Roundtable on Sharing Earthquake Geotechnical and Related Damage Data for Improved Resiliency of Bay Area Lifelines and Critical Infrastructure

Held August 26, 2015

Roundtable Summary

Representatives of Bay Area lifelines, other essential service providers, and government agencies met on August 26, 2015 to discuss sharing earthquake-related impact information to enhance Bay Area resilience. Organizers of the Roundtable were the California Earthquake Clearinghouse and the Bay Area Center for Regional Disaster Resilience (BACRDR), which served as Roundtable facilitator. The East Bay Municipal Utility District (EBMUD) hosted the meeting at its Administration Building in Oakland, CA.

Roundtable Format and Outcomes. Participants, through five overview presentations and interactive discussion spoke of their respective organizational data sharing priorities/ requirements and capabilities for sharing geotechnical-related damage data and other information for emergency operations and lifelines response and restoration activities. The focus was on how to better understand operational information needs and facilitate and expedite provision of data. Participants also discussed how the Clearinghouse can provide support to these goals, as well as share data with other interested lifelines and critical infrastructures to address vulnerabilities and risk, in particular those associated with infrastructure interdependencies. Participants concluded their discussion with recommendations for "quick win" and other useful activities they could undertake in collaboration together, and with the Clearinghouse and interested stakeholders to strengthen and expand earthquake data sharing capabilities for a more resilient Bay Area.

Opening Remarks

Roundtable host Steve Frew welcomed participants on behalf of EBMUD, which provides water and wastewater services to a large part of the San Francisco East Bay. After participant introductions, Paula Scalingi for BACRDR opened the meeting by noting that the Roundtable was the latest in a series of Bay Area workshops, exercises, and other events on infrastructure interdependencies and broader related resilience issues. She pointed out that these events underscored the importance of sharing information on assets, outages, disruptions, and damage to gain more in-depth appreciation of all-hazards risks to interdependent lifelines and other essential service providers, and actions that should be taken pre- and post-event for preparedness, mitigation, response, and initial recovery. Dr. Scalingi added that the Roundtable is meant to be the beginning of a deepening dialogue with follow-on activities to develop an effective cross-sector information-sharing process necessary for a resilient Bay Area. Such a process will also help meet recovery objectives in the nearly completed Cal OES/FEMA Bay Area Earthquake Plan related to community capacity building. Key points useful to keep in mind for the

discussion included that: information sharing is fundamental to disaster resilience, types of data shared will vary depending on organizational requirements, the data's intended use and end-users (sharing among infrastructures, between infrastructures and different levels of government, and with the public), and the willingness and ability of an organization to make its data externally available to other organizations. A significant challenge is lack of model protocols and procedures for multi-organization information sharing that can provide a template for what data is shared, how it is shared, how it is stored, analyzed, and disseminated, and kept secure. The Roundtable offered an opportunity to discuss these issues and identify ideas for follow-on actions that Bay Area utilities and other organizations can take with Clearinghouse participants to facilitate information sharing.

Highlights of Presentations on Organizational Data Sharing Capabilities and Needs

