Response to the Loma Prieta Earthquake

Janet A. McDonnell

RESPONSE TO THE LOMA PRIETA EARTHQUAKE

by

Janet A. McDonnell

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Foreword

The circumstances surrounding the Loma Prieta earthquake in California in the fall of 1989 were unique. Yet the threat of further earthquakes is constant. There are valuable lessons to be learned from the Loma Prieta disaster that have much broader application and underscore the importance of the Corps' readiness mission.

Historian Janet McDonnell has sifted through hundreds of documents and conducted scores of interviews to tell the story of the Corps' response and the specific missions it performed for FEMA and other agencies. Her analysis has led to several important conclusions. One is that the Corps is a versatile organization that has tremendous capabilities and can take on missions quickly and execute them extremely well. Dr. McDonnell has also raised several questions that the Corps must resolve for the future.

Our intent in publishing this manuscript is to give the Corps' leadership and team members who have been or might be involved in emergency planning and operations the benefit of Dr. McDonnell's analysis and conclusions.

WILLIAM D. BROWN
Colonel, Corps of Engineers
Chief of Staff

The Author

Janet A. McDonnell is a senior historian with the U.S. Army Corps of Engineers. She received her Ph.D. from Marquette University. Dr. McDonnell has published *The Dispossession of the American Indian: Indian Land Policy, 1887–1934* as well as several articles on Indian land policy. Her most recent publication is the *U.S. Army Corps of Engineers Response to the* Exxon Valdez *Oil Spill.*

She is currently writing a history of the Corps' support of U.S. forces during the Gulf War and a history of the Army's role in the reconstruction of Kuwait.

Introduction

In September and October of 1989, the United States experienced two of the worst natural disasters in its history: Hurricane Hugo and the Loma Prieta earthquake. The dramatic story of the earthquake response must be placed against the backdrop of Hurricane Hugo. Hugo, one of the most devastating and costly hurricanes to affect the United States, began pounding the Virgin Islands on 17 September 1989 with winds exceeding 140 miles an hour. After crossing St. Croix and Puerto Rico, it ravaged the Carolinas. While the nation was still reeling from the storm on 17 October 1989, the Loma Prieta earthquake struck northern California.

The Loma Prieta earthquake touched the lives of 10 times the number of people affected in an "average" disaster to which the Federal Emergency Management Agency (FEMA) responds, and federal outlay for the earthquake was 20 to 30 times the norm. In addition, the earthquake occurred 3,000 miles from the resources assembled to respond to Hurricane Hugo.

Federal, state, and local agencies faced severe challenges as they struggled to provide essential services and supplies for the disaster victims in California. The state and local governments, which have primary responsibility for disaster response, were quickly overwhelmed; and the resources of many federal agencies were brought to bear. The Department of Defense and the Corps of Engineers responded quickly and aggressively. The Corps not only performed its traditional role of conducting damage surveys and administering contracts as it had after Hurricane Hugo, it also took on new missions such as inspecting private homes for damage and delivering rental assistance checks.

The Corps' response to the Loma Prieta earthquake revealed both strengths and weaknesses and provided valuable lessons for the future. This manuscript traces the Corps' early response and its efforts to set up an effective organizational

structure. It then describes and evaluates the specific missions that the Corps performed for FEMA and other agencies.

The focus of this manuscript is on Corps operations rather than policy making and implementation at the headquarters level of the Department of the Army or within the Department of Defense. The manuscript does not deal with broader issues of the Department of Defense and the Department of the Army involvement and their organizational structure—such as the roles of the Director of Military Support and the Assistant Secretary of the Army for Installations, Logistics, and Environment and the relationship of each to the Corps. Nor does this manuscript deal at length with the role and responsibilities of the disaster control officer who coordinated all Department of Defense support with FEMA officials on site. Further study of the earthquake response focusing on the larger policy issues and structure of the Department of the Army and the Department of Defense involvement awaits the work of another historian.

JANET A. McDONNELL

Acknowledgments

Many individuals contributed to this Loma Prieta history. Robert Fletcher, who was chief of the Readiness Branch at the Corps of Engineers headquarters at the time, initiated the project and consistently supported it.

Edward Hecker, Don Masters, and other members of the South Pacific Division emergency management staff graciously shared their time and their records. Frank Rezac and Cindy Fergis from the division's public affairs office provided the photographs.

William Baldwin of the Corps' Office of History read the manuscript and offered valuable insights. Kathy Richardson and Marilyn Hunter provided editorial expertise.

I am most grateful, however, to Major General John Sobke and other individuals I interviewed for sharing their knowledge and insights so that we can learn from the Loma Prieta experience.

Janet McDonnell

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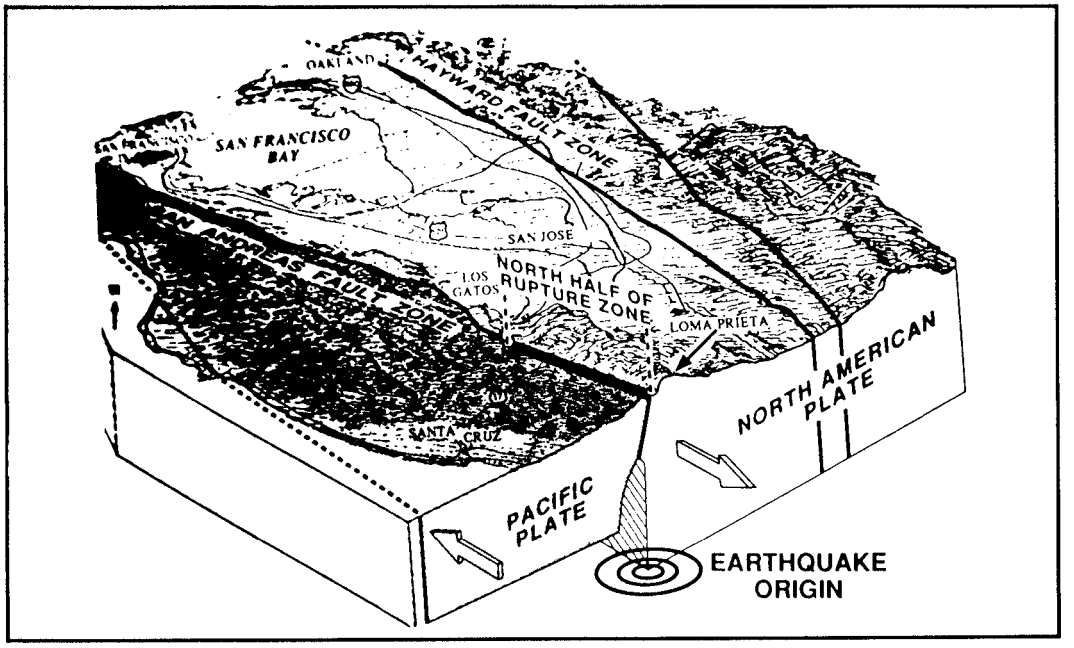
Initial Response

At 5:04 P.M. Pacific Daylight Time (PDT) on Tuesday, 17 October 1989, while many San Franciscans gathered at Candlestick Park to watch the third game of the World Series, the San Francisco Bay area was shaken by an earthquake that registered 7.1 on the Richter scale. Its epicenter was roughly 10 miles east–northeast of Santa Cruz and 60 miles southeast of San Francisco, near the 3,800-foot-high Loma Prieta Mountain. (Loma Prieta is a Spanish name for Dark Hill.[1]) The earthquake was the most damaging in the United States in the past 80 years. It shot tremors as far south as Los Angeles and as far north as the California/Oregon state line. Although the earthquake lasted only 15 seconds, it killed 62 people, injured 2,435 others, and left thousands homeless. The estimated material loss reached $7 billion. Over 14,000 residents in seven counties were forced into shelters for the homeless.[2]

Of the 62 deaths, 42 resulted from the collapse of the two-tiered Cypress Street structure of I–880. Six deaths



The Loma Prieta earthquake began 11.5 miles underground 17 October 1989.

occurred in San Francisco when an unreinforced masonry brick wall fell on the occupants of adjacent cars. Four deaths in the Marina district were caused by building collapse and fire, and four occurred in Santa Cruz when several buildings in the Pacific Garden Mall collapsed. Six more deaths were related to the earthquake. Most of the structural damage was to unreinforced masonry commercial and residential buildings and to older wood frame homes and apartments. Two-tiered freeways were particularly vulnerable; sections of I–480 (the Embarcadero Freeway) and I–880 (Cypress Street) all sustained major damage. The most serious destruction in San Francisco occurred in the fashionable Marina district where homes were damaged by failed foundations or ensuing fire. Whole blocks would have to be torn down and rebuilt.[3]

The most heavily damaged section of San Francisco was the Marina district where four people died.

Hundreds of people in San Francisco slept outside that first night because they were either homeless or feared their homes would collapse. By first light on 18 October, weary work crews struggled to restore electricity, telephone service, and gas lines. Subway and trolley service resumed by midday. Nearby communities sent water and fuel to keep emergency generators going.

A destroyed building crushes a car in San Francisco's Marina district.

The Federal Emergency Management Agency (FEMA), created in 1979 to consolidate the various federal emergency programs, is the lead federal agency in responding to disasters. Within an hour of the earthquake, Grant C. Peterson, FEMA's associate director for state and local programs who had been serving as acting director since June, had assembled a crisis management staff of 40 to 50 people and alerted the 26 member agencies of the Plan for Federal Response to a Catastrophic Earthquake.[4]

Under the 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 100–707), as amended, the federal government assists state and local governments in preparedness, response, and recovery efforts. After the President declares a disaster, FEMA supplements the efforts and resources of state and local governments and voluntary relief agencies. Emergency management has four phases: preparedness, response, recovery, and mitigation.

- In the preparedness phase, state and local governments develop emergency plans and conduct training and exercises.
- In the response phase, local, state, federal, and voluntary relief agencies provide food, shelter, and emergency

power. FEMA does not maintain a stockpile of material resources but can direct other federal agencies to provide staff, equipment, supplies, and other resources.

- During the recovery phase, FEMA provides grants and loans to repair homes and public facilities.
- Hazard mitigation involves finding methods to reduce risks to life and property in the future.[5]

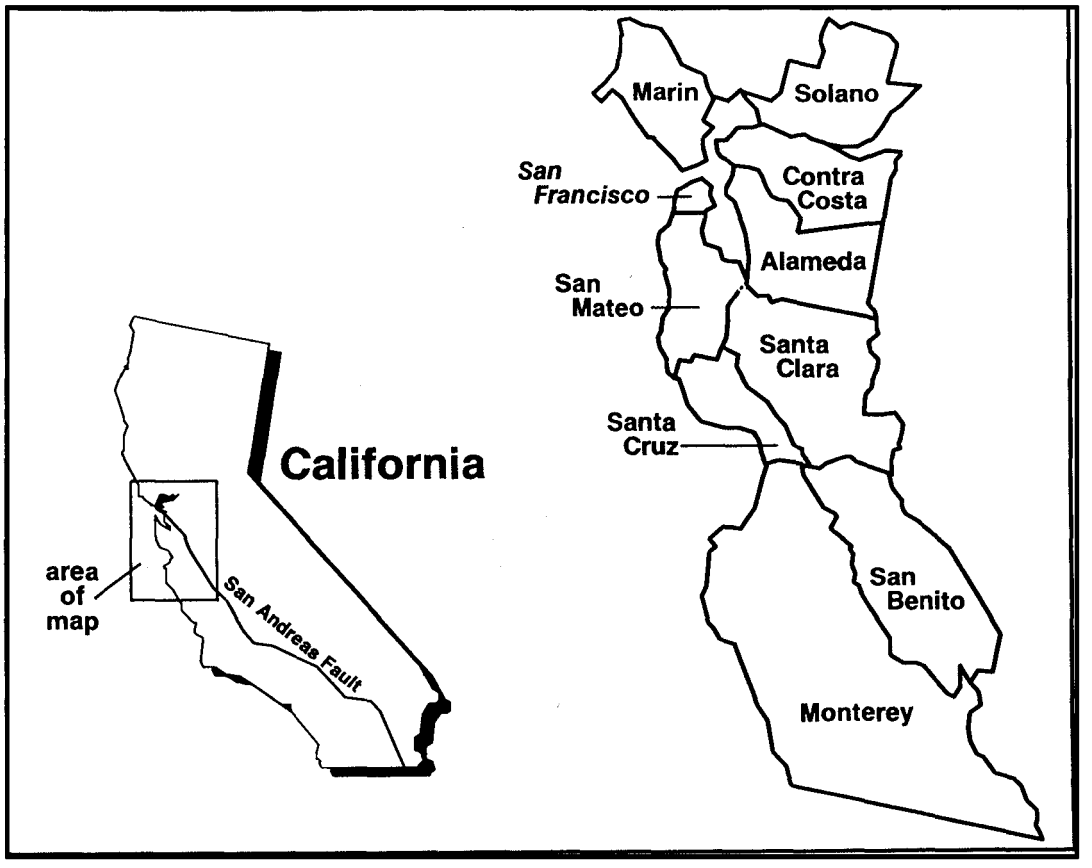
Within hours of the earthquake, FEMA opened an emergency information and coordination center in Washington, DC. Late Tuesday night, FEMA officials convened a meeting of the Catastrophic Disaster Response Group at the center. Representatives from the departments of Agriculture, Commerce, Energy, Health and Human Services, Justice, Transportation, and Veterans Affairs; Environmental Protection Agency; General Services Administration; Federal Aviation Administration; National Communications Systems; and the American Red Cross met to discuss the situation and to identify requirements for federal assistance to supplement state and local efforts. John P. Elmore, chief of the Operations, Construction, and Readiness Division, Headquarters, U.S. Army Corps of Engineers (HQUSACE), represented the Corps.

