal identification (such as driver's license)
- Prescription medicine for at least the length of the deployment, plus 2 days
- Sleeping bag and inflatable mattress if the situation warrants it.

Field Work Tools

- Lockable backpack (most things can be stored in this)
- Clipboard, if paper forms are anticipated in the field
- Field manuals: ATC-20-1 and ATC-45 (if you do not have these, they can be purchased from the Applied Technology Council, www.atcouncil.org)
- Notebook (waterproof, if possible; can search online for this)
- Professional ID card, such as wallet card for professional license or certification
- SAP ID (if plastic card, have on a lanyard or clip; if electronic, have it on your electronic device, or carry a printed version on you)
- SAP identifying clothing, if available
- Waterproof permanent marking pens
- Waterproof writing pens or pencils

Other Items (depending on field conditions)

- Binoculars (to observe conditions too high or remote to see easily)
- Swiss army knife or multi-tool
- Tape measure
- Magnetic compass
- Knee pads
- Shower slippers, if staying in a camp setting
- Small battery-powered radio with extra batteries (for after-hours)
- Reading materials (for after-hours)

DURING DEPLOYMENT

When you are contacted by a professional organization, or by your California state agency supervisor if you are a state employee, and you agree to be deployed:

- Provide your cell phone number and other means for you to be contacted.
- Write down the information on where you are going, when, and the contact person and their phone number at the location you are going to.
- Obtain maps or direction on the area you are traveling to.
- Wear safety vest while deployed.
- Travel safely to destination. Be prepared to show your SAP identification card at all official travel stops.
- Sign in at deployment center, check in with SAP Coordinator, and attend initial briefings.
- Obtain briefing packet from SAP Coordinator.
- Become deputized if local officials are deputizing SAP evaluators.
- Obtain field assignment with other SAP evaluators and/or local building inspectors. Never go into the field alone!
- Obtain supplies from the SAP Coordinator, including official placards, evaluation forms (whether paper or digital), placard fasteners (whether staple guns, clear packing tape, or duct tape), caution tape for barricades, and other necessary equipment.
- Review a structure together as a group, and discuss the issues and procedures in order to get everyone 'on the same page.'
- Travel to assignment.
- For each structure, follow the procedure for safety evaluation, and arrive as a team on a consensus on how the structure should be posted.
- Write all pertinent information on the placards and post the structure.
- Copy the damage and restriction information onto the Assessment Form as it is written on the Restricted Use placard (if such a placard is used), and retain the form for the local jurisdiction's records.
- Upon completion of the assignment, return to the designated deployment center.
- Attend daily debriefing with the SAP Coordinator, review the Assessment Forms for completeness, and give them to the SAP Coordinator (or upload to the building department's computer).
- Sign out at the end of the workday.
- If you are needed the following day, return then to obtain your next assignment, and restock on supplies as needed, such as more placards.
- Once you complete your deployment, proceed with demobilization:
    - Hand in all local government supplies, equipment, and materials.
    - Go over any remaining issues at your final debriefing.
    - Round up all personal items and receipts.

- Understand the procedure for travel and other extraordinary expense reimbursements.
- Return home as safely as possible. This could easily mean departing the next day if you concluded your work at the end of a workday.

AFTER DEPLOYMENT

- Submit to the local government the travel expense claim forms and receipts for unreimbursed meals, hotel costs, and travel expenses, using the form provided in your briefing packet, or obtained at demobilization.
- Respond to Cal OES requests for improvement suggestions or other After-Action information.
- Examine your go-kit and re-stock any depleted items.
- Contact your professional organization's contact person to inform them of your deployment completion, and your redeployment availability in the event of another disaster event.
- Continue to ensure that Cal OES or your professional organization has your updated contact information at all times.

ATC-20 Rapid Evaluation

ATC-20 Rapid Evaluation Safety Assessment Form

Inspection

Inspector ID: _____ Inspection date and time: _____ ☐ AM ☐ PM

Affiliation: _____ Areas inspected: ☐ Exterior only ☐ Exterior and interior

Building Description

Building name: _____

Address: _____

_____

Building contact/phone: _____

Number of stories above ground: _____ below ground: _____

Approx. "Footprint area" (square feet): _____

Number of residential units: _____

Number of residential units not habitable: _____

Type of Construction

☐ Wood frame ☐ Concrete shear wall

☐ Steel frame ☐ Unreinforced masonry

☐ Tilt-up concrete ☐ Reinforced masonry

☐ Concrete frame ☐ Other: _____

Primary Occupancy

☐ Dwelling ☐ Commercial ☐ Government

☐ Other residential ☐ Offices ☐ Historic

☐ Public assembly ☐ Industrial ☐ School

☐ Emergency services ☐ Other: _____

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Observed Conditions:	Minor/None	Moderate	Severe
Collapse, partial collapse, or building off foundation	☐	☐	☐
Building or story leaning	☐	☐	☐
Racking damage to walls, other structural damage	☐	☐	☐
Chimney, parapet, or other falling hazard	☐	☐	☐
Ground slope movement or cracking	☐	☐	☐
Other (specify) _____	☐	☐	☐

Estimated Building Damage (excluding contents)

☐ None

☐ 0–1%

☐ 1–10%

☐ 10–30%

☐ 30–60%

☐ 60–100%

☐ 100%

Comments: _____

_____

Posting

Choose a posting based on the evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Localized *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Post INSPECTED placard at main entrance. Post RESTRICTED USE and UNSAFE placards at all entrances.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: _____

_____

_____

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: _____

_____

☐ Detailed Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

☐ Other recommendations: _____

Comments: _____

_____

Inspected "Green" Placard

INSPECTED

LAWFUL OCCUPANCY PERMITTED

This structure has been inspected (as indicated below) and no apparent structural hazard has been found.