California Earthquake Clearinghouse – Anne Rosinski, California Geological Survey
The Clearinghouse was founded in 1971 after the San Fernando earthquake and operates under State and Federal mandate. In the event of an earthquake, Clearinghouse activation is supported through state resources, or if the state is unable to do so, it is supported through federal resources. The Clearinghouse conducts overflight missions, and helps facilitate field investigations, in support of information sharing, which is at the heart of what the Clearinghouse does. Its principal function is to provide State and Federal disaster response managers and the scientific and engineering communities with prompt information on ground failure, structural damage, and other consequences from significant seismic events, such as earthquakes and tsunamis. The Clearinghouse does not have a blueprint for an information sharing process and does not direct or control activities of participants, who all have a common goal of supporting response and recovery. The Clearinghouse also is not a public information organization nor conducts press conferences. Organizations are responsible for their own communication with the media. There are significant benefits to be gained by being able to share information in real-time, in two directions, across disciplines and in multiple formats and applications. The Clearinghouse-led collaborative promotes the use of standard formats and protocols to allow existing technology to transform data into meaningful incident-related content and enable data to be used by the largest number of participating Clearinghouse partners, thus providing responding personnel with enhanced real-time situational awareness, rapid hazard assessment, and more informed decision-making in support of response and recovery. An example of a Clearinghouse success was in the response to the August 24, 2014, M6.0 South Napa Earthquake. The Clearinghouse was physically activated for three days for the event, and coordinated field investigations with up to 100-plus visitors from 40 organizations at its physical location, including satellite communications and truck support both provided through advanced coordination with Caltrans, two overflight missions through advanced coordination with the California Highway Patrol (CHP), and reconnaissance and high resolution photography. The Clearinghouse also coordinated a multi-agency, State-Federal-private partnership to acquire airborne LiDAR in critical areas, held nightly briefings to inform researchers and emergency managers, and served as a virtual clearinghouse for multi-disciplinary data sharing and integration. In addition to providing Napa earthquake support, the Clearinghouse supported the Capstone 2015 exercise, working with a broad variety of stakeholders and disciplines, including Cal EPA, the California Department of Public Health, California National Guard, USGS, NASA JPL, law enforcement, and emergency management. The Clearinghouse is currently engaged in

outreach and recruitment of lifelines and other critical infrastructure and organizations to partner with it in data sharing activities, initially through providing publicly available outage information. Although there are challenges to information exchange, achieving movement of data through technology interoperability can mitigate obstacles and make data sharing proceed more easily.

East Bay Municipal Utility District – Xavier Irias and Serge Terentieff
EBMUD has 29 dams, five treatment plants, 138 pumping plants, 167 reservoirs/tanks, 122 pressure zones, 73 regulators, 30 rate control stations, 400,000 services, and 4,200 miles of distribution pipelines, including 360 miles of large diameter pipes. It is not a matter of what EBMUD in a major earthquake "fixes first" to restore water service (e.g., fire departments, hospitals), because EBMUD doesn't have a good idea in such a scenario how long it would take to restore services. At the same time, people have expectations of zero downtime, making it important to address assumptions. A complicating factor is infrastructure interdependencies. For example, EBMUD is dependent on electric power. In the old days there was no line power or communications required for system reliability. Today interdependencies have resulted in more system fragility and increasing vulnerability that EBMUD must address. Storage of water also is an issue, because storage must be sized for multiple objectives. This has resulted in less storage in many cases and this can impinge on resilience. EBMUD is currently working to improve its damage prediction capabilities pre and post-event, and is expecting more than 4,000 breaks from a M7.0 Hayward Fault earthquake along with losing power to a substantial percentage of its pumping plants. Liquefaction will be a major problem, as will landslides. The utility is trying to get a better handle on vulnerabilities through modeling, but the analysis does not yet take into account interdependencies. For the South Napa earthquake, it took seven days to restore water service to 80 percent of customers. In a Hayward fault earthquake, the system will be without service well beyond seven days, and service restoration will be complicated by interdependencies. EBMUD is significantly dependent on power for communications with crews in the field and with reservoirs. Fuel availability and access to service roads are big concerns. The utility has 48 hours of fuel to power emergency generators and pumps. EBMUD is meeting with PG&E in the near future to discuss how to share information to address these and other interdependency concerns. Regarding data sharing, EBMUD can provide pre-event damage estimates and predictions, specific geotechnical studies (for example, on liquefaction), post-event level of service impacts, and information on specific facilities that are out of service. Information EBMUD needs pre-event includes earthquake and geologic hazards data (wave propagation, peak ground velocity, permanent ground deformation, and data on fault rupture/liquefaction/lateral spread and landslide displacement, and differential settlement), site-specific geotechnical studies, GIS data on critical infrastructure, and results of damage predictions from other utilities to better understand interdependencies. Post-event needs include: rapid sharing of data on service impacts related to electric power and natural gas, highway and service roads, fuel production facilities, communications, and data to support coordination to set common priorities for service restoration. Information-sharing topics EBMUD would like to see addressed with other utilities and local agencies include sharing assumptions of service impacts on critical infrastructures and interdependencies, including anticipated times for service restoration and length of time they can continue in operation without water, power, fuel, etc.