A representative from the governor of California's office also attended the meeting in Washington. The Catastrophic Disaster Response Group placed a conference call to state emergency officials in Sacramento, who indicated that the state was still assessing damage and had thus far been able to meet the requests for assistance from local governments. When queried by the Catastrophic Disaster Response Group, state officials recommended against activating the federal earthquake plan. These officials believed the state could handle the situation and thought that federal agencies would not need the authority provided in the plan.[6]

Once the Plan for Federal Response to a Catastrophic Earthquake is activated, federal agencies have automatic authority to obligate funds from the Disaster Relief Fund in coordination with state counterpart agencies. Although the plan was not activated in its entirety and federal agencies were not given this authority to obligate funds, federal officials decided to organize federal agencies along the lines of

the 11 emergency support functions (ESFs) described in the plan. Under the plan, the Corps of Engineers is responsible for ESF #3, construction management (now public works and engineering).[7]

In those first frantic hours, as the Catastrophic Disaster Response Group assembled, the White House quickly mobilized government resources. Stung by criticism of its Hurricane Hugo relief efforts, the White House was anxious to demonstrate its responsiveness and compassion. Following Hurricane Hugo, critics had charged FEMA with failing to put enough resources in place and taking weeks to set up disaster application centers in some counties and even longer to distribute emergency relief checks. President Bush, who had staunchly defended FEMA in the aftermath of Hurricane Hugo, visited FEMA headquarters the morning after the earthquake and directed Chief of Staff John Sununu to oversee the earthquake relief effort. He also dispatched Vice President Dan Quayle and Transportation Secretary



The Loma Prieta earthquake created a seven-county major disaster area in California. Three northern counties were added later.

Samuel K. Skinner to the bay area and visited the area himself two days after the earthquake.[8]

Early on 18 October, at the request of Acting Governor Leo T. McCarthy, Bush declared a major disaster in California under the Stafford Act, making seven counties in the bay area eligible for federal disaster aid money. He authorized FEMA to provide individual assistance and public assistance in Alameda, Monterey, San Benito, San Mateo, Santa Clara, and Santa Cruz counties, and in San Francisco. By law, federal funds were to supplement state and local funds, not replace them. Under the Stafford Act, public assistance was limited to 75 percent of the total eligible costs. Tommie C. Hamner, director of FEMA Region IX headquarters in San Francisco, became the designated federal coordinating officer. Subsequently, federal authorities declared the counties of Contra Costa, Marin, and Solano and the cities of Isleton and Tracy part of the disaster area.[9]

Department of Defense Response

The Department of Defense responded to the earthquake even before the disaster declaration. Defense Secretary Richard Cheney activated the Directorate of Military Support (DOMS), a group of officers in the Pentagon who coordinate the military's response to a civilian disaster. The Secretary of the Army—the Defense Department's executive agent for support to FEMA during a disaster—advised the director of military support, Major General James D. Smith, to activate a joint task force to coordinate, manage, and task all Department of Defense support to FEMA. Army officials initiated a DOMS crisis response cell in the Army Operations Center at 9:15 P.M. Eastern Daylight Time (EDT) on 17 October. The DOMS crisis response cell alerted all nearby Army, Navy, and Air Force aviation (helicopter), engineer, and medical units to be ready to provide support. A full joint task force met for the first time at 7:00 A.M. the next morning. The Secretary of the Army directed the commanders of the major military commands to coordinate Department of Defense disaster assistance in their respective geographical areas of responsibility. The commander of the U.S. Army Forces Command (FORSCOM) was designated as the supported commander and all other Department of Defense commanders-in-chief were designated supporting commanders.[10]

General Smith sent an execution order to FORSCOM indicating that because the President had signed a disaster declaration, Department of Defense could use its resources on both public and private lands to perform work that the FEMA federal coordinating officer requested. He directed FORSCOM to plan for and conduct disaster support operations in the areas of responsibility. FORSCOM would appoint a Department of Defense military representative as a disaster control officer. As the single point of contact for the federal coordinating officer, this person would coordinate all FEMA mission assignments for military assistance. The FORSCOM commander designated Major General Todd P. Graham,

deputy commander of Sixth Army, as the disaster control officer for the earthquake.[11]

Sixth Army, headquartered in the Presidio overlooking San Francisco Bay, spearheaded the Army's response. The commanding general of Sixth Army is responsible for responding to federal disasters in 12 western states. As regional Department of Defense executive agent, Sixth Army's responsibilities included the urban search and rescue mission (ESF #9) if required. When the tremors began, Colonel Albert E. Carlson, the deputy chief of staff for operations at Sixth Army, hurried down the stairs to the emergency operations center (EOC) in the basement of the headquarters building. The center, already fully staffed and operational because it was participating in a mobilization exercise, shifted its efforts from running the exercise to handling earthquake requests.[12]

Within minutes, Sixth Army staff reestablished telephone communications and began calling in additional critical personnel. A Sixth Army liaison was already en route to the California Office of Emergency Services (OES) in Sacramento. Navy and Air Force liaisons were already present in the emergency operations center and other liaisons would arrive later. Carlson observed that if Sixth Army staff had not been in the midst of an exercise, it would not have been as proficient as it was. He acknowledged some glitches in the response that would have been more difficult to smooth out if the right people had not been there for the exercise.

Carlson and his staff soon were joined by Tommie Hamner, who was locked out of his own headquarters building across the parade grounds at the Presidio. Sixth Army temporarily provided Hamner with a desk and phone so he could begin his operations.[13]

Sixth Army geared up for its urban search and rescue mission. Its fire trucks were among the first on the scene in the Marina district. Sixth Army also sent military police to help civilian police direct traffic so they could get the fire trucks through. Nine military police from the Presidio immediately assisted with local traffic control, while other military police provided support to urban search and rescue. The Presidio furnished bedding and light sets to the city of San Francisco. Sixth Army compiled lists of available disaster assistance equipment from all military services and later

deployed three people to FEMA's disaster field office as logistical liaisons. It provided six helicopters and two fixed-wing aircraft to provide airlift assistance, which included special missions for the Corps of Engineers. By 30 October, over 800 active duty Army soldiers had participated in disaster relief operations.[14]

Other services, particularly the Navy and Marines, also played key roles in the response effort. Navy ships in San Francisco Bay helped fight fires in the city and supplied heavy equipment to aid in rescue efforts on collapsed freeways in Oakland. The USS *Lang*, moored in San Francisco Harbor, provided steam services for power generation to the city utility company. The USS *Gray*, also in the harbor, provided electrical services to Pacific Gas and Electric to support damage control in the Marina district. The USS *Kansas City* and USS *Flint* were also in San Francisco Bay with helicopter detachments on standby. The USS *Texas* provided communications coordination for the bay area.

Personnel from the Treasure Island Naval Station helped evacuate people from the Oakland Bay Bridge and provided emergency food and shelter for people trapped on the bridge. Alameda Naval Air Station provided construction battalion personnel and equipment to support rescue operations on the collapsed section of I–880.[15] On 20 October, the *Pelilieu* traveled to San Francisco Bay to assist in the recovery. The Marine Air Group 42, stationed at the Alameda Naval Air Station, provided air lift for personnel and equipment. By 23 October, the Navy had committed 15 ships to the earthquake recovery operations. In addition, 18 aircraft and 35 ships provided assistance. Sailors and marines from the *Pelilieu, Fort Fisher*, and *Schenectady* performed various tasks ranging from making lunches for relief workers to transporting fresh water into Santa Cruz. The Navy provided large tents with generators and lighting for use by rescue workers on I–880. Volunteers from the *Gompers* helped the Red Cross evaluate structural damage to buildings in Oakland.

Beginning on 25 October, 25 marines from the *Pelilieu* assisted with traffic control during rush hour at the Port of San Francisco. The 15th Marine Expeditionary Unit furnished 121 marines to help remove downed trees and clear

roads near Soquel Valley, California. Marine personnel established a backup communications net for FEMA at its disaster field office, and four marines were detailed to the Presidio to provide administrative support for FEMA.[16]

The Air Force responded along with the other services. California's Office of Emergency Services established a medical staging area at Travis Air Force Base and a disaster support area at Mather Air Force Base. The Air Force provided aerial reconnaissance support from Beale Air Force Base.[17]

Roughly 900 displaced persons were sheltered in Department of Defense facilities: 300 aboard the *Pelilieu* and 600 more at the Presidio in the Golden Gate Reserve Center and in renovated barracks. On 27 October, the displaced men aboard the *Pelilieu* were transferred to an onshore Red Cross center. On 30 November, the last 103 people sheltered at the Presidio were relocated to other Red Cross shelters off the installation.[18]

The California National Guard also contributed greatly to the response. Within an hour of the earthquake, the California Air National Guard's 129th Air Rescue and Recovery Group, based at the Moffett Field Naval Air Station near San Jose, had its first HC–130 Hercules transport conducting a damage assessment over the San Francisco Bay area. By 6:00 P.M. every National Guard unit in California had been put on alert for possible state active duty.

The California Army National Guard operated a helicopter detachment from the Alameda Naval Air Station. On 18 October, DOMS reported 1,050 California guardsmen were on state active duty performing earthquake recovery operations. Their missions included medical evacuation, aerial observation and damage surveys, air transportation, and engineer support. Their equipment included 4 C–130 cargo aircraft and 12 helicopters.[19]

The California National Guard formed two task forces in expectation of receiving missions from the California Office of Emergency Services. The Guard assisted primarily in the areas of aviation support to law enforcement and damage assessment operations. By 23 October, only 119 soldiers remained on state active duty with the California National Guard.[20]

Corps of Engineers Early Response

Along with the other Department of Defense agencies, the Corps of Engineers responded quickly to the earthquake. In the first 24 hours, the Corps struggled to establish command, control and communications; reestablish a base of operations; account for its personnel; respond to early missions; and assess damage. For division and district officials, balancing the need to reconstruct their own organizations (such as finding new offices, accounting for personnel) with the need to conduct earthquake response operations was no easy task.

This was not the first time that the Army engineers had responded to a major earthquake in San Francisco. Immediately after the devastating San Francisco earthquake in 1906, Army engineers patrolled the city streets to provide security and aided in fire fighting. They also inspected buildings for structural damage and dynamited buildings to create fire blocks. In the aftermath of the earthquake, engineers at Fort Mason fed and housed 20,000 refugees who poured into the post. Working with local authorities and other agencies, they restored utility and transportation services, demolished weakened and structurally unsafe buildings, and designed and constructed camps to house the homeless.[21]

When the Loma Prieta earthquake hit, San Francisco District Engineer Colonel Galen Yanagihara and a small cadre of his staff were still at work. His deputy, Lieutenant Colonel William T. Coffey, was standing underneath the Embarcadero Freeway waiting for his car pool. After Coffey and another car pool member, Lieutenant Colonel Frederick Ferrin, the South Pacific Division chief of staff, reached the Marina district and began to sense the extent of the damage, they made plans to return to the city later in the evening.[22]

A few blocks away at the South Pacific Division headquarters, Rich Young, an experienced Corps emergency management specialist, felt the building shake. He immediately tried to establish communications with the Sacramento District and Corps headquarters in Washington. Within

minutes he established contact with Sacramento using a telephone patch off a VHF radio. Young also contacted Helga Grahl, an emergency management specialist at the San Francisco District, and then walked to the district headquarters at 211 Main. As Young approached the darkened district building, he found Yanagihara and Grahl in front operating out of Yanagihara's car. Young and Grahl carefully climbed up and down the steps of the building to retrieve portable radios and other supplies.[23]

Meanwhile, the chief of the South Pacific Division's Emergency Management Branch, Edward Hecker, tried to communicate with his office from his home in Concord north of the city. Although he could not get through, he contacted the emergency management representatives at Corps headquarters in Washington and monitored conversations in San Francisco on his VHF radio.[24]

From miles away at the Sacramento District, Pat Kuzmiak, an emergency management specialist, attempted to reach the South Pacific Division but was unsuccessful. The Sacramento District activated its crisis management team and tried to establish contact with headquarters, other Corps districts, and state and federal agencies.