☐ **Inspected Exterior Only**

☐ **Inspected Exterior and Interior**

Report any unsafe condition to local authorities; reinspection may be required.

Inspector Comments:

_____

_____

_____

_____

Facility Name and Address:

_____

_____

_____

Date _____

Time _____

(**Caution:** Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions for:

_____
(Jurisdiction)

Inspector ID / Agency

_____

_____

_____

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

The above is a pdf version of the green INSPECTED placard.

Restricted Use "Yellow" Version 1

RESTRICTED USE

Caution: This structure has been inspected and found to be damaged as described below:

_____
_____
_____
_____

Entry, occupancy, and lawful use are restricted as indicated below:

_____
_____
_____
_____
_____
_____

Facility Name and Address:

_____
_____
_____

Date _____

Time _____

(**Caution:** Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions for:

_____
(Jurisdiction)

Inspector ID / Agency

_____
_____
_____

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

The above is a pdf version of one of the yellow RESTRICTED USE placard types.

Restricted Use "Yellow" Version 2

RESTRICTED USE

Caution: This structure has been inspected and found to be damaged as described below:

_____
_____
_____
_____

Entry, occupancy, and lawful use are restricted as indicated below:

☐ Do not enter the following areas: _____
_____

☐ Brief entry allowed for access to contents: _____
_____

☐ Other restrictions: _____
_____

Facility name and address:

_____
_____
_____

Date _____

Time _____

(**Caution:** Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions for:

_____
(Jurisdiction)

Inspector ID / Agency

_____
_____
_____

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

The above is a pdf version of one of the RESTRICTED USE placard types.

Unsafe "Red" Placard

UNSAFE

DO NOT ENTER OR OCCUPY
(THIS PLACARD IS NOT A DEMOLITION ORDER)

This structure has been inspected, found to be seriously damaged and is unsafe to occupy, as described below:

_____
_____
_____
_____
_____
_____

Do not enter, except as specifically authorized in writing by jurisdiction. Entry may result in death or injury.

Facility Name and Address:

_____
_____
_____

Date _____

Time _____

This facility was inspected under emergency conditions for:

_____
(Jurisdiction)

Inspector ID / Agency

_____
_____
_____

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

The above is a pdf version of the red UNSAFE placard.

ATC-20 Detailed Evaluation

ATC-20 Detailed Evaluation Safety Assessment Form

Inspection

Inspector ID: _____

Affiliation: _____

Inspection date and time: _____ ☐ AM ☐ PM

Final Posting
from page 2

☐ Inspected
☐ Restricted Use
☐ Unsafe

Building Description

Building name: _____

Address: _____

_____

Building contact/phone: _____

Number of stories above ground: _____ below ground: _____

Approx. "Footprint area" (square feet): _____

Number of residential units: _____

Number of residential units not habitable: _____

Type of Construction

☐ Wood frame
☐ Steel frame
☐ Tilt-up concrete
☐ Concrete frame
☐ Concrete shear wall
☐ Unreinforced masonry
☐ Reinforced masonry
☐ Other: _____

Primary Occupancy

☐ Dwelling
☐ Other residential
☐ Public assembly
☐ Emergency services
☐ Commercial
☐ Offices
☐ Industrial
☐ Other: _____
☐ Government
☐ Historic
☐ School

Evaluation

Investigate the building for the conditions below and check the appropriate column. There is room on the second page for a sketch.

	Minor/None	Moderate	Severe	Comments
Overall hazards:				
Collapse or partial collapse	☐	☐	☐	_____
Building or story leaning	☐	☐	☐	_____
Other _____	☐	☐	☐	_____
Structural hazards:				
Foundations	☐	☐	☐	_____
Roofs, floors (vertical loads)	☐	☐	☐	_____
Columns, pilasters, corbels	☐	☐	☐	_____
Diaphragms, horizontal bracing	☐	☐	☐	_____
Walls, vertical bracing	☐	☐	☐	_____
Precast connections	☐	☐	☐	_____
Other _____	☐	☐	☐	_____
Nonstructural hazards:				
Parapets, ornamentation	☐	☐	☐	_____
Cladding, glazing	☐	☐	☐	_____
Ceilings, light fixtures	☐	☐	☐	_____
Interior walls, partitions	☐	☐	☐	_____
Elevators	☐	☐	☐	_____
Stairs, exits	☐	☐	☐	_____
Electric, gas	☐	☐	☐	_____
Other _____	☐	☐	☐	_____
Geotechnical hazards:				
Slope failure, debris	☐	☐	☐	_____
Ground movement, fissures	☐	☐	☐	_____
Other _____	☐	☐	☐	_____