California Independent System Operator (CA ISO) – Rod Wheeler
The California ISO is one of nine independent system operators/regional transmission operators (ISOs/RTOs) in North America, serving 33 percent of the U.S. power systems (three high voltage power grids in North America include the eastern, western, and Texas interconnections). CAISO is one of the largest ISOs, delivering 300 million megawatt-hours of electricity each year and managing about 80% of California's electric flow, 60 percent of which is natural gas fired. CAISO oversees the operation of California's bulk electric power system, transmission lines, and electricity market generated and transmitted by its member utilities. The primary stated mission of the CAISO is to "operate the grid reliably and efficiently, provide fair and open transmission access, promote environmental stewardship, and facilitate effective markets and promote infrastructure development." CAISO was created in 1998 when the state restructured its electricity markets at the recommendation of the Federal Energy Regulatory Commission (FERC), following the passage of the federal Energy Policy Act of 1992, which removed barriers to competition in the wholesale generation of the electricity business. CAISO is regulated by FERC, compliant with the North American Electric Reliability Corporation (NERC), and is part of the Western Electricity Coordinating Council (WECC), which is overseen by Peak Reliability. In a major earthquake that causes a partial or complete shutdown of the electric grid, for initial system restoration, CAISO will assess system conditions and communicate with its transmission and generation operators and also communicate ISO system conditions to the Peak Regional Coordinator, which is responsible for coordinating restoration of the western interconnection. Coordinating a power system recovery requires sharing infrastructure conditions and resource availability. Recovery takes much sharing of information and it may take weeks to months to fully replace damaged equipment. There is no quick way to repair assets. Some equipment replacement requires a long lead-time. It may take a month to a year to supply transformers. Power can be brought into the state from outside if the interconnections are not damaged. Interdependencies can complicate the recovery process. Many power plants depend on waste water and roadways are necessary to transport equipment. Information and coordination will be needed between the ISO and local electric utilities, adjacent balancing authorities, Peak Reliability, natural gas providers, water and waste water processing, Cal OES, Caltrans, CHP, engineering and construction contractors, and replacement equipment providers.

University of California San Francisco Police Department (UCSF) – Michelle Heckle
The University of California, San Francisco (UCSF), is a center of health sciences research, patient care, and education and is widely regarded as one of the world's leading universities in health sciences. Though one of the 10 campuses of the University of California, it is the only UC school dedicated solely to graduate education, and in health and biomedical sciences. Some of UCSF's treatment centers include kidney transplants and liver transplantation, radiology, neurosurgery, neurology, oncology, ophthalmology, gene therapy, women's health, fetal surgery, pediatrics, and internal medicine. UCSF has a work force of 22,800 people and is San Francisco's second largest employer. UCSF is considered a local government entity. It has a large footprint extending from Fresno through the North Bay with hospitals and clinics serving 44,000 people and 23,000 students. The UCSF infrastructure includes onsite housing for students and numerous research facilities. Major assets include the Mount Zion campus which contains UCSF's Comprehensive Cancer Center, Women's Health Center, and the Osher Center for Integrative Medicine and outpatient resources. The San Francisco General Hospital campus cares for the indigent population of San Francisco and contains San Francisco's only Level I trauma center. UCSF is also affiliated with the San Francisco VA Hospital and the J. David

Gladstone Institutes, a private biomedical research entity that has recently moved to a new building adjacent to UCSF's Mission Bay campus, which is affiliated with UCSF Benioff Children's Hospital Oakland (formerly Children's Hospital & Research Center Oakland). The headquarters of the new California Institute for Regenerative Medicine are also located nearby in the Mission Bay neighborhood. UCSF has its own police department, which serves its two major campuses, as well as all satellite sites within the city and South San Francisco. Regarding earthquake-related information, UCSF needs early notification, information on impacts to its hospitals and research facilities and their supporting services (power, water, communications, etc.), impacts on elevators and helipads, and other medical surge-related information; also impacts to structures and student housing. Hospitals are required to have a continuity of operations plan for 72 hours-worth of supplies, arrangements for procuring essential supplies and services, and have large storage facilities.