Some confusion existed initially about who was in charge of the Corps' activities because the South Pacific Division commander, Brigadier General (later Major General) John Sobke, was out of the bay area and could not be reached by phone. Corps plans traditionally focus on catastrophic rather than near-catastrophic scenarios. In a catastrophic event, planners assumed the San Francisco District and the South Pacific Division would be out of operation for some time. Under the current catastrophic earthquake plan, command and control automatically shifted to the Sacramento District so the San Francisco District and the division could focus on reconstructing themselves. With both the division and the San Francisco District emergency operations centers out of operation in the first few hours, the Sacramento District officials decided to assume their support role as outlined in the federal response plan. This included sending the initial situation reports to HQUSACE. The district continued this function until the South Pacific Division officials reestablished a command center at the Presidio.[25]

Because of poor communications between the division, HQUSACE, and the San Francisco District, the Sacramento District assumed some command and control functions. The district quickly activated its emergency operations center. Within 15 minutes it had made contact with HQUSACE and within the San Francisco area. In the next hour, the Sacramento District operations center had verified contact with FEMA, the Bureau of Reclamation, Sixth Army, HQUSACE, other Corps districts, and California's Office of Emergency Services and Department of Water Resources. The Sacramento District's first situation report went to HQUSACE at 5:00 A.M. PDT the next morning.[26]

General Sobke was hosting an installations conference in Las Vegas, Nevada, along with most of the senior staff from his districts and the division, including the South Pacific Division Deputy Commander Colonel Dennis K. Culp, Sacramento District Commander Colonel Jack A. LeCuyer, and the division's Chief of Construction–Operations, Dave Fulton. When Sobke received word of the earthquake, he prepared to return to the bay area with his staff as quickly as possible, chartering a Lear jet for the return trip. The airplane ticket was a piece of paper signed "Contracting Officer" on which LeCuyer had written words to this effect: "I promise to pay you for this airplane. Send a bill." By 7:00 P.M. they were on their way.[27]

General Sobke and the others planned to have a helicopter meet them at the Monterey airport to take them to the Presidio's Crissey Field. There was no helicopter when they arrived, but people from Fort Ord picked them up and transported them to the 7th Infantry Division headquarters where they arranged for a Blackhawk helicopter to take them to Crissey Field. General Sobke called the Chief of Engineers, Lieutenant General Henry J. Hatch, about 9:00 P.M. from the Monterey airport to report that he was on his way back to the bay area.

During the flight, General Sobke and his staff planned an immediate response. They decided to have Corps personnel check all the dams and levees, coordinate with Sixth Army to see if engineers were needed to support the urban search and rescue mission, establish operations centers to

respond to FEMA requests, and seek increased authority for emergency contracts.[28]

While General Sobke and his staff were en route, Colonels Ferrin and Coffey decided to join Colonel Yanagihara in establishing a base of operations at the Sixth Army emergency operations center, arriving there between 7:00 and 7:30 P.M. By 10:00 P.M. the division's emergency operations center was reestablished within the Sixth Army EOC at the Presidio. Ferrin, Coffey, and others were hard at work when General Sobke, Colonel Culp, and Dave Fulton arrived at the Presidio around 11:00 P.M. Upon his arrival, General Sobke took charge of the response activities. He and his senior staff received a briefing on the current situation and then discussed plans and strategies. Sobke directed Edward Hecker to visit FEMA Region IX headquarters to determine the kinds of missions the Corps could expect.[29]

Having the Corps collocated at the Presidio improved communications and allowed for rapid coordination. Sixth Army officials were generally pleased with the set up. Yet the facilities quickly became cramped, and the shortage of phones and space restricted operations. Division personnel needed their own space, as well as their data processing systems, map displays, and communications. They continued to operate out of the Presidio until about noon on 19 October, when power was restored to the division headquarters building.[30]

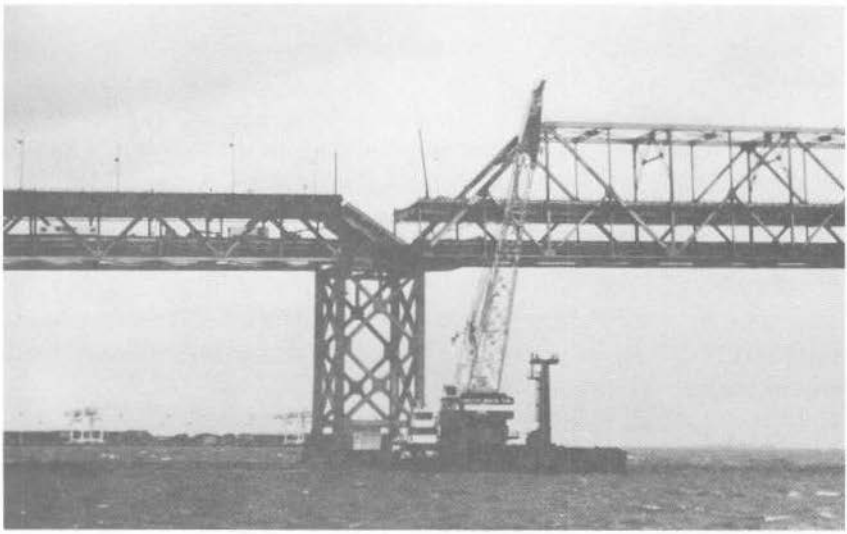
San Francisco District personnel also operated out of the emergency operations center at the Presidio for two days after the earthquake. Damage to their headquarters building was minimal, but file drawers were overturned, pictures were down, and books were strewn on the floor. In addition, the air quality was poor. Coffey, Yanagihara, and others realized, however, that the district and division could not function well out of the same location because their perspectives and concerns differed. District officials had difficulty exercising independent command and control in the cramped Sixth Army operations center. It was a challenge, Colonel Coffey observed, to meet the needs of the division commander and still function as a unit commander with concern for the status of his staff and building. Moving the district headquarters to a new location would allow it to reestablish itself

over the next four or five days and to do the things that only it, not the division, could do, such as emergency surveys and dredging contracts.[31]

District officials recommended to General Sobke that the San Francisco District reestablish itself at the Corps' resident office in the base yard at Sausalito. They chose the base yard because it was undamaged and offered special capabilities such as an emergency operations van. Moreover, it was the closest Corps-owned property and contained an easily recognizable landmark, the Bay Model. Officials reconstituted the San Francisco District at the district base yard in Sausalito at noon on 19 October.[32]

During the first 24 hours after the earthquake, besides establishing command and control and a base of operations, Corps personnel began assessing damage. The California Office of Emergency Services called the Sacramento District emergency operations center at 6:45 P.M. on 17 October to ask the Corps to provide engineers to inspect dams within the bay area. In response, the district sent two Corps representatives who met with their state counterparts early the next morning. The team completed its survey of 40 dams near the epicenter that same day. It concluded that all federal dams inspected within 50 miles of the epicenter were structurally sound. Three nonfederal dams near the epicenter (Newell Creek, Lexington, and Lake Elsman) had major cracks; but because of the low water level of the three reservoirs, they posed no significant threat to public safety. The Corps also coordinated a joint Corps/state inspection of the flood control systems in the Sacramento and San Joaquin river deltas.[33]

On the morning of 18 October, as the Sacramento District team began its survey, General Sobke; Brigadier General George Baxter, Commander, Sixth Army; and Tommie Hamner surveyed damage to the bay area by helicopter. With no power and with phone lines jammed, getting accurate information about the nature and extent of the damage proved difficult. From the air, Sobke and Baxter were too far away to get a clear sense of the earthquake's effects, but they could see damage to the Bay Bridge, the Marina, and the Cypress Street section of I–880. When Sobke returned from his survey that morning, he reported to Brigadier General (later Major General) Patrick Kelly, Director of Civil Works, HQUSACE, by phone.[34]



A collapsed section of the San Francisco–Oakland Bay Bridge.

Meanwhile, Corps officials in Washington followed the events in California closely. General Hatch had tried to contact the South Pacific Division within minutes of the earthquake but only succeeded in reaching a frightened telephone operator at the Presidio. HQUSACE activated its emergency operations center around 9:30 P.M. Eastern Standard Time (EST). Predesignated crisis management team members reported to the operations center to support the response operations. Through the crisis management team, headquarters would arrange for personnel, supplies, and laboratory support for the South Pacific Division. Lieutenant Colonel James Jeffrey Robertson represented the Corps on the DOMS team in the Pentagon.

After division and San Francisco District personnel were established at the Presidio, headquarters officials directed them to call in every half hour with a situation report to the HQUSACE emergency operations center to determine the USACE technical expertise they needed quickly, to find out what types of assistance would be requested of the Corps, to videotape the earthquake damage by helicopter if possible, and to check with the Sacramento District on any requests for inspections of non-Corps dams and levees in the bay area.[35]

At 12:25 A.M. on 18 October, Corps headquarters tasked the Engineering and Housing Support Center (EHSC) at Fort Belvoir, Virginia, to report on the status of prime power assets available for deployment to California. EHSC had three 14-person prime power teams at Fort Belvoir and a forward team of 5 people. It had seven 750 kilowatt heavy-weight generators and one light-weight generator at Toole, Utah, that could be used. The center also had a 4.5 megawatt power plant at Travis Air Force Base that would require heavy lift and transportation but could be in operation 48 hours after it was on the ground. Although EHSC prepared itself for a major mission in California, that mission never materialized.[36]

Finally, in those early hours, Corps headquarters worked to get the South Pacific Division the delegation of contracting authority that it required. General Sobke requested a redelegation of authority from HQUSACE. On 18 October, the Commander, USACE, authorized General Sobke to delegate to his district engineers authority to execute indefinite contract agreements (letter contracts) that did not exceed $10 million for San Francisco earthquake response only. Authority was granted to increase the maximum value of each architect–engineer indefinite delivery type (IDT) contract to $1 million and each delivery order up to $250,000. The authority was valid as long as earthquake disaster procedures remained in effect, unless the division commander rescinded it. Later that day, at Sobke's request, headquarters granted authority to the division and its districts to execute indefinite contract agreements of up to $20 million.[37]

Organizational Structure

Federal agencies initially were handicapped in coordinating their efforts because the federal response plan was not activated. With telephone systems overloaded, emergency personnel had to rely on cellular phones. FEMA had difficulty coordinating all the agencies with emergency support functions and gaining reliable damage information until it established a disaster field office under the direction of the federal coordinating officer (FCO) in Mountain View, California, on 23 October, the Monday following the earthquake. The Plan for Federal Response to a Catastrophic Earthquake outlined 11 emergency support functions. The federal coordinating officer dispensed with the emergency support function designations after the first week of the disaster field office operations. Clearly, this was primarily a recovery operation that did not require the full participation of all federal agencies identified in the federal response plan.[38]

Decisions on how to organize the Corps' response were not based on any previous plan because the earthquake was not as catastrophic as the plans had envisioned. General Sobke made his decisions on an ad hoc basis using the recommendations of his staff. He quickly divided responsibilities roughly down the center of San Francisco Bay because damage to the Bay Bridge effectively isolated the Corps in an east/west direction. The Sacramento District would do preliminary damage assessment in the eastern half, primarily in the Oakland area, and the San Francisco District in the western half. The general also placed the Sacramento District's Monterey office under the San Francisco District.[39] The loose structure generally worked well.[40] Corps officials modified their organizational structure as their missions became clearer and as FEMA refined its own organizational structure.

On Saturday, 21 October, after getting word that FEMA planned to establish a disaster field office, Edward Hecker drafted a structure for Corps operations at that office, which

Dave Fulton briefed to General Sobke the next morning. Under the plan, the Corps ESF #3 organization at the disaster field office would consist of three cells: a command and control cell staffed by the division; an individual assistance cell staffed by the Sacramento District; and a public assistance cell staffed by the San Francisco District. After Sobke approved the plan, division officials quickly drove to Mountain View.[41] Before setting up operations at the disaster field office, Corps personnel met with FEMA officials, Bob Vickers, Bruce Baughman, and Bob Brussard, who directed FEMA's individual assistance and public assistance programs. They explained to FEMA the Corps' capabilities and its plans for responding to possible missions.

When Edward Hecker, Rich Young, and other Corps personnel arrived at the disaster field office, they found an empty facility with no phones, furniture, partitions, or tables. Based on the anticipated workload, they requested space for 70 people: 30 from each district and 10 from the division. The South Pacific Division would draw personnel from Corps engineering, construction and operations, planning, human resources, information management, and real estate offices to staff the disaster field office, plus clerical and administrative personnel.[42]

As the disaster field office began operations, General Sobke expanded on his initial concept of operations and laid out the organizational structure on 23 October in a five-paragraph field order, Earthquake Operations Order #2. The division's mission, he explained, was to—

- Implement ESF #3 (construction management) of the federal earthquake contingency plan.
- Support the Sixth Army commander in ESF #9 (urban search and rescue).
- Support FEMA in other assigned tasks.
- Assist other federal agencies directly on a reimbursable basis under their authorities.
- Provide authorized flood emergency services under Public Law 84–99 (Flood Control and Coastal Storm Emergencies).
- Support defense installations.