General Comments: _____

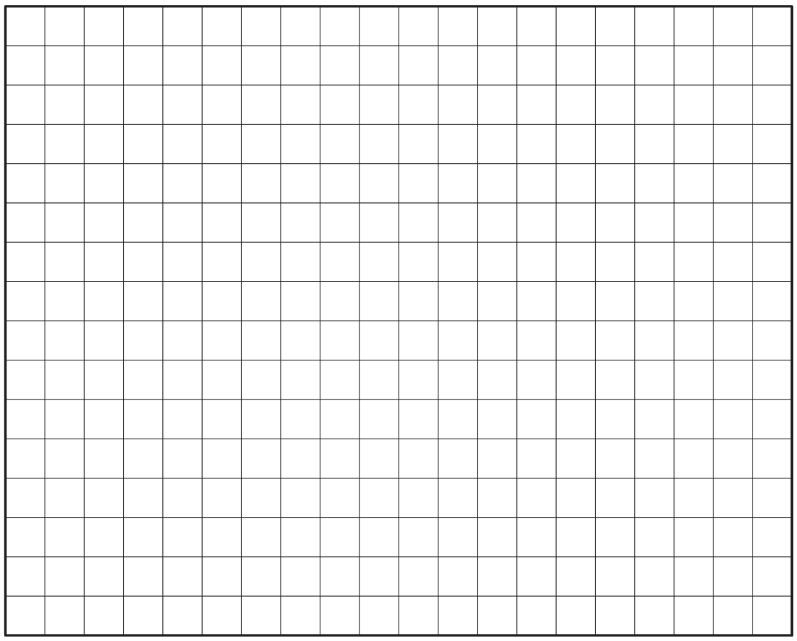
_____

Continue on page 2

ATC-20 Detailed Evaluation Safety Assessment Form Page 2

Building name: _____ Inspector ID: _____

Sketch (optional)
Provide a sketch of the building or damaged portions. Indicate damage points.



Estimated Building Damage
If requested by the jurisdiction, estimate building damage (repair cost ÷ replacement cost, excluding contents).

- ☐ None
- ☐ 0–1%
- ☐ 1–10%
- ☐ 10–30%
- ☐ 30–60%
- ☐ 60–100%
- ☐ 100%

Posting
If there is an existing posting from a previous evaluation, check the appropriate box.

Previous posting: ☐ INSPECTED ☐ RESTRICTED USE ☐ UNSAFE Inspector ID: _____ Date: _____

If necessary, revise the posting based on the new evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Local *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Indicate the current posting below and at the top of page one.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: _____

_____

_____

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: _____

_____

☐ Engineering Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

☐ Other recommendations: _____

_____

_____

Comments: _____

_____

Geotechnical Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
GEOTECHNICAL EVALUATION Page 1

Facility Name _____
Address _____
Co-City-Vic _____
Mo/Day/Yr _____/_____/_____ Time _____ use 24 hr.
Type of Disaster _____

SAP ID #s. _____
Other Reports _____
No. Photos _____ No. Sketches _____
Ref. Dwgs. _____
Est. Damage % _____
Facility Status [ ]

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:		Recommended:		Posted at this assessment:	
	None O		Green O		Yes O
	Green O		Yellow O		No O
	Yellow O		Red O		
	Red O				

B. RECOMMENDATIONS

Monitor _____
Other _____

C. COMMENTS

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

GEOTECHNICAL EVALUATION

Facility Name _____ SAP ID #s _____

DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

D. OBSERVED GEOTECHNICAL CONDITIONS WITH EFFECT ON FACILITY

Observed Condition	Extent of Condition D.O.	Effect of Condition D.O.	Observed Condition	Extent of Condition D.O.	Effect of Condition D.O.
Ash flows	_____	_____	Flooding	_____	_____
Avalanches	_____	_____	Landslides/mudslides	_____	_____
Collapsed soils.....	_____	_____	Lava flows	_____	_____
Cut	_____	_____	Liquefaction	_____	_____
Differential settlement	_____	_____	Lurching	_____	_____
Displacement	_____	_____	New springs	_____	_____
Dried springs	_____	_____	Ponded water	_____	_____
Erosion	_____	_____	Sand boils	_____	_____
Faulting	_____	_____	Tsunami/seiches	_____	_____
Fill	_____	_____	Soil shear failure	_____	_____

E. CONTINUING HAZARDS TO LIFE/PROPERTY (Please describe) _____

Airport Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
AIRPORT EVALUATION Page 1

Facility Name: _____
Address: _____
Co-City-Vic _____
Mo/Day/Yr _____/_____/_____ Time _____ use 24 hr
Type of Disaster _____

SAP ID #s. _____
Other Reports _____
No. Photos ____ No. Sketches _____
Ref. Dwgs. _____
Est. Damage %_____
Facility Status [ ]

SAFETY INSTRUCTIONS: The possibility of the presence of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard. ALSO: The FAA is responsible for checking and evaluating damage to control tower equipment, lighting controls, communication systems, navigational aids, and approach light systems. Obtain permission from tower to enter runway. Permission obtained from _____

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will no render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:		Recommended:		Posted at this assessment:	
	None O		Green O		Yes O
	Green O		Yellow O		No O
	Yellow O		Red O		
	Red O				