SABER (Single Automated Business Exchange for Reporting) – Jim Morentz

SABER is a private sector initiative to create a single means to exchange business disruption and restoration information. California Earthquake Clearinghouse partners and FEMA are consumers of data provided by SABER member organizations. SABER is built on XchangeCore Web Service Data Orchestration developed by the U.S. Department of Homeland Security, the U.S. Department of Defense, and the private sector. The system is currently operated by a non-profit. SABER is fully operational and deployed to cut across the information exchange divide that exists between public and private sector information sharing. The system enables utilities to deposit their disruption and restoration information to be shared with authorized utilities, private sector, government agencies, and other approved organizations. Lifelines and other critical infrastructures may have outage, closure, and restoration data in various formats, e.g., a simple spreadsheet or sophisticated cloud services, with some portion they are willing to share. There are organizations that may want the information, but have different systems to receive data, which causes confusion and impedes sharing the information. Organizational websites are insufficient to meet earthquake and other disaster-related data sharing needs of lifelines and other critical infrastructure and government agency partners. SABER provides an integrated view of modeled damage, reported outages, other disruption reports, and field observations. Users of SABER who make their disruption and restoration information available to the California Earthquake Clearinghouse partners and other organizations include large retailers, other businesses, and government agencies: Target, Sears, Macy's, Walmart, Walgreens, Costco, Boyd Gaming, Rocky Gap Casino Resort, Los Angeles County Community Clinic Association, Florida Division of Emergency Management, Rhode Island Business Alliance, City of Nashua (NH) Office of Emergency Management, Information Technology Disaster Resource Center, Maryland Emergency Management Agency, Hennepin County (MN) Emergency Management, FEMA National Business Emergency Operations Center, FEMA-Region IX Private Sector Liaison Office, FEMA National Response Coordination Center, Missouri State Emergency Management Agency, North Carolina Emergency Management, Pinellas County FL Emergency Management Agency, Clark County and the City of Las Vegas Emergency Management Agency, Minnetonka MN Fire and Emergency Management, Washington County Utah Emergency Services, Broome County NY Community Organizations Active in Disaster, Duchess County NY Emergency Management, Missoula County Montana Office of Emergency Management, City of Houston Office of Emergency Management, and the San Francisco Department of Emergency Management.

Key Points and Issues Raised in Participant Discussion

- Infrastructure interdependencies were cited as a priority concern by presenters and other participants, and are a key driver for information sharing for lifelines and other critical infrastructures. BART participants noted that electric power is the lifeblood of BART, and stations depend on water facilities for fire suppression, fuel for power generators, and oil for lubricants, and on suppliers for parts for vehicles. A USGS participant cited the need to have information pre-event on utility assets that cross earthquake fault lines.

- Sharing earthquake data for improved resiliency of Bay Area lifelines and critical infrastructures requires addressing issues of information exchange including governance, sharing agreements, privacy and protection, government-private perspectives and technology interoperability.

- A good "quick win" activity for utilities and other critical infrastructures to experience and see the benefits of data sharing and test data sharing mechanisms and interoperability needs is to share examples of publically available data with the Clearinghouse.

- Most utilities appear to use ShakeCast earthquake data to assess potential damage to assets and systems. Involvement in the Clearinghouse could add "ground truth" to these impact assessments.

- Information on earthquake impacts for response and initial recovery will be synthesized at the State Operations Center. The Clearinghouse can contribute to, and facilitate information sharing.

- It is important to look at ways to obtain additional information for situational awareness on earthquake impacts, such at 911 and crowd-sourcing.

Ideas/Recommendations for Action

The following ideas and recommendations for action were raised by participants both during the Roundtable and in follow-up discussions and emails.

- Creation of a **Data Sharing Workgroup** that will meet initially face-to-face and subsequently through conference calls to plan and oversee a **Bay Area Interdependent Lifelines and Critical Infrastructure (CI) Data Sharing Initiative** that will focus on "quick win" and other activities.