The division would establish policy, coordinate Corps efforts, and accept missions; and its commander would continue to direct the operation. The division's crisis manager would serve as the link between the districts and other federal agencies and would assign the missions to the districts. The districts would provide preliminary damage assessments for the affected areas (San Francisco District for Santa Clara, Monterey, Santa Cruz, San Benito, San Mateo, and San Francisco counties and the city of San Francisco, and the Sacramento District for Alameda County). The San Francisco District would manage support to FEMA in conducting damage survey reports, while the Sacramento District would manage the individual assistance program.[43]

Recognizing the importance of the response effort, Sobke placed his own deputy, Colonel Culp, at the disaster field office to establish procedures, clarify policy, and determine the scope of Corps missions there. Colonel Culp and his small staff functioned as a command and control element that coordinated the activities of San Francisco and Sacramento districts and oversaw the Corps' public assistance and individual assistance offices at the disaster field office. Culp's command and control cell screened FEMA taskings to determine which district was in a better position to respond, based on its staffing resources and expertise, and then forwarded the taskings to appropriate district personnel for action. The command and control cell also kept Corps headquarters, the division, and the district emergency operations centers informed of the status of operations in the field.[44]

In addition, the command and control cell functioned as the FEMA liaison, a staff element for FEMA's ESF #3. Colonel Culp or one of his staff attended daily briefings with FEMA officials and kept them informed of the status of the Corps activities. During these meetings, Bruce Baughman or Bob Brussard gave the Corps verbal instructions regarding new missions or changes in missions. Together, Corps and FEMA officials prepared a scope of work that became the Corps' formal mission statement.[45]

The Corps' command cell at the disaster field office included Culp, Hecker, and Mike Grebinski, along with a small support staff. Lieutenant Colonel Timothy Mason headed the individual assistance cell and Lieutenant Colonel Coffey

directed the public assistance cell. The lean three-cell structure at the disaster field office worked well, though Culp observed that he could have used a few more people, particularly one from resource management to set up cost-accounting procedures quickly.[46]

Initially, all taskings flowed into the South Pacific Division's emergency operations center where officials screened them and assigned them to the districts. After the Corps established its command and control cell at the disaster field office, the cell gave taskings directly to the regional headquarters that Sacramento and San Francisco districts had established in Mountain View. After the regional office received a tasking, it set up its own procedures to execute the mission. Except for reporting, the regional office became a relatively independent operation under the auspices of the district commander. The Sacramento District's regional office in turn established seven area offices, while the San Francisco District's regional office established three. Only taskings outside the individual and public assistance missions were forwarded to the division headquarters.[47]

Although many command and control responsibilities shifted from the division headquarters to the Corps' command and control cell at the disaster field office, some remained at the division's emergency operations center. General Sobke remained the final authority on accepting or declining missions. Dividing command and control responsibilities between the disaster field office Corps cell and the division headquarters occasionally presented problems. Corps people at the disaster field office often could respond more quickly than those at the division and better understood the urgency of the situation. They sometimes needed to make immediate decisions, and passing issues up to the division commander could be time consuming.

Later, as the work became routine, division officials deactivated their emergency operations center, and Fulton replaced Culp in Mountain View. Officials also deactivated the district emergency operations centers, and district elements working on the earthquake response came directly under Fulton.[48]

With its organizational structure now firmly in place, the Corps could more effectively pursue its missions in support

of FEMA and other agencies. The largest and most significant Corps missions were preliminary damage assessment, individual assistance, public assistance, direct federal assistance, and technical assistance. The Corps also provided support to other agencies such as the California Department of Transportation (CALTRANS) and did work such as levee repair on its own authority. As the following sections illustrate, each mission presented unique challenges.

Preliminary Damage Assessment

The Corps' first major tasking from FEMA was to provide preliminary damage assessments for the seven-county disaster area. Officials in Washington needed reliable information to discuss with the President's staff whether or not to declare a disaster and what counties to include. Initially, the Corps received verbal taskings from FEMA followed by mission assignment letters (MALs). Corps officials actually wrote the mission assignment letters for FEMA because the agency lacked enough clerical help. The verbal tasking on 18 October for preliminary damage assessment was later confirmed in Mission Assignment Letter #1. FEMA requested that the Corps provide inspectors to perform preliminary damage assessments in conjunction with the state of California. Reimbursement for expenses related to this request was not to exceed $17,000. FEMA would not reimburse expenses over this limit unless the FEMA regional director amended the MAL.[49]

On the afternoon of 18 October, General Sobke sent Colonel Yanagihara south to set up a field office in a motel in Monterey for preliminary damage assessment. Twelve preliminary damage assessment teams, under the Sacramento District's direction, headed to Monterey that same day. Each team was augmented by an engineer from the California Office of Emergency Services. Colonel Yanagihara briefed California Congressman Leon E. Panetta on their activities when the latter visited the operations center in Monterey. Initial inspections included roadways, bridges, and other public facilities, as well as general damage to commercial and residential areas. By 22 October, the teams had completed general damage assessments of Monterey, Santa Cruz, and San Benito counties.[50]

Individual Assistance Mission

Another major FEMA mission for the Corps of Engineers was to conduct habitability inspections under FEMA's individual assistance program. After a natural disaster, individuals can apply to FEMA for housing assistance, and FEMA inspects the property to verify the extent of the damage. Under its temporary housing program, FEMA can provide the following:

- A grant to make minimal repairs to restore habitability.
- Rental assistance, for 1 to 3 months, but up to 18 months.
- A mobile home for up to 18 months if other housing is not available.

If FEMA cannot satisfy the victims' temporary housing needs, it refers them to the Small Business Administration (SBA) or other programs. The SBA is authorized to lend up to $100,000 for real property damage and up to $20,000 for personal property. Two days after the earthquake, FEMA established a toll-free, 24-hour hotline and began taking applications for assistance. On 22 October, FEMA opened seven disaster application centers, one in each affected county.[51]

On Friday, 20 October, FEMA asked the Corps of Engineers to provide 300 people to perform real and personal property inspections of individual residences in the seven counties and to provide all administrative, supervisory, and logistical support. FEMA traditionally hired contractors to conduct the inspections, but the response to Hurricane Hugo had strained the supply of available contractors. Anxious to put as many inspectors in the field as quickly as possible, FEMA turned to the Corps. The formal mission assignment letter, which came a few days later, specified that reimbursement was not to exceed $1 million. When Colonel Culp received FEMA's request Friday evening, he quickly called the Chief of Staff, HQUSACE, who indicated that General Hatch

would have to decide to accept the mission. After discussing the matter with General Sobke, who favored accepting the mission, General Hatch gave his approval.[52]

Officials were already discussing the types of people they would need (such as engineers, engineer technicians, and construction representatives) and other essentials such as valid drivers licenses. They also discussed whether the Corps should contract out the inspections, use Corps personnel, or share the responsibility with contractors. Division officials favored using Corps personnel because they believed the contracting process would take too long and many Corps people wanted to be involved in the response effort. In addition, FEMA official Robert Brussard had indicated that the Corps should use its own inspectors rather than contractors.

Brussard requested that the Corps bring in Gene Dretke, acting chief of Construction–Operations, Southwest Division, to run the habitability inspections and act as the FEMA liaison because FEMA officials had worked with Dretke in previous disasters and had confidence in him. Corps officials complied because the mission was new and Dretke had expertise that would be valuable in setting up the initial procedures.[53]

At 2:51 A.M. on 21 October, the emergency operations center in HQUSACE sent a "warning order" to all districts and divisions stating that the South Pacific Division had received a tasking from FEMA to support structure damage assessments. The work required roughly 300 Corps employees, primarily construction inspectors and engineers (GS–9 through GS–12), who should arrive in Sacramento on Sunday, 22 October. All divisions in the continental United States and the Pacific Ocean Division were tasked to support this mission. Offers of help from throughout the Corps immediately began pouring into the South Pacific Division emergency operations center.[54]

The warning order was followed by a letter from General Hatch informing all division commanders that he needed 300 Corps employees in California the next day to support the individual assistance mission. He asked commanders to send their "best" people because they would be dealing directly with the public. General Hatch also observed that the initial response to the warning order had been "terrific." Following

the Hatch letter, the South Pacific Division sent out more specific instructions. The inspectors were to be GS–9, GS–11, or GS–12 engineer/engineer technicians and construction representatives/inspectors, were to have valid drivers licenses, and were to be authorized to have a rental car. They were to bring red jackets, hard hats, rain gear, and basic instruction materials.[55]

Meanwhile, early Saturday morning, LeCuyer met with his staff and directed them to make things as simple as possible for people arriving in California for temporary duty. District staff should meet the volunteers at the airport, arrange for hotel rooms, and secure needed equipment (such as cameras, wet-weather gear, rental cars, credit cards). Lieutenant Colonel Mason, who was in charge of the Corps' individual assistance mission, and other district officials struggled to set up a mechanism to receive, train, and mobilize these people in the field. Over the weekend, the Sacramento District arranged for 300 rental cars; hotel rooms throughout the seven counties; conference facilities; equipment; and the materials the individual inspectors might need such as phone credit cards, tape measures, red jackets, and

The Corps of Engineers inspected hundreds of private homes like this one in Oakland, California.

hard hats. The arrangements were nearly complete by the time the first planeload of 50 inspectors arrived at 10:30 P.M. on Saturday. District personnel met them at the airport, bused them to a hotel, and transferred them to a processing center the next morning. By Sunday night, 320 people had registered.[56]

On 24 October, FEMA had 500 Corps and contract inspectors in the field with the first batch of 2,000 assistance applications. By 26 October, the registrations for individual assistance had increased to 21,389.[57]

The Sacramento District established a regional headquarters in Santa Cruz near the disaster field office, which Colonel LeCuyer directed until Colonel Mason took command on 27 October. This office tracked personnel and workloads, answered questions, and solved problems throughout the Corps organization.

FEMA planned for the Corps people to operate independently and complete inspections throughout the seven-county area rather than work with the 17 disaster application centers that FEMA had established. Based on that guidance, Corps officials decided to set up seven area offices, situated to provide the most flexibility in covering the seven-county area. Monday morning, while the inspectors were being trained, a few military officers from Corps districts went out as an advance party to set up the seven offices, ensure that the hotels were ready to receive the inspectors, and establish the necessary communications links. A military officer remained at each field office to oversee operations and logistical support.

Mason and other officials determined the organizational structure for each area office and the kind of equipment needed such as phones and fax machines. Each area office required an administrative staff of four or five people. Officials located the offices in areas where they believed the greatest damage had occurred: Oakland, San Francisco, Santa Cruz, Hollister, and Watsonville in the south. They also located one in Los Gatos on the San Jose side of the mountains and one in Redwood City to cover the area between San Francisco and San Jose.

District officials divided the 300 inspectors into 10-person teams, each headed by someone from the Sacramento District,

A Corps of Engineers team investigates the damage to a home in Watsonville, California.

which they could assign to the seven area offices as the workload evolved. For example, they first placed only two teams in Oakland because—aside from the bridge collapse—the damage did not seem extensive. By early November, nine teams were in Oakland, each swamped with requests. Officials sent four teams each to Redwood City, Hollister, Los Gatos, and Santa Cruz because these towns were near the epicenter where most of the damage seemed to be. Lacking good information on the extent of damage, the Corps positioned the teams as best it could.[58]

After six hours of training by two FEMA inspectors, the first teams moved out on Monday night. Individual assistance applications dribbled into FEMA, so the inspectors did not have any work for the first few days. One Corps official later observed that FEMA might have called for the inspectors too quickly. Others, however, argued that it was better to have some inspectors sitting around temporarily waiting for work than risk not responding to those in need. On 30 October, Fulton reported that although the division was "well positioned" to execute its habitability inspection mission, it had

not received its individual taskings as soon as expected because of the time FEMA needed to establish its disaster application centers and to process the initial requests for assistance.[59]

Corps officials at the disaster field office provided the area offices with general guidance but left the details of the operations up to them. Dretke and Mason occasionally visited the area offices to improve coordination. The procedures at the Marina Area Office, headed by Captain Charles Rimbach, typified those used at the other field offices. FEMA gave the applications—sometimes as many as 500 to 1,000—to Dretke who divided them among the field offices. A driver delivered large stacks of applications from the disaster field office (normally 25 to 50, but sometimes many more) to the Marina where the staff sorted them by ZIP code and distributed them among four inspection teams. The inspectors attempted to contact the applicants by phone or visited the site to set up an appointment (the applicants had to be present when the inspection was made). Moreover, the inspectors needed the applicants' signatures because most applications were made over the phone.[60]

The individual assistance procedures provided for both quality assurance and quality control. Area office staff reviewed the applications that the inspectors brought back to ensure that they were complete and in proper form. Then the applications went to the disaster field office, where a small group of Corps personnel provided additional quality assurance. Quality assurance personnel at the disaster field office had a better idea of what FEMA wanted and sent any questions back to the field. They organized the applications in neat packages so Dretke could return them to FEMA. The applications were returned to FEMA within 48 to 72 hours.[61] After Dretke returned the signed applications to FEMA, 40 to 50 FEMA staff members at the disaster field office reviewed them again. FEMA was pleased with the quality of the Corps' work.