B. RECOMMENDATIONS:

Monitor _____
Other _____
_____

C. COMMENTS

_____
_____
_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

AIRPORT EVALUATION

Facility Name _____ SAP ID #s _____

D. DAMAGE OBSERVATIONS (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

1. SURFACE DISPLACEMENT

	(Amount in inches) D.O.	Horiz.	Vert.
Runway pavement	_____	_____	_____
Taxiway pavement	_____	_____	_____
Aircraft Aprons	_____	_____	_____
Car parking areas	_____	_____	_____
Access roadways	_____	_____	_____
Bridges	_____	_____	_____
Liquefaction	_____		

Bridge Report Attached o

Geotechnical Report Attached o

2. UNDERGROUND UTILITIES

	D.O.
Water mains	_____
Water services	_____
Gas mains	_____
Sewer	_____
Collapsed o	
Displaced o	
Large storm drains	_____
Aircraft fueling systems	_____
Airfield lighting	_____
Underground electrical	_____

3. BUILDINGS

	D.O.
Control tower structure	_____
Passenger terminal buildings	
Structural	_____
Mechanical	_____
Electrical	_____
Utility plant buildings	
Equipment	_____
Piping	_____
Emergency generator building	
Equipment	_____
Fuel supply	_____

E. REMARKS _____

Bridge Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
BRIDGE EVALUATION Page 1

Facility Name_____
Address _____
Co-City-Vic _____
Mo/Day/Yr _____/_____/_____ Time _____
use 24 hr.
Type of Disaster_____

SAP ID #s._____
Other Reports_____
No. Photos ____ No. Sketches _____
Ref. Dwgs. _____
Est. Damage %_____
Facility Status ☐

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:	None O	Recommended:	Green O	Posted at this assessment:	Yes O
	Green O		Yellow O		No O
	Yellow O		Red O		
	Red O				

B. RECOMMENDATIONS

Monitor _____	O	Use for emergency vehicles _____	O
Use for public transportation _____	O	Close to truck traffic_____	O
Use for pedestrians _____	O	Use for private passenger vehicles only_____	O
Use for two-way traffic_____	O	Use for one-way traffic _____	O
Use off-site detour _____	O	Use for on-site detour _____	O
Use underpass only_____	O	Use overpass only _____	O
Barricade_____	O	Shore and brace _____	O

C. COMMENTS

_____
_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

BRIDGE EVALUATION

Facility Name _____ SAP ID #s _____

D. BRIDGE DESCRIPTION

1. Type

	MATERIAL				
	Concrete Prestr.	Concrete Reinf.	Steel	Timber	Composite
Arch	o	o	o	o	o
Box	o	o	o	o	o
Cantilever	o	o	o	o	o
Girder	o	o	o	o	o
Slab	o	o	o	o	o
Suspension	o	o	o	o	o
Truss	o	o	o	o	o
Other	o	o	o	o	o

2. Foundation: Caisson o Pile o Spread footings o

3. Internal support

	Number of spans One	Number of spans Two	Number of spans No.	Height (ft)
Bents (frames)	o	o	_____	_____
Columns	o	o	_____	_____
Piers	o	o	_____	_____

4. Abutments High _____ ft.
Low _____ ft.

5. Road Dimensions Length _____ ft.
Curb to curb _____ ft.
Walks _____ft.

E. DAMAGE OBSERVATIONS (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

1. FOUNDATION
D.O.
____ Earth movements/gaps
Piles at:
____ a) Abutments
____ b) Piers
Spread footings at:
____ a) Abutments
____ b) Piers

2. ABUTMENTS
____ Disturbance or erosion
____ Wall movement (____in)
____ Backfill settlement (____in)

3. WINGWALLS
_____ Damage
o Movement
o Separation

4. APPROACHES
D.O.
____ Damage
o Operational
o Roadway settled (___in)
o Off bridge seat

5. BEARINGS
_____ Integral
_____ Contact
_____ Rocker
_____ Elastomeric Pad

6. INTERMEDIATE SUPPORTS
____ Settlement
____ Damage
o Near top
o Near bottom
o Near middle
o Moment failure
o Shear failure
o Compression failure
o Support lost

7. SUPERSTRUCTURE
D.O.
____ Girder
o Shear cracks
o Moment cracks
____ Deck
o Long joints enlarged
o Expansion joints
_____ Truss
o Upper chord
o Lower chord
o Diagonals
____ Suspenders

8. GEOTECHNICAL
____ Liquefaction
____ Landslide
____ Faulting
____ Other

F. REMARKS

_____

_____

_____

Road/Highway Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
ROAD-HIGHWAY EVALUATION Page 1

Facility Name_____
Address _____
Co-City-Vic_____
Mo/Day/Yr _____/_____/_____ Time_____
use 24 hr.
Type of Disaster_____

SAP ID #s. _____
Other Reports _____
No. Photos _____ No. Sketches_____
Ref. Dwgs._____
Est. Damage %_____
Facility Status

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None O Green O Yellow O Red O
Recommended: Green O Yellow O Red O
Posted at this assessment: Yes O No O

Existing barricades in position O

B. RECOMMENDATIONS

Monitor _____ O
Ok for public transportation ____ O
Ok for pedestrians _____ O
Ok for two-way traffic_____ O
Use detour(s) _____ O
Ok for emergency vehicles _____ O
Ok for private vehicles_____ O
Ok for one-way traffic _____ O
Install barricades _____ O
Aftershocks potentially dangerous to traffic___ O
Traffic in danger due to adjacent unstable/unsound structure_____O

C. COMMENTS

_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

ROAD-HIGHWAY EVALUATION

Facility Name _____ SAP ID #s _____

D. DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

1. ROADBED

D.O.		Location	Extent
_____	Fills	_____	_____
_____	Cuts	_____	_____
_____	Subgrade	_____	_____
_____	Slip-outs	_____	_____
_____	Slides	_____	_____
_____	Washouts		

2. PAVEMENTS

D.O.