  Such activities include:

  - **A California Earthquake Clearinghouse Lifelines and CI Exchange Proof Project**. The project will entail utilities and other interested organizations sharing examples of publically available data with the Clearinghouse to demonstrate that lifeline information exchange can be operationally accomplished and lay an information exchange baseline that can be called upon in the event of an earthquake to improve response and initial recovery.

- Development of a **Lifelines and CI Information Sharing Protocol** (procedures and mechanisms) to support more in-depth analysis of all-hazards impacts and better understanding of associated infrastructure interdependencies, risk, and operational needs for preparedness/mitigation and prioritized restoration. This activity would build on Clearinghouse and other capabilities, including data sharing approaches organizations and cross-sector coalitions (and regions) may be using.

- Conducting an **Interdependent Lifelines and CI Information Sharing Tabletop Exercise** in late winter or early spring of 2016 with a Hayward Fault Earthquake scenario to examine the outcomes of the Clearinghouse Information Exchange Proof Project and draft Lifelines and CI Information Sharing Protocol.

- **Enhanced imaging and LiDAR capabilities** for pre and post-earthquake.

- **Additional investigation of infrastructure interdependencies-related impacts and restoration needs and timelines**. A suggestion was made for further analysis of lessons learned from the South Napa earthquake for water system and other infrastructure damages and information-sharing associated with what equipment and supplies/repair materials were needed.

Next Steps

The next step will be to convene the Lifelines and CI Data Sharing Workgroup. The first meeting will be held on Tuesday, October 26 from 10 a.m. to 12:00 p.m. at the same meeting location as the Roundtable, EBMUD in Oakland. Focus of the meeting will be on the identified action items above:

- A more detailed presentation for the Clearinghouse Saber System.

- Examples of types of products Clearinghouse participating organizations could receive and ideas for other useful products.

- Overview of Clearinghouse proposed *Information Exchange Proof Project* through which interested organizations will provide sample data sets of publically available information to the Clearinghouse.

- Discussion of developing a *Lifelines and CI Information Sharing Protocol* with examples of approaches underway in other regions.

- Discussion of a potential *Lifelines and CI Information Sharing/Interdependencies Tabletop Exercise* with a major earthquake scenario in the late winter or early spring of 2016.

Roundtable Participants

1. Marla Blagg, BART Police Department
2. Tom Horton, BART
3. Paula Scalingi, Bay Area Center for Regional Disaster Resilience
4. Gerald Kiernan, Bay Area Center for Regional Disaster Resilience
5. Janell Myhre, Bay Area Urban Areas Security Initiative

6. Kevin Chao, California Department of Public Health–Environmental Health Laboratory
7. Maria Solis, California Public Utilities Commission
8. Anne Rosinski, California Earthquake Clearinghouse
9. Rod Wheeler, California Independent System Operator
10. Phil Beilin, City of Walnut Creek
11. Steve Mogan, DoD Defense Coordinating Element, Region IX
12. Maggie Ortiz, Earthquake Engineering Research Institute
13. Mike Ambrose, EBMUD
14. Elizabeth Bialeu, EBMUD
15. Carlton Chan, EBMUD
16. Steven Frew, EBMUD
17. Sharon Hu, EBMUD
18. Xavier Irias, EBMUD
19. Serge Terentief, EBMUD
20. Atta Yiadom, EBMUD
21. Laurie Johnson, GEER Steering Committee
22. Evermary Hickey, PG&E
23. Cecile Pinto, PG&E
24. Damaris Villalobos-Galindo, San Jose Water Company
25. Tony Eshabaur, San Francisco International Airport
26. Jim Morentz, Single Automated Business Exchange for Reporting (SABER)
27. Michelle Heckle, University of California San Francisco Police Department
28. Bruce Macler, U.S. Environmental Protection Agency
29. Ken Hudnut, U. S. Geological Survey
30. Keith Knudsen, U. S. Geological Survey
31. Pat McCrory, U. S. Geological Survey