One of the most significant problems that the Corps faced with the individual assistance mission was anticipating the workload. FEMA was unable to give the Corps accurate projections of future workloads, and the flow of applications remained sporadic. The Marina office, for example, might

receive 800 applications on one day and none the next. The Oakland office might get 800 to 1,000 applications in one day, creating a backlog, while the Watsonville office experienced a lull. Predicting the number of applications was impossible.

Because of the fluctuating workload, Corps officials had difficulty allocating resources. Area offices at times were either overstaffed or understaffed. As the work evolved, the Corps found that it did not always have its people in the right places. When Corps officials initially deployed the inspectors, they did not know how many applications to expect or where the bulk of the work would be. The initial deployments were designed to cover the disaster area as well as possible and to place inspectors as close as possible to major damage so they would not waste time in travel.[62]

Ultimately, the bulk of the work developed in San Francisco and Oakland, both of which were short inspectors. Officials moved people from one location to another to compensate for changing workloads. By early November, they had closed offices at Hollister, Los Gatos, and Redwood City, and were planning to merge the Watsonville office with Santa Cruz. This would leave three offices: one on the east side of the bay (Oakland), one on the west side of the bay (San Francisco), and one to cover the southern area. The Corps could not move its people around as easily as the contractors who worked out of their homes. Finding hotel accommodations was sometimes challenging. No hotel rooms were available in Oakland, and Corps inspectors staying in Hollister and Watsonville were too far away to commute.

In previous disasters such as tornadoes and hurricanes, damage was more concentrated. The earthquake was a unique situation for the Corps and FEMA, because the work force in the field had to react to the ebb and flow of applications over a wide geographic area. Contractors used local hires, and if the workload dropped, they could lay these people off for a few days and bring them back as needed. This option was not available to the Corps nor could Corps inspectors work out of their homes.[63]

The productivity of Corps and contractor inspectors also differed. FEMA measured productivity by applications that each inspector completed in a day. Contractors handled an

average of 10 to 12 applications per day, and sometimes as many as 25 to 30. Corps inspectors, who tended to spend more time with each applicant, averaged only 2 to 3 applications per day. Mason countered, however, that productivity can be measured in many ways. Contractors had strong incentive to process applications as quickly as possible because they were paid per application. Corps inspectors had come to California voluntarily to provide assistance and spent more time with applicants listening to their concerns and reassuring them.[64]

Mason also contended that Corps inspectors made more of an effort to contact applicants. FEMA required inspectors to make three serious attempts at contact (by phone call or visit) within 48 hours. Corps inspectors put extra effort into contacting applicants, sometimes scouring homeless shelters and delaying inspections to accommodate the applicants. Although Mason understood FEMA's concerns about productivity, he concluded, "We think they [the inspectors] are doing a good job in the field and we think that the public is very receptive to what the Corps was doing and appreciative." Mason gave the Corps inspectors high marks in "customer care," but not in productivity.[65] The Corps had to consider and respond to two customers—the applicant and FEMA—and the needs of each were not always the same.

At a heated meeting on the morning of 8 November, FEMA officials informed Corps representatives that their production rate was unacceptable, and Corps officials acted quickly to resolve the problem. Dretke directed his inspectors to increase their productivity. Culp agreed with FEMA's criticism of the Corps for not emphasizing production enough and conceded that the Corps got into the "production mode" about 24 hours late. Initially, Corps officials told the inspectors that their primary goal was to take care of the needs of the applicant, but that took more time. After the directive to increase productivity, the inspectors made fewer attempts to contact individual applicants and spent less time with them. Although Corps productivity was low compared to that of the contractors, FEMA was very pleased with the quality of the inspections. It normally took experience in three disasters for an inspector to do the quality work that Corps inspectors were doing for the first time.[66]

Besides productivity, finding people with the right expertise posed a problem. The Corps had only 48 hours to put 300 people with specific skills at certain grade levels in the field. For example, when work began, officials found that they lacked data processing skills in the field. The field offices also needed more clerical and administrative personnel as well as finance and accounting and resource management specialists to deal with time-keeping and accountability questions.

Critics complained that Corps inspectors were over qualified. At it turned out, the mission required more construction inspection skills than engineering skills, but with only a short time to mobilize for a new mission, Corps officials could not determine exactly what skills were required. Professional engineers at GS–13 through GS–15 were at times performing GS–9 through GS–11 work. However, given the uncertainty, Culp responded, having these professional engineers available in the area to perform other functions was an advantage. For example, officials diverted one habitability inspector who was a geotechnical expert to the hazard mitigation team.[67]

Inadequate training and changing guidance presented additional problems. Inspectors had received a few hours of FEMA training, but those without previous disaster experience had no frame of reference. FEMA representatives provided no pamphlet highlighting the critical elements. Instead, the inspectors received a sample report that was explained in detail. Each application, however, was unique and the pertinent information did not always fit neatly in the spaces provided. Moreover, FEMA guidance on how to fill out the application and the information that inspectors were to provide changed continually. The Marina office, for example, received eight "volumes" of changing guidance from the disaster field office and personnel became discouraged. Getting information to the inspectors was complicated by their varied work schedules, and sometimes they had to go back to the applicant for additional information.[68]

At times, language posed a problem. The bulk of the damage assessments in Hollister was for Hispanic residents, and only two inspectors at the office spoke Spanish. Corps inspectors translated the standard letter for applicants into

Spanish and Chinese and used Spanish–speaking inspectors in certain areas.[69]

As part of the individual assistance mission, Corps inspectors also delivered rental assistance checks. (Never before had anyone hand-delivered checks after a natural disaster.) Some applications came to Corps inspectors from FEMA with pre-approved rental assistance checks (for three months' rent) attached. If the inspector verified that the applicant was the owner and concluded that the house was uninhabitable, he was authorized to hand the applicant the rental assistance check as soon as he finished his inspection.

Although this was the fastest method of getting financial assistance to homeless earthquake victims, problems developed. Some ineligible people received checks. More important, inspectors who hand–carried the checks risked being robbed. Nevertheless, Corps inspectors continued to deliver the checks. Officials modified the procedures somewhat to ensure that inspectors traveled in groups when delivering the checks.[70]

Confusion and fraud also hampered the individual assistance program. Some addresses on applications turned out to be empty lots, school yards, and city parks. One hotel had 80 rooms, but 150 people claimed to be living there. Over 3,000 of the first 10,000 applications were duplicates because some people who originally registered by telephone registered again in person or by phone. FEMA later implemented an address check to identify duplicate registrations. Roughly a third of the applications for aid came from multiple residents at the same address, which resulted in duplicate inspections of the property and duplicate payments.[71]

The individual assistance mission ended a month after it had begun. Within 30 days, Corps members completed 19,469 habitability inspections and delivered, or attempted to deliver, 1,054 assistance checks with a value of almost $3 million. Every division in the Corps supplied inspectors for the individual assistance mission except the South Atlantic Division, which was still involved in Hurricane Hugo recovery operations. Over 330 Corps inspectors participated in the program.[72]

Corps costs for personnel, transportation (including air fares and rental cars), lodging, equipment, and supplies amounted to roughly $4.5 million. The first group of inspectors left in late October. By mid-November, fewer than 100 were still working in the field headquarters, Oakland, and San Francisco. By 22 November 1989, the day before Thanksgiving, the last Corps individual assistance inspectors left for their home districts.[73]

Public Assistance Mission

While the Sacramento District grappled with the individual assistance mission, the San Francisco District took charge of the public assistance effort for FEMA. FEMA's public assistance program provides federal grant assistance for the repair, replacement, or restoration of disaster-damaged publicly owned facilities and certain private nonprofit facilities. Grants are provided on a 75/25 percent federal/nonfederal cost sharing basis. Eligible applicants include the state and any county, city, village, town, or other political subdivision of the state, as well as private nonprofit organizations or institutions that own and operate certain educational, utility, emergency, or medical facilities or that provide essential government service.

Work that is eligible for federal grant assistance is classified as either emergency or permanent.

- Emergency work must be performed immediately to save lives, ensure public health and safety, and protect property.
- Permanent work includes repair or restoration of public roads and streets, water control facilities (such as dams and levees) owned or maintained by an eligible applicant, public office buildings, utility distribution systems (such as sewage treatment plants), public parks, and recreational facilities. Damaged facilities are restored to their predisaster condition and design, subject to applicable codes, standards, and specifications.[74]

In Mission Assignment Letter #2, FEMA requested that the Corps provide inspectors to assess damage and conduct initial inspections. The inspectors would prepare damage survey reports (DSRs) according to FEMA regulations and deliver those reports directly to the disaster field office for FEMA review and distribution to the state of California. When the governor's authorized representative notified FEMA and the Corps that work covered by the damage

survey report was completed, Corps inspectors would make additional surveys as necessary to confirm that the work in the original project application had been completed. They worked with state counterpart agencies to ensure that each FEMA-approved site where damage exceeded $25,000 was inspected by a federal and/or state official and that the completed work complied with the approved scope of work and the FEMA engineering analysis. The inspections, conducted jointly with the appropriate state counterpart inspectors, were to begin within 7 days of Corps notification and were to be completed within 30 days.

The mission assignment letter specified that reimbursement be limited to $600,000 unless the FEMA regional director approved additional expenses by amending the original mission assignment letter. To obtain additional obligating authority, the Corps had to submit a request for additional funding based on projected need and an estimate of the revised total cost of the project. In mid-November, FEMA increased funding for the public assistance/damage survey report mission from $600,000 to $3 million and later to $3.5 million.[75]

In previous response efforts, FEMA had directed the public assistance program itself, using Corps personnel to do the inspections. FEMA followed the same approach after the earthquake. But on 25 October, Bruce Baughman, who had been sent from FEMA headquarters in Washington to head the public assistance program, asked the Corps to manage the entire operation to include training, equipping, and deploying inspectors. FEMA retained ultimate responsibility and signatory authority.

Baughman decided to put the Corps in charge of the entire public assistance mission in part because of the many inspectors requiring supervision. He also understood that the Corps preferred to be given the freedom to decide how to accomplish a mission and to set its own standards. Culp and other Corps officials were predisposed to take on the entire mission. They felt they could respond more effectively and exert better control if given a standard and allowed to organize as they saw fit to accomplish a mission. And, with its resources already strained by Hurricane Hugo,

FEMA did not have the staff to manage the public assistance program.[76]

Corps officials established a goal of a 2 percent error rate and offered to have Corps personnel do the quality assurance to achieve this rate. FEMA officials rejected the offer, indicating that they would do the final check. Corps officials decided to establish their own quality assurance section even though FEMA would perform another review.[77]

During that first weekend, Coffey and other Sacramento District staff developed a plan for tackling the public assistance/damage survey mission. On Sunday night, 22 October, they explained their plan to General Sobke and received his approval. At that point, Colonel Coffey and Helga Grahl quickly drove to Santa Clara to establish a base for damage survey reports. Baughman approved the structure that the Corps created to accomplish the mission.[78]

Meanwhile, Edward Hecker met with Bruce Baughman, Roy Gorup, and Daryl Waite, the FEMA public assistance staff. FEMA tasked USACE with providing an additional 25 DSR inspectors, bringing the total to 60. Training for the first phase (35 inspectors) would take place on Wednesday, 25 October, and for the second phase (25 inspectors) on Thursday, 26 October. FEMA also tasked the Corps with providing two to four specialized DSR inspectors for the Port of Oakland Marine Terminal and Metropolitan Oakland International Airport, with expertise in evaluating damage to the port's heavy cranes as well as in doing the damage survey report for the runway.[79]

FEMA began doing damage survey reports on 22 October and conducted the first public assistance applicant briefings the next day. Public assistance procedures were well defined. As soon as some preliminary damage assessments were complete, FEMA held public forums for city and county officials to explain procedures for requesting and obtaining public assistance. All public and private organizations within that geographic or political jurisdiction could attend. FEMA officials distributed a two-inch thick packet of forms, which included a one-page form called a "notice of intent" on which applicants indicated the type of damage that their property had sustained. FEMA explained how to fill out the forms and the attendees returned them at the end of the meeting.

After the meeting, FEMA entered the information into a computer database at the disaster field office as a notice of intent and assigned an identification number that corresponded to the agency submitting the notice. Then FEMA passed the notices on to the Corps for coordination. A team composed of one federal representative (Corps or contractor) and one state representative, notice of intent in hand, then visited the agency applicant and started to assess the scope of the damage and write the damage survey report. This appointment was critical because at that point the Corps started compiling the report, which contained both engineering estimates and documentation provided by the applicant.