_____ Longitudinal cracks

_____ Transverse cracks

_____ Vertical displacement

Amount _____

Side up (N, S, E, W) _____

Pavement type: o AC o PCC o Other

Describe _____

3. TRAFFIC CONTROL FACILITIES

D.O.

_____ Condition

o Operating

o Critical regulatory signs standing

Exceptions and conditions: _____

_____

_____

_____

4. UTILITIES

D.O.

_____ Drainage

_____ Gas lines

_____ Petroleum lines

_____ Underground power lines

_____ Aboveground power lines

_____ Sewers

_____ Water lines

_____ Other _____

5. OBSTRUCTION/HAZARDS

D.O.

_____ Bridges

_____ Buildings/structures

_____ Debris

_____ Joint poles

_____ Mud

_____ Power lines

_____ Rocks

_____ Trees

_____ Water

_____ Other _____

E. REMARKS _____

_____

_____

_____

_____

_____

Pipeline Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
PIPELINE EVALUATION Page 1

Facility Name _____
Address _____
Co-City-Vic _____
Mo/Day/Yr _____/_____/_____ Time _____
use 24 hr.
Type of Disaster _____

SAP ID #s. _____
Other Reports _____
No. Photos _____ No. Sketches_____
Ref. Dwgs. _____
Est. Damage %_____
Facility Status [ ]

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:		Recommended:		Posted at this assessment:	
	None O		Green O		Yes O
	Green O		Yellow O		No O
	Yellow O		Red O		
	Red O				

B. RECOMMENDATIONS

Monitor_____	O	Continue in service _____	O
Remove from service_____	O	Install temp. above-ground line____	O
Provide temporary alternate service	O	Check water quality/safety _____	O
Unblock entrance _____	O	Divert flow_____	O

_____ _____
_____ _____
_____ _____

C. COMMENTS

_____
_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
PIPELINE EVALUATION Page 2

Facility Name _____ SAP ID #s _____

D. PIPELINE DESCRIPTION

1. Type of pipeline: Pressure o Gravity o Storm Drain o
   Water o San. Sewer o Other o _____

2. Pipe nominal diameter: _____ 3. Proximity to water/sewer/gas line: _____

	AC	CI	CMP	DI	PVC	RC	STEEL	VC	WI	Other	Unknown
Bell & Spigot											
Butt											
Caulked											
Comp. Ring											
Riveted											
Welded											
Unknown											

4. Describe the failure mode:
   - o Circumferential crack
   - o Burst pipe barrel
   - o Sheared pipe barrel
   - o Sheared service connection
   - o Pulled joint
   - o Broken joint
   - o Other _____
   - o Liquefaction Describe _____

_____

_____

E. DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

SURFACE OBSERVATIONS

D.O.
- ____ Ground surface disturbed
- ____ Visible leakage
- ____ Service connection broken
- ____ Headwall damaged
- ____ Endwall damaged
- ____ Manhole damaged

D.O.
- ____ Soffit damaged
- ____ Invert displacement
- ____ Horizontal displacement
- ____ Trash-rack blocked/damaged
- ____ Leakage at valves
- ____ Leakage continuing
- ____ Leakage rates _____

Nearest valve/MH (if less than 1/4 mile) _____

Pump Station Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
PUMP STATION EVALUATION Page 1

Facility Name _____
Address _____
Co-City-Vic _____
Mo/Day/Yr _____/_____/_____ Time _____
use 24 hr.
Type of Disaster _____

SAP ID #s. _____
Other Reports _____
No. Photos _____ No. Sketches _____
Ref. Dwgs. _____
Est. Damage %_____
Facility Status [ ]

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:		Recommended:		Posted at this assessment:	
	None O		Green O		Yes O
	Green O		Yellow O		No O
	Yellow O		Red O		
	Red O				

B. RECOMMENDATIONS

Monitor _____ O
Remove from service _____ O
Brace structure before using _____ O
Check filter basket _____ O
_____
_____
_____

Continue in service _____ O
Check pump-motor alignment ____ O
Recheck after power restored_____ O
_____
_____
_____

C. COMMENTS

_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

PUMP STATION EVALUATION

Facility Name _____ SAP ID #s _____

D. PUMP STATION DESCRIPTION

o Water o Wastewater o Sewage o Other _____

- o Wet Well
- o Dry Well

	No. Motors			
	Elect	Gas	Gasoline	Diesel
Centrifugal				
Reciprocal				
Horizontal				
Vertical				