Corps officials could not determine from the original notice of intent how many damage survey reports would be required or the scope of the work or the number of inspectors required. The notice indicated the type of discipline needed (such as structural engineering, plumbing) but beyond that provided little information. For example, if the applicant checked off "roads" on the form, it could indicate damage to 18 miles of roads or 40 miles. The report provided the scope of work and the cost estimate that became the basis for grant funding.[80]

The Corps established three sites (San Francisco, Mountain View, and Santa Cruz), each with a station chief who was responsible for managing the DSR missions within a particular geographic area. This was a command and control cell in charge of all the individual inspection teams. The station chiefs, in turn, reported to the damage survey report chief, Lieutenant Colonel Coffey.

The 128 teams produced over 6,000 damage survey reports with a value exceeding $25 million. A quality assurance/quality control team reviewed each report. Corps involvement in this process continued until spring 1990.[81]

As Corps personnel executed the damage survey reports, they sent them to a FEMA public assistance officer for approval. No two reports were alike, and quality became a problem. The Corps had to verify its initial guidance on filling out the damage survey report with the FEMA reviewers to ensure that they agreed. The Corps' internal review process apparently worked well, for FEMA accepted

A Corps of Engineers inspector surveys wreckage at the Pacific Garden Mall in Santa Cruz, California.

95 to 96 percent of the damage survey reports the first time they were submitted.[82]

Not all inspectors were adequately trained. A June 1988 memorandum of agreement between the Corps and FEMA specified that each engineer division create a cadre of personnel who could write damage survey reports, but in return, FEMA would help provide training. Although each Corps division was linked with a FEMA region for training, not all FEMA regions provided that training. Sometimes if an engineer division spanned more than one FEMA region, no one took responsibility for training.[83]

FEMA later waived the requirement that inspectors be trained before they arrived and indicated that inspectors had to be trained only before they went into the field. The Corps in conjunction with FEMA conducted a four-hour training session for DSR inspectors. But the training was inadequate, in part because FEMA had no instruction manuals available for inspectors. In November 1988, some federal statutes had changed, and FEMA was in the process of printing new manuals reflecting these changes. FEMA has no uniform standards or guidelines for training across the country.[84]

Without adequate training and guidance, Corps inspectors had difficulty estimating costs. Corps officials charged that FEMA standards for estimating costs were inconsistent and did not reflect the local market. For example, repairing a brick wall in Santa Cruz was cheaper than repairing one in San Francisco, but FEMA standards did not reflect this. The limits that FEMA placed on repair costs also created problems. Although the amount of acceptable costs was an issue that FEMA and the applicant had to resolve, the DSR teams were at times caught in the middle. FEMA apparently had regulations that outlined what it would reimburse, but it had not yet put out guidance that defined and clarified its criteria.[85]

Corps officials complained that FEMA's guidance changed continually. Without site-specific or consistent standards, Lieutenant Colonel Coffey observed, there was no agreement on proper costs. What was acceptable kept changing, and FEMA officials at the three different stations were not in accord. They returned rejected estimates to frustrated inspectors who then had to go back to the agency applicant. As a result, their credibility suffered.

Baughman, however, denied that the cost amounts listed on the disaster survey reports were ever changed at the disaster field office during his tenure and disputed the idea that discrepancies occurred in authorized prices. He claimed that FEMA used a standard unit price list, developed with state concurrence. If a local jurisdiction proved that its costs were greater than the standard costs, the costs were altered.[86]

During the first two weeks, managing the personnel coming in from other districts and divisions posed a problem. Planning was hampered by lack of any advance notice of how many people would be reporting and the absence of any uniform, mandatory period of service. The Sacramento District staff successfully processed and deployed 300 inspectors, but the processing took place outside the disaster area so hotel rooms were available. Providing for the DSR inspectors inside the disaster area was more difficult.[87]

Public assistance/disaster survey work was more detailed and required more training than did habitability inspections, so it was difficult to move inspectors back and forth between programs. In only a few instances could Corps officials divert

personnel from individual assistance to public assistance work. Only 45 to 50 of the 300 individual assistance inspectors were qualified and trained to do damage survey reports. Once the inspectors were in the field, it was not feasible to switch them from one program to another. After giving the individual assistance and public assistance missions to separate districts, the Corps was unable to transfer resources between the two missions because each district wanted to retain control of its resources.[88]

Chief of Engineers LTG Henry Hatch talks with Corps inspectors in Watsonville, California.

Coffey recommended that in the future the Corps provide a civilian personnel officer located outside the disaster area to manage and assign its personnel. Inside the disaster area, officials were too busy setting up an organization, conducting training, and providing logistics support. For future disaster responses, Coffey also proposed that the Corps deploy a management structure, organized in teams, each with a head and an administrative assistant. For example, the Santa Cruz office had three people from the Corps' Missouri River Division who operated as a unit. Coffey plugged them

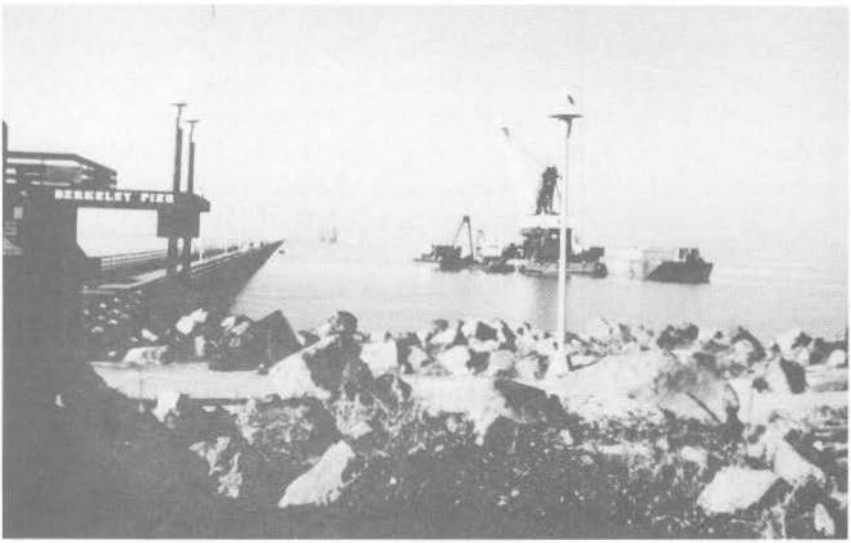
as a management cell to supervise 26 teams. He recommended that the Corps prepackage management structures for disaster field offices composed of emergency operating personnel from the districts.[89]

Direct Federal Assistance

FEMA's third formal tasking to the Corps was direct federal assistance. FEMA asked the Corps to provide liaison and technical support to include material, equipment, and personnel as requested. Under Mission Assignment Letter #3, reimbursement was not to exceed $1 million without Hamner's authorization. FEMA later increased this amount to $5 million and amended the mission assignment letter by adding "construction, dredging," to "material, equipment, and personnel." Corps work under the MAL was cost shared at a 75/25 ratio of federal/state contributions.[90]

Under MAL #3, the Corps provided ferry service and dredging support. With the Bay Bridge closed, commuters in the bay area needed alternative means of transportation. Expanding ferry service between the East Bay harbor and San Francisco was the best method for meeting the immediate transportation need. Hence, FEMA tasked the Corps to assist in establishing ferry service. The South Pacific Division in turn tasked the San Francisco District to inspect the dock at Berkeley Yacht Harbor, to either repair it or construct a new floating dock, and to dredge the channel to accommodate ferries. The division also directed the San Francisco District to survey Golden Gate Fields at Albany and to verify the need for a floating dock at Bay Farm Island in San Leandro Bay. Two days later, the South Pacific Division changed the tasking with FEMA's consent. The San Francisco District would dredge the slip at the Marriott Hotel dock in Berkeley Yacht Harbor and pursue the assigned work at Bay Farm Island, but cancel all work at Golden Gate Fields. On 2 November, the South Pacific Division directed the San Francisco District to provide a floating dock, 40 feet by 80 feet, at Todd Shipyard in Alameda to promote trans-bay ferry service. On 31 October, Corps personnel inspected seven ferry boat sites as requested by the California Department of Transportation (CALTRANS).[91]

The channel depths at Berkeley Marina had to be deepened so ferries could safely enter and leave the harbor. CALTRANS, through FEMA, immediately requested that the Corps execute and administer the dredging contract. Corps officials promptly obtained the required approvals from environmental agencies, such as the Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the State Department of Fish and Game.



A Corps contractor dredges the Berkeley Marina to expand ferry service.

Once the approvals were received, the Corps implemented emergency contract procedures to ensure that dredging was completed as quickly as possible. It secured two contracts, one with Manson Dredging and the other with the Dutra Dredging Company. Work under the Manson Dredging contract, which deepened the channel to 6 feet below mean low low water (MLLW), began 21 October and ended 27 October, for a total cost of $150,000. The Dutra Dredging Company contract completed the project to 9 feet below MLLW at a cost of $60,268. This contract was awarded on 3 November and completed 15 November, six days later than anticipated because of a labor union strike. The combined dredging contract costs totaled $210,268.[92]

Under the direct federal assistance mission, FEMA also tasked the Corps to provide a heating system for 19 housing units at Buena Vista Farm labor camp in Watsonville, California.[93]

Technical Assistance

In Mission Assignment Letter #5, FEMA asked the Corps to provide technical assistance to state and local interests as requested. FEMA specified that reimbursement for technical assistance expenses not exceed $100,000 unless approved by the FEMA regional director, but it later increased the amount to $1,750,000. At FEMA's direction, on 23 and 24 October, Sacramento and San Francisco district mechanical and structural engineers inspected four state and county bridges (Fruitvale Avenue Railroad Bridge, Miller Sweeney Bridge, High Street Bridge, and Park Street Bridge) in Alameda County to determine the extent of damage. FEMA indicated that the Alameda bridge inspections were a technical assistance mission paid for entirely with federal funds.[94]

The Sacramento District provided engineers to inspect the structural integrity of piers for safety and for ferry use at the following sites: Todd Shipyard at Jack London Square in Alameda, the container pier at the south end of Richmond Inner Harbor, Vallejo Pier, Berkeley Marina (part of the original mission assignment), San Leandro Marina, and Emeryville Marina. The San Francisco District also provided two structural engineers to inspect buildings owned by the Santa Cruz Department of Parks and Recreation.[95]

A large part of the Corps' technical assistance effort involved geotechnical support. The earthquake triggered thousands of landslides in the north central portion of California's coastal ranges from the San Francisco Bay area to the Big Sur coastline. Most of the landslides occurred near the earthquake's epicenter in the Santa Cruz Mountains. The steep mountains, which receive up to 60 inches of rain per year, historically produce slides during heavy seasonal rains and earthquakes.

The landslides were predominantly shallow (10 feet or less) rock falls, rock slides, and soil slides. Typically, these slides pushed quickly down steep slopes, depositing boulders and finer grained material. Slides killed two people during

or immediately after the earthquake. Large blocks of soil also broke away and some of these block slides showed evidence of continued or renewed movement as the result of rainfall in the mountains 10 days after the earthquake.[96]

County officials and residents worried that aftershocks and winter storms could lead to more landslides, further destruction of property, and loss of life. Santa Cruz County officials appealed to state and federal agencies and to their congressional representatives for assistance in evaluating this possible geologic hazard in the area.

In the first days after the earthquake, an on-site Waterways Experiment Station (WES) team consisting of personnel from the Geotechnical Laboratory and Structures Laboratory evaluated the earthquake's effects. During the week of 30 October, personnel from the two laboratories supported the FEMA disaster mitigation team at the disaster field office. On 13 November, a Geotechnical Laboratory geologist assisted FEMA and the South Pacific Division in mapping and planning mitigation action for a major landslide in the Santa Cruz Mountains.[97]

At a public meeting hosted by California Congressman Leon E. Panetta on 28 October 1989, officials offered federal technical assistance for evaluating the geologic hazards posed by the slides in Santa Cruz County. Representatives of the Corps of Engineers, the California Division of Mines and Geology, and the county met on 3 November to identify the scope of the technical assistance required. Participants identified technical support for ongoing investigations of massive slides in the Santa Cruz Mountains as the most critical need.

A few days later, on 8 November, representatives of FEMA, the U.S. Geological Survey, the Corps, the California State Office of Emergency Services, and Santa Cruz County met to discuss the county's request for assistance. Soon after, the county formally requested, through the Office of Emergency Services, that FEMA provide technical assistance for the geologic hazards analysis study.[98] FEMA then directed the Corps to provide technical assistance at a cost of $1,350,000 to Santa Cruz County to investigate geologic hazards resulting from the earthquake. FEMA specified the need for geotechnical advice and resource support to Santa Cruz County in the following areas: survey and mapping of areawide

hazards, foundation investigation and instrumentation, and preliminary slope stability modeling and geologic hazards analysis to determine public-safety hazards and emergency measures required.

An interagency technical advisory group (TAG) was established to perform the investigation, which included representatives of Santa Cruz County, the U.S. Geological Survey, the California Division of Mines and Geology, and the San Francisco District. The district provided a project manager to oversee scheduling and funding, to administer Corps engineering services contracts, and to coordinate participation from other Corps elements such as the South Pacific Division and the Waterways Experiment Station.[99]

At the request of the county, FEMA funded the studies and reviewed the overall objective and scope. The Corps provided technical and contractual support and served as project manager. The technical advisory group made up of representatives of the county, the U.S. Geological Survey, and the Corps met regularly to advise the county and the project manager on the scope of the mission, various technical concerns, and data analysis and interpretation.

The analysis would be conducted in three phases, the first of which involved identifying and surveying the slides. The second phase involved geologic characterization and installation of monitoring instruments, and the third phase was for data reduction and analysis. Phase one mapping began soon after the earthquake and was 95 percent complete by 22 November 1989. Surveys of the slides began on 15 November, and 10 of the 12 surveys were completed by 22 November. The last two were completed by 7 December. On 6 December, a contract was awarded to William Cotton and Associates to perform the geologic characterization of and install the instrumentation (phase two) in the first two landslides selected for the detailed study (Villa del Monte complex and Schultheis Road landslide). Work on the geologic characterization of the most critical of the slides began 8 December, and the drilling and instrumentation work was scheduled to begin 10 days later.[100]

Work for Others

Besides responding to FEMA missions, the Corps provided assistance to other federal and state agencies as requested. The Corps, for example, responded to a request from CALTRANS for a "forensic" engineering study of the collapsed I–880 section in Oakland, California. The two-tiered elevated structure, the Cypress Street Viaduct, fed traffic from Oakland onto the Bay Bridge. During the earthquake, the upper deck fell onto the lower deck, crushing motorists. Widespread interest focused on discovering exactly why the structure failed.

A collapsed section of the two-tiered I–880 in Oakland, California.

On 18 October, after visiting the collapsed Cypress Street Viaduct, Colonel LeCuyer contacted Robert K. Best, the director of CALTRANS, to offer help in the cleanup and removal of the structure. At the request of CALTRANS, on 19 October, Sacramento District officials provided a general

plan for the work. A forensic engineering study was to be included, presumably to be conducted by or at the direction of CALTRANS. Best favored the forensic study because it would:

- Establish the facts concerning the standards by which the bridge was designed, constructed, and retrofitted.
- Document the damage and establish how the structure failed.
- Determine the performance of existing seismic restrainers.
- Determine the condition and performance of the footings and piles.
- Provide new knowledge concerning details and materials for use in future seismic retrofit projects.[101]

CALTRANS officials asked the Sacramento District to contract with an expert engineering firm to conduct a detailed study. The Corps had to move quickly before the entire viaduct was demolished.[102] On 26 October, Best asked General Sobke to proceed with the selection of the consultant engineers for the forensic engineering study. Sobke realized that such a study could put the Corps in the position of criticizing CALTRANS and the engineers who had constructed the freeway, and he knew that others were already making assessments. When General Hatch visited the area on 26 October, Sobke asked him for guidance.

General Hatch informed General Sobke that the forensic study mission was not appropriate for the Corps of Engineers. The Department of Transportation's Federal Highway Administration had the principal oversight and funding authority to conduct the proposed forensic analysis and the Corps would defer to it. Moreover, a congressional committee had asked the National Institute of Standards and Technology to study the I–880 collapse. Additional studies were under way at the state level, including Governor Dukemejian's Blue Ribbon Commission, and Corps officials wanted to avoid any duplication of effort. The issue of the I–880 collapse was controversial and sensitive, and General Hatch did not want the Corps to put itself in the position of criticizing the work of other engineers.[103]

Although the Corps declined the forensic study mission, the Sacramento District sent four people to the site to create a record of the failed structure for future reference. Between 20 and 23 October, they took hundreds of photographs and recorded hours of videotape of the structure, which they later turned over to the state. The district also developed a contingency plan for demolishing the failed sections and contacted other districts to identify personnel and companies with heavy-lift experience and equipment. District officials pulled the team off the site with 75 percent of their documentation effort complete, and the structure was demolished soon after. The technical information that the district compiled proved to be a very valuable resource for post-earthquake response studies.[104]

Besides the request for a forensic study, on 20 October, CALTRANS asked the Corps to help clean up the Cypress Street Viaduct. CALTRANS could handle the removal of debris, but it needed the Corps' help in obtaining a disposal site for the estimated 60,000 cubic yards (120,000 tons) of heavily reinforced concrete to be removed from the collapsed structure.[105]

On 25 October, the Sacramento District and the South Pacific Division representatives met with CALTRANS and others to discuss potential ocean disposal sites. Corps personnel explained that because the I–880 rubble was not dredge or fill material, the Corps had no permit authority for disposal beyond the three-mile limit. The Corps tried to locate a site acceptable to the federal agencies involved in the approval process. After evaluating various alternatives, they identified a deep-water site roughly 30 nautical miles west of the Golden Gate Bridge as the most feasible.

Corps officials also explained that to expedite the disposal of rubble, CALTRANS needed to obtain an exception to the Ocean Dumping Act. The basis was to allow the placement of materials at this site to enhance the development of fisheries resources. Under the applicable regulations, the National Oceanographic and Atmospheric Administration (NOAA), the U.S. Coast Guard, the Environmental Protection Agency, and the Corps of Engineers had to concur before the site was used.[106] The Environmental Protection Agency gave the site

preliminary approval as a "fisheries resources site" and obtained the necessary concurrence from the U.S. Coast Guard and the Corps. However, NOAA's approval was stalled because of objections from commercial fishing interests.

Another potential site, about six miles out and known as the "BART site," was also proposed, but with a caveat that time-consuming coordination with numerous agencies was required. An upland disposal alternative, which the port and CALTRANS had been discussing, was mentioned. The Corps representatives cautioned that portions of the Oakland airport could not be used due to wetlands classification. On 30 October, Colonel LaCuyer provided CALTRANS with a report identifying various aquatic and upland disposal sites.[107]

Besides work for CALTRANS, the Corps also provided support to the Port of Oakland. The Oakland airport, owned and operated by the Port of Oakland, suffered $30 million in damage. It had to be repaired immediately to handle the increasing demands resulting from the earthquake. The major damage was to its 10,000-foot air-carrier runway and parallel taxiway. Massive cracks in both had taken a third of the taxiway and runway out of service. In addition, the dike along the eastern side of the runway that held back the bay waters had been damaged significantly.

The failure of the Bay Bridge and the I–880 section had greatly increased the demands on the Oakland airport. Several air carriers announced plans to increase the number of flights into Oakland because of limited access to the San Francisco airport. The Oakland airport was also one of the nation's largest aircraft maintenance facilities. Military Air Command flights between the United States and Korea, Japan, and the Philippines could not operate from Oakland without the repairs.[108]

The Port of Oakland's maritime facilities also suffered $75 million in damage; $50 million of this was to the port's Seventh Street Marine Terminals, constructed in the 1960s. Because the 75-acre Seventh Street Public Container Terminal was inoperable, the port was losing an important source of revenue. The other $25 million in damages occurred throughout the port area and included subsidence damage to utilities, wharves, and other harbor structures.

The port facilities were particularly critical in the wake of the earthquake. After the closing of the Bay Bridge, the major transportation link between East Bay and San Francisco, a passenger ferry system had been established at the port. The port was a major export facility for California Central Valley agricultural products as well as cargoes from the inland areas of the United States destined for the Pacific Basin. It was also important for national defense. Portions of the port's Outer Harbor Terminal were located on waterfront property leased from the U.S. Army. The port's rent payments were used for rehabilitating the Army's wharf facilities. Federal legislation authorized such leasing arrangements to assure that the U.S. military services could maintain adequate shipping facilities at minimal cost to taxpayers.[109]

At the request of the Port of Oakland, the Sacramento District inspected the port and Oakland airport and prepared preliminary damage assessments. The district was tasked with doing the preliminary damage assessment only, and by 24 October, it had 20 inspectors at work. The San Francisco District would perform a disaster survey report with assistance from the Sacramento District if necessary. Port of Oakland authorities estimated the damage to be $108 million, including damage to the Oakland airport. The Federal Aviation Administration delivered $8 million of $17 million in emergency funding for the airport on 27 October.[110]

Occasionally, work for others took the form of technical assistance. The U.S. Department of Education, for example, asked the Corps to survey damage to school districts in the declared counties. The Corps also wrote disaster survey reports for San Francisco International Airport for the Federal Aviation Administration. The Los Angeles District structural engineers helped the General Services Administration inspect federal facilities in San Francisco. Engineers were also assigned to the Presidio and Oakland Army Base to help with damage assessments. The Small Business Administration tasked the Corps to provide eight people to verify damages beginning 4 January 1990.[111]

Other Corps Activities

Besides work for FEMA and other agencies, the Corps repaired levees on the San Lorenzo and Pajaro rivers. The San Lorenzo River carries runoff from the Santa Cruz Mountains through the city of Santa Cruz into the Pacific Ocean. In 1955, the Corps had improved a floodway channel and constructed levees along the banks of the San Lorenzo River to manage periodic floods. The earthquake severely damaged the levees and floodway, and with the rainy season fast approaching, Santa Cruz faced the threat of a major flood.[112]

On 19 October, a San Francisco District inspection team observed significant cracking, sloughing, and lowering of levee crests along several reaches of both projects, and damage to project gravity and pump station drainage structures that could fail completely with normal winter flow conditions. Corps inspectors found several cracks, about 1,200 to 1,500 feet long and 2 feet deep, in the levee on the San Lorenzo River. They completed their inspection on 21 October.[113]

Because of the urgent need for repair before the winter rains, General Sobke sought an exception to the requirement that the California governor specifically request assistance. He asked HQUSACE to give him the authority to approve the two projects. Sobke estimated that the Pajaro River would require 4,200 feet of levee construction at a cost of $1 million and the San Lorenzo River would require 4,200 feet of levee construction at a cost of $2 million.[114]

Public Law 84–99, *Flood Control and Coastal Storm Emergencies*, authorized the Corps of Engineers to repair only those federal and nonfederal flood control projects that had been damaged by floods, hurricanes, or coastal storms. If an "imminent danger" of flooding existed, the Corps could act to alleviate the threat to public health and safety. But this authority would be considered only after a request from the state governor confronted with the threat of flooding. The South Pacific Division requested authority under P.L. 84–99 to repair the levees.

A Corps inspector measures a fracture in the Pajaro River levee.

The fact that the Corps had constructed the levees initially made it easier to justify its involvement. After being built, both projects had been turned over to local residents for operation and maintenance. Corps officials reasoned that the Corps design had failed because the damaged levees no longer provided adequate flood protection for Santa Cruz and Watsonville. In addition, late October marked the beginning of the flood season.[115]

Within hours, HQUSACE approved the South Pacific Division's request. In his letter authorizing the South Pacific Division to proceed with repair of the levees, John Elmore increased the South Pacific Division commander's authority for approving flood control projects damaged by earthquake from $500,000 to $3 million.[116]

The division quickly established a resident office staffed by personnel from San Francisco and other districts. Within two weeks, Corps personnel prepared plans, specifications, and bidding packages. On 28 October, the Corps awarded Granite Construction a $1.44 million contract for work on the San Lorenzo River project; on 31 October, the Corps awarded the company a $1.35 million contract for the Pajaro River project. The projects consisted of 20.5 miles of earthen levee along the Pajaro River and 42 miles of earthen levee on the tributary Corralitos Creek. The Corps estimated that 9,530 feet of levee on the Pajaro River and 4,530 feet of levee on the San Lorenzo River required repair.[117]

By November, it became clear that the estimated $3 million cost of repairs to the San Lorenzo levees would be exceeded. The cost estimates at that time were $1.75 million for the San Lorenzo repairs and $1.84 million for the Pajaro repairs. As the work progressed, crews discovered additional damage that added to the cost. Furthermore, large overruns had occurred in the import fill requirements at both projects because the material was shrinking 20 to 30 percent. Colonel Yanagihara requested $3.58 million to complete the repairs.[118] Elmore increased the commander's delegated authority from $3 million to $3.6 million.[119]

By 15 December, contractors had rebuilt 5,200 feet of levee at 8 locations along the San Lorenzo River; by 11 December, they had repaired 12,000 feet of levee at 49 locations along the Pajaro River.[120]

Chief of Engineers LTG Henry Hatch and Corps inspectors examine the San Lorenzo River levee damage.