No. Operable			
Elect	Gas	Gasoline	Diesel

Str. Type	Buried	Above Grade
Concrete		
Masonry		
Frame		
Other		

o Building (Building Evaluation Attached)

E. DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

1. STRUCTURE
- _____ Access
- _____ Crane runway
- _____ Fixed hoist
- _____ Floor
- _____ Fore bay
- _____ Foundation
- _____ Roof
- _____ Walls
- _____ Hatches

2. PUMPS
- _____ Anchors
- _____ Casing
- _____ Connected piping
- _____ Supports
- _____ Valving

3. MOTORS/ENGINES
- _____ Anchors
- _____ Connected piping
- _____ Couplings to pumps
- _____ Power supply
- _____ Transformer(s)

4. CONTROLS
- _____ Internal power
- _____ Supports
- _____ Wiring
- _____ Valving

5. EXTERNAL PIPING

	Inlet	Outlet
Piping	____	____
Leaked	o	o
Leaking	o	o

Leakage rate, gpm _____

6. EXTERNAL POWER
- _____ Electrical continuity
- _____ Fuel lines
- _____ Fuel storage

7. AUXILIARY EQUIPMENT
- _____ Charts
- _____ Lighting, exterior
- _____ Lighting, interior
- _____ Meters & gauges
- _____ Overhead crane
- _____ Small diameter pipe
- _____ Electrical Cabinets

F. REMARKS

_____

_____

_____

Reservoir Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
RESERVOIR EVALUATION Page 1

Facility Name _____
Address _____
Co-City-Vic _____
Mo/Day/Yr _____/_____/_____ Time _____
use 24 hr.
Type of Disaster _____

SAP ID #s. _____
Other Reports _____
No. Photos _____ No. Sketches ____
Ref. Dwgs. _____
Est. Damage %_____
Facility Status

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None o Green o Yellow o Red o
Recommended: Green o Yellow o Red o
Posted at this assessment: Yes o No o

B. RECOMMENDATIONS

Monitor_____ o
Remove from service_____ o
Continue in service_____ o
Continue in service, repair ASAP_____ o
Drain and repair _____o
Lower water level and continue service____ o
_____ ft

_____
_____
_____
_____
_____
_____

C. COMMENTS

_____
_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
RESERVOIR EVALUATION

Facility Name _____ SAP ID #s _____

STEEL RESERVOIR

D. RESERVOIR DESCRIPTION

Capacity _____ MG Wall Height _____ ft. O/S Diameter _____ ft.

Roof Type: O Wood O Steel O Flat O Conical O Knuckled Edge

Shell: O Welded O Bolted O Riveted

Floor support: O Footing ring O Oiled sand O A.C. O Other _____

Footing: O Concrete ring O Other _____ O None

Pipe connection O Rigid O Flexible
Anchorage to foundation _____ Dia. _____ Spacing

E. DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

1. SHELL
D.O.
_____ Elephant's foot
a. Height _____ ft.
b. Circumferential extent _____ft.
_____ Other buckling
_____ Horizontal joints broken
_____ Vertical joints broken
_____ Plate split
_____ Seismic anchors
_____ Rocking of reservoir evidenced
_____ Sliding of reservoir evidenced
_____ Leaks evident. Rate _____ gpm
_____ Unexplained wet spots on adjacent ground
_____ Shell penetrations damaged
_____ Other attachments to shell damaged
_____ Pipe Connections to Tank

2. VALVE PIT
D.O.
_____ Access
_____ Control Piping
_____ Gauges
_____ Hatches
_____ Inlet-outlet piping
_____ Pit flooded
_____ Roof
_____ Walls
_____ Charts
_____ Valves

3. ROOF _____
4. FOOTING _____
5. FLOOR _____
6. ABOVE GROUND PIPING _____
7. UNDERGROUND PIPING _____

F. REMARKS

_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
RESERVOIR EVALUATION Page 3

Facility Name _____ SAP ID #s _____

PRESTRESSED CONCRETE RESERVOIR

G. RESERVOIR DESCRIPTION:

Wire or Strand Wrapped	Buttress Type using individual Tendons, usually inside wall	Bar Tendons on Tank Surface
TENDONS:		
O 220 ksi - 0.142" or 0.172" dia	O Strands O Wires O Bars	O Bars w/ prop. couplers
O 270 ksi - 3/8" dia		
WALL CONSTRUCTION:		
O Cast-in-place	O Cast-in-place	O Cast-in-place
O Shotcrete	O Precast	O Shotcrete
O Shotcrete w/ steel diaphragm		
O Precast		
O Precast w/ steel diaphragm		

TENDON PROTECTION SYSTEMS:

O Shotcrete O Corrosion inhibiting grease O Galvanizing protected by:
O Grout O Plastic sheath

Tank Restraints O Seismic cables O Curb (restraining sliding)
Capacity _____ MG Wall height _____ ft O/S diameter _____ ft
Roof Type: O Flat O Dome O Exposed (Y/N): _____
O Fill depth _____ O Surface usage_____

H. DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

1. SHELL

D.O.
_____ Shell or shotcrete cracked
_____ Vertical cracks more than 2 feet long
_____ Unexplained excessive loss of contents
_____ Bulging observable
_____ Visible construction joints
_____ Wall leaking
_____ Wet spots
_____ Spouts
_____ Horizontal cracks more than 25% of perimeter
_____ Corrosion at horizontal cracks
_____ Shotcrete delaminated at cracks
_____ Attachments to shell loose
_____ Leaks @ rust stains
_____ Major leaks at shell/foundation joint
_____ Unexpla. wet spots on adjacent ground
_____ Corrosion at manholes/other penetrations
Leakage rate _____ gpm

2. HORIZONTAL PRESTRESSING

D.O.
Wrapping:
_____ Corrosion
_____ Corrosion at horiz. cracks
Individual tendons:
_____ Corrosion products
_____ Leaks @ tendon locations
_____ Leaks @ tendon anchorages
_____ Tendon anchorage distressed
_____ Tendon anchorage disrupted/loose
_____ Cracking near tendon anchorage
_____ Tendon location visually observable
_____ Discoloration of conc. in line w/tendons
Bar tendons on surface:
_____ Tendons failed
_____ Tendons sound loose
_____ Evidence of rust

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
RESERVOIR EVALUATION Page 4

Facility Name _____ SAP ID #s _____

I. DAMAGE OBSERVED (D.O.)

	0	1	2-3-4	5	6	NA	NO
Damage Scale:	None (0%)	Slight (1-10%)	Moderate (11 - 40%)	Severe (41 - 60%)	Total (over 60%)	Not Applicable	Not Observed

1. ROOF
D.O.

Flat or Conical
_____ Displaced with respect to wall
_____ Sagging
_____ Cracked at edges
_____ Cracked at interior supports
_____ Supporting column spalled

Dome Shell
o Shotcrete o CIP concrete
o Precast concrete
_____ Construction joints
_____ Cracks
o Show reinforcement/corrosion
o Increasing with time
_____ Delaminating
_____ Misalignment of surface
_____ Rust lines @ top of soffit over rebar
_____ Dome Ring
_____ Corrosion
_____ Distress @ shell/ring juncture
_____ Shotcrete loose/hollow-sounding
_____ Vertical cracks
_____ Wire (strand) exposed/corroded

2. OTHER
D.O.

FOOTING _____
FLOOR _____
ABOVEGROUND PIPING_____

3. VALVE PIT
_____ Access
_____ Control piping
_____ Gauges
_____ Hatches (equipment)
_____ Inlet-outlet piping
_____ Pit flooded (depth _____ ft.)
_____ Roof
_____ Walls
_____ Charts
_____ Valves

J. REMARKS

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Wastewater Treatment Plant Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

TREATMENT PLANT EVALUATION (WASTEWATER) Page 1

Facility Name _____	SAP ID #s. _____
Address _____	Other Reports_____
Co-City-Vic _____	No. Photos _____ No. Sketches ____
Mo/Day/Yr _____/_____/_____ Time _____ use 24 hr.	Ref. Dwgs._____
Type of Disaster _____	Est. Damage %_____
	Facility Status

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:	None o	Recommended:	Green o	Posted at this assessment:	Yes o
	Green o		Yellow o		No o
	Yellow o		Red o		
	Red o				

B. RECOMMENDATIONS

Monitor_____	o	Continue in service_____	o
Remove from service_____	o	Check effluent quality/safety_____	o
Chlorinate and by-pass_____	o		
_____		_____	
_____		_____	

C. COMMENTS:

_____

_____

_____

_____

_____

_____

_____

_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

TREATMENT PLANT EVALUATION (WASTEWATER)

Facility Name _____ SAP ID #s _____

D. DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed

1. PROCESS COMPONENT (D.O.)

	Structural	Mechanical	Electrical
Screening/grinding	_____	_____	_____
Influent pumping	_____	_____	_____
Grit removal	_____	_____	_____
Primary treatment	_____	_____	_____
Secondary treatment	_____	_____	_____
Tertiary treatment	_____	_____	_____
Quaternary treatment	_____	_____	_____
Effluent disinfection	_____	_____	_____
Solids digestion	_____	_____	_____
Solids dewatering	_____	_____	_____
Solids disposal	_____	_____	_____

2. TRIBUTARY PUMPING PLANTS/FORCE MAINS

Pumping Plant Name			
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

3. TRIBUTARY GRAVITY SEWER SYSTEM

Briefly summarize your assessment of the condition of the gravity sewer system (recognizing the limitations of time and resources during this initial inspection period).

_____

_____

_____

_____

_____

_____

_____

_____

_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

TREATMENT PLANT EVALUATION (WASTEWATER)

Facility Name _____ SAP ID #s _____

E. Check: Electrical power (control panel, emergency generator)
Telemetry
Disinfection process (chemical containers, feeder, piping)
Broken pipes, flooding, leaking
Chemical feed (spills)
Unit Processes

OBSERVATIONS

RAW SEWAGE _____

SCREENING/GRINDING _____

INFLUENT PUMPING _____

GRIT REMOVAL _____

PRIMARY TREATMENT _____

SECONDARY TREATMENT _____

TERTIARY TREATMENT _____

QUATERNARY TREATMENT _____

EFFLUENT DISINFECTION _____

SOLIDS DIGESTION _____

SOLIDS DEWATERING _____

SOLIDS DISPOSAL _____

Water Treatment Plant Evaluation Form

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**
TREATMENT PLANT EVALUATION (WATER) Page 1