Another significant activity was the Corps' first-time involvement on a hazard mitigation team (HMT). Hazard mitigation, a process to reduce or eliminate threats to life and property, grew out of Sections 409 (Hazard Mitigation Planning) and 404 (Hazard Mitigation Grant Program) of the Disaster Relief Act of 1974 (Public Law 93–288; 42 U.S.C. 5121–5202). On 25 October, Tommie Hamner invited the Corps to participate in a hazard mitigation team that FEMA had created to develop strategies and recommend measures to reduce or eliminate future earthquake damage in California.[121] The team met from 31 October to 2 November at the disaster field office in Sunnyvale. Attendees included representatives from federal agencies on FEMA Region IX's Regional Interagency Steering Committee (RISC) and from the principal agencies of the National Earthquake Hazards Reduction Program (NEHRP), with the exception of the National Science Foundation.

The Corps had nine representatives on the hazard mitigation team: Robert Edmisten and Paul Komoroske, emergency management specialists from the South Pacific Division and

the Seattle District respectively; Dr. Gus Franklin, a geotechnical expert from WES; Dr. Robert Hall, a structural specialist from WES; David Sills and Jack Hurdle, emergency managers from the Lower Mississippi Valley Division and the Memphis District; Dr. Surya Bhamidipaty, a hydraulics specialist from the South Pacific Division; Chuck Perry, a geotechnical specialist from the Seattle District; and Greg Hempen, a geophysicist from the St. Louis District.[122]

In its final report, the team made roughly 60 recommendations in such areas as hazard identification and monitoring, repair, and construction. It also addressed the need to identify and pre-position federal, state, and local resources to mobilize immediately for a disaster. The report observed that current federal law prevented major federal participants, such as the Department of Defense, from mobilizing immediately.[123]

Conclusion

In the first days after the earthquake, the decision not to implement the Plan for Federal Response to a Catastrophic Earthquake caused confusion among the agencies involved and hampered the response. Agencies found themselves without an adequate plan to cover a less-than-catastrophic event. If implemented, the federal response plan would have forced FEMA, the California Office of Emergency Services, and other agencies to collocate. Instead FEMA needed several days to bring the various state and federal agencies together at the disaster field office. Meanwhile, Sixth Army staff had difficulty locating and contacting the offices with which they needed to work. Current plans did not provide well for the immediate response phase. Rather, FEMA's authority was primarily geared to a well-organized recovery process that involved receiving applications, sending out inspectors, evaluating inspection reports, and reimbursing local claimants. Without activating the federal response plan, FEMA had difficulty mobilizing federal resources.[124]

The General Accounting Office (GAO) confirmed this problem when it conducted an audit between October 1989 and September 1990. GAO concluded that, as with Hurricane Hugo, the Loma Prieta response was hampered by staffing and coordination problems between agencies at all levels. Assistance was delayed in some cases because FEMA was not authorized to assume the state's role as immediate responder. According to GAO, legislation might be needed giving FEMA such authority.[125]

While GAO conducted its investigation, the Office of Management and Budget (OMB) tasked FEMA to evaluate its responses to Hurricane Hugo and the Loma Prieta earthquake and to identify weaknesses, strengths, and lessons learned. FEMA formed a task force to obtain comments and prepare a report for OMB. On 25 January 1990, FEMA held a meeting in Sunnyvale, California, that included representatives of the Corps of Engineers and the other federal and state

agencies that had participated in the response. One major theme was the need to execute the federal plan for near-catastrophic events.[126]

The consensus was that besides flaws in the current plans, the cost-sharing requirements hampered recovery. Because of cost sharing, state officials were reluctant to ask federal agencies for assistance. For example, with the public assistance program, FEMA paid 75 percent of the damage costs; individual cities, towns, and municipalities paid the remaining 25 percent. The state reimbursed the localities for 75 percent of their 25 percent, so they ultimately paid only 6 percent. FEMA had to get the state to agree to share the costs before it could task the Corps or other agencies to do work. One Corps official complained that initially the state often had slowed the response. The Corps would have responded faster, he observed, if it had not had to wait for state coordination.[127]

Frustrated Sixth Army and Corps officials pointed out that they had tremendous capabilities for providing relief, but any actions had to be requested by the state and approved by FEMA. One Sixth Army official observed that they received few requests for help in a disaster because city and state governments were reluctant to pay when they could perform the mission themselves or use the National Guard. Negotiations on cost sharing are appropriate in the recovery phase, argued one Corps official, but not in the initial response phase where the focus is on eliminating human suffering. The response phase, he added, should not be hampered in any way by administrative procedures or policies.[128]

The Loma Prieta response highlighted the need for federal and state agencies not only to have adequate plans, but also to test those plans on a regular basis. In July 1989, the South Pacific Division, anxious to establish itself as the Corps' earthquake center of expertise, had sponsored a Tactical Command Readiness Exercise in Sacramento. Along with representatives of 25 federal, state, and local agencies (including FEMA and the California Office of Emergency Services), the division conducted this exercise to sharpen earthquake response expertise. Sobke observed that the division's "overall preparation went a long way toward helping us respond to this event."[129]

In August 1989, FEMA had conducted a "Response '89" exercise to test its catastrophic earthquake plan. Federal and state officials observed that this exercise improved the Loma Prieta response. Sixth Army and Corps district and division officials specifically benefitted from the exercise. The collapse of the Bay Bridge and elevated roadways, the fires and drop in water pressure, and the interruption of services had all been addressed in simulation. The August exercise, however, also revealed problems. Unfortunately, the report identifying these problems was not released until after the Loma Prieta earthquake.[130]

Besides the need to develop and exercise adequate plans, Loma Prieta dramatized the need for flexibility. The Corps of Engineers responded quickly and effectively in part because of the flexibility of its organization. The Corps is structured so that if a district or division is temporarily unable to respond, personnel from another district or division can move in rapidly and establish command and control to achieve what General Sobke called the "same professional results."[131] Sacramento District officials immediately assumed communications and reporting functions. The South Pacific Division and the San Francisco District officials were able to resume operations at the Presidio without delay or confusion. Moreover, General Sobke and his staff created an innovative, effective three-cell organization at the disaster field office that made the Corps more responsive to FEMA's requests. They created a structure for individual assistance and public assistance missions that could quickly absorb Corps personnel from across the country.

Hundreds of Corps employees from throughout the field responded when the call went out for assistance, giving new meaning to the motto, "The Corps Cares." The Corps' response was even more impressive given the fact that some of its personnel were still dealing with Hurricane Hugo.

At a 2 November 1989 ceremony on the parade grounds at the Presidio, the commanding general of Sixth Army, Lieutenant General Baxter; General Sobke; and San Francisco mayor, Art Agnos, recognized 11 Corps personnel for their contributions. The Santa Cruz director of public works, Larry L. Erwin, expressed gratitude for the Corps' prompt action in addressing the damage to the city's flood control

project: "The fact that the Corps had a survey team in our city one day after the October 17, 1989, earthquake is truly amazing."[132]

Assistant Secretary of the Army (Civil Works) Robert W. Page congratulated the Corps for its "outstanding efforts" during Hurricane Hugo and the California earthquake: "The Army Corps of Engineers distinguished itself as a unique national asset ready to serve the nation in a variety of ways." On 6 December, General Hatch presented Meritorious Service Medals to four Sacramento District military officers and Commander's Awards for Civilian Service to 14 Sacramento District employees, calling the response "absolutely magnificent." A few weeks later, he commended Corps members for responding to the challenges of Hurricane Hugo and the Loma Prieta earthquake. "I know of no other organization, in government or out," he concluded, "that could have done what we did."[133]

The earthquake experience gave the Corps the opportunity to demonstrate its capabilities and perform new missions, and the Corps performed well. Yet the earthquake also raised important questions that the Corps must resolve for the future.

- If FEMA offers the Corps the individual assistance mission again, should the Corps accept it?
- Should the Corps put itself in the position of delivering assistance checks?
- How can the Corps expedite its authority, approval, and funding processes?
- Should the Corps develop and maintain a database that lists the names of Corps personnel who could be called on in future disasters based on their areas of expertise?
- Should it train a cadre of Corps personnel to respond to emergencies?
- Should the Corps purchase emergency equipment and store it until needed?
- On a more philosophical level, who is the Corps' customer: the tasking agency (such as FEMA) or the disaster victim?

- What criteria should the Corps use to measure its success when it responds to an earthquake or other domestic emergency?

A tendency exists to cut back on training, exercises, personnel, and other resources for emergency operations, particularly in times of tight budgets when other needs seem more pressing. The South Pacific Division had resisted that attitude because of its location in a geologically fragile part of the world. But General Sobke cautioned, other divisions also need to be prepared.[134]

Though costly and destructive, the Loma Prieta earthquake was not the large earthquake that had been predicted in California. The damage was confined to certain well defined areas, and most power and communications systems were restored quickly. If the damage had been widespread, the Corps districts and the division would have had greater difficulty providing for their own personnel and for the hundreds of inspectors who converged on the bay area. Corps officials easily reestablished themselves at the Presidio, but what if that facility had been unavailable? In a more catastrophic event, district and division commanders would have been more challenged in balancing the need to reconstitute their commands with the need to respond to requests for assistance.

Serious earthquake threats exist throughout the nation. According to FEMA, 44 states have seismic risk areas and 13 heavily populated areas are in high-risk locations. Earthquake threats exist not only in California and Alaska but also along the New Madrid Fault that encompasses seven states in the midsection of the country. Severe earthquakes struck there in 1811 and 1812. The Corps of Engineers must be prepared to respond as aggressively and effectively in the future as it did in California.

Notes

Initial Response

[1]*San Francisco Chronicle*, 26 October 1989, section B, p. 6.

[2]Alexander G. Tarics, "Earthquakes and Our National Defense," *The Military Engineer*, March/April 1990, vol. 83, no. 534, p. 31; Sacramento District, *Public Affairs Report.*

[3]U.S. Army Corps of Engineers South Pacific Division, *After Action Report—Corps of Engineers Response to the Loma Prieta Earthquake*, December 1990, p. 6. (Hereafter cited as SPD *After Action Report.*)

[4]*The New York Times*, 19 October 1989, section B, p. 15.

[5]General Accounting Office, "Disaster Assistance: Federal, State, and Local Responses to Natural Disasters Need Improvement," March 1991, p. 4. (Hereafter cited as GAO Report.)

[6]*The New York Times*, 19 October 1989, section B, p. 16; FEMA Situation Report (SITREP), 19 October 1989, 6:00 A.M.; interview with Edward Hecker, SPD, San Francisco, CA, 25 January 1990. All interviews cited herein were conducted by the author.

[7]Memorandum, R. Gregg Chappell, Deputy Chair, Catastrophic Disaster Group, 19 October 1989, HQUSACE EOC #401.

[8]*San Francisco Chronicle*, 26 October 1989, section B, p. 5; *The New York Times*, 19 October 1989, section B, p. 16.

[9]FEMA SITREP, 19 October 1989, 6:00 A.M.; memorandum, Deborah Hart, Chief, Program Coordination, Disaster Assistance Programs (FEMA) to Department of Agriculture, Corps of Engineers, and others, 18 October 1989, HQUSACE EOC #50; FEMA SITREP, 27 October 1989.

Department of Defense Response

[10]Message 180715Z, Director of Military Support to Joint Chiefs of Staff, J–3, 18 October 1989, HQUSACE EOC #58;

DOMS Information Memorandum #1, 19 October 1989, SPD EOC #2.

[11]DOMS Information Memorandum #1.

[12]Interview with MG Todd P. Graham, Deputy Commander, Sixth Army, Presidio, San Francisco, CA, 25 January 1990, pp. 1–2; interview with COL Albert E. Carlson, Deputy Chief of Staff for Operations, Sixth Army, Presidio, 26 January 1990, p. 2; Carlson, Memorandum for Commander, U.S. Army Forces Command, 18 October 1989.

[13]Carlson interview, pp. 2–5.

[14]DOMS Information Memorandum #6, 25 October 1989, SPD EOC #276; DOMS Information Memorandum #7, 26 October 1989, SPD EOC #300; Carlson interview, pp. 9–10, 39; DOMS Information Memorandum #9, 30 October 1989, SPD EOC #351.

[15]DOMS Information Memorandum #1.

[16]DOMS Information Memorandum #2, 20 October 1989 SPD EOC #132; DOMS Information Memorandum #4, 23 October 1989; DOMS Information Memorandum #5, 24 October 1989, SPD EOC #268; and DOMS Information Memorandum #6.

[17]DOMS Information Memorandum #4; DOMS Information Memorandum #8, 27 October 1989, SPD EOC #323.

[18]DOMS Information Memorandum #4; DOMS Information Memorandum #9; DOMS Information Memorandum #16, 7 December 1989, HQUSACE EOC #454.

[19]*National Guard,* February 1990, vol. 44, no. 2, pp. 28–29; DOMS Information Memorandum #1.

[20]DOMS Information Memorandum #3, 21 October 1989, SPD EOC #160; DOMS Information Memorandum #4.

Corps of Engineers Early Response

[21]Leland R. Johnson, "Emergency Response: A History of the Army Engineer Disaster Relief Mission, 1794–1950," chapter 4, pp. 13, 15, 19, 21, 24, 25, Research Collections of