Facility Name _____
Address _____
Co-City-Vic _____
Mo/Day/Yr _____/_____/_____ Time _____
use 24 hr.
Type of Disaster _____

SAP ID #s. _____
Other Reports _____
No. Photos _____ No. Sketches_____
Ref. Dwgs. _____
Est. Damage %_____
Facility Status [ ]

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:		Recommended:		Posted at this assessment:	
	None O		Green O		Yes O
	Green O		Yellow O		No O
	Yellow O		Red O		
	Red O				

B. RECOMMENDATIONS

Monitor _____	O	Continue in service_____	O
Remove from service _____	O	Check effluent quality/safety_____	O
Chlorinate and by-pass _____	O		
_____		_____	
_____		_____	

C. COMMENTS:

_____
_____
_____
_____
_____
_____
_____
_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

TREATMENT PLANT EVALUATION (WATER) Page 2

Facility Name _____ SAP ID #s _____

D. DAMAGE OBSERVED (D.O.)

	0	1	2-3-4	5	6	NA	NO
Damage Scale:	None (0%)	Slight (1-10%)	Moderate (11 - 40%)	Severe (41 - 60%)	Total (over 60%)	Not Applicable	Not Observed

1. PRETREATMENT

D.O.

_____ Raw water channels
_____ Aerators
_____ Rapid mix
_____ Flocculation
  _____ basins
  _____ baffles
  _____ paddles
  _____ scrapers
_____ Sedimentation
  _____ basin
  _____ troughs
  _____ scrapers

2. FILTRATION

_____ Structure
_____ Troughs
_____ Beds
_____ Backwash system
_____ Surface wash system

3. CHEMICAL TREATMENT

_____ Chlorine piping
_____ Chlorine cylinders
_____ Chlorine feeders
_____ Other chemical piping
_____ Other chemical feeders
_____ Other chemical storage

4. CONTROL SYSTEMS

_____ Mechanical
_____ Electrical
_____ Pneumatic
_____ Hydraulic
_____ Manual
_____ Automatic

5. HEAD HOUSE

D.O.

_____ Bearing walls
_____ Nonbearing walls
_____ Frame (general condition)
_____ Structural members
  _____ Structural connections
  _____ Roof
  _____ Floors
  _____ Stairs
_____ Elevators
_____ Glass
_____ Mechanical equipment
_____ Electrical equipment
_____ Filter gallery
  _____ Piping
  _____ Pipe gallery

6. CLEARWALL

_____ Tank-type(use Reservoir Assessment)
_____ Containment structure
_____ Influent piping
_____ Effluent piping

7. WASHWATER RECLAMATION

_____ Settling basin
_____ Mechanical equipment
_____ Electrical equipment
_____ Piping
_____ Detention basin
_____ Sludge discharge

E. Remarks

_____

_____

_____

_____

_____

STATE OF CALIFORNIA **SAFETY ASSESSMENT PROGRAM (SAP)**

TREATMENT PLANT EVALUATION (WATER) Page 3

Facility Name _____ SAP ID #s _____

F. Check:

Electrical power (control panel, emergency generator)
Telemetry
Disinfection process (chemical containers, feeder, piping)
Broken pipes, flooding, leaking
Chemical feed (spills)
Unit Processes

OBSERVATIONS

RAW WATER _____

PRECHLORINATION _____

AERATION _____

RAPID MIX _____

FLOCCULATION _____

SEDIMENTATION _____

FILTRATION _____

DISINFECTION _____

FLUORIDATION _____

CLEARWELL _____

DISTRIBUTION SYSTEM _____

Building Safety Checklist

Building Assessment Safety Checklist

General

- ☐ Be aware and cautious.
- ☐ Always work in teams of at least 2 individuals.
- ☐ Always wear a hard hat and safety shoes.

Initial Assessment of Building That Is Not Posted

- ☐ Do not enter obviously unsafe buildings.
- ☐ Do not enter buildings or access appendages of buildings located on potentially unstable slopes.
- ☐ Do not enter buildings where falling hazards exist that could block exits from the building.
- ☐ If the building is leaning or out-of-plumb, do not enter unless It is absolutely necessary to determine the appropriate posting. When inside or outside try to stay on the side of the building away from the direction it is leaning.
- ☐ Before entering any building make sure exit doors are fully operable and you can leave quickly.
- ☐ Make sure that exits are clear and there is no falling hazards that could obstruct the pathway.
- ☐ Be aware of hanging or exposed electrical wires.

Subsequent Assessments

- ☐ If an unsafe building must be entered which has not been stabilized, take the following steps:
  1. Visually assess the damage from the exterior and evaluate the potential for collapse.
  2. One member of the team is to remain outside to monitor the building while other team members are inside.
  3. To the extent possible, verify stability of every room or part of the structure before entering.
- ☐ Do not enter a building where a hazardous material spill or release has occurred.
- ☐ Do not enter buildings, or access any appendage of a building, located on a hillside known to be moving or where slide potential exists.

Building Assessment Safety Checklist. Is designed so you can cut it out and insert it into your copy of ATC-20-1. Contains information already found in the SAP Evaluator manual, but this is in a one-page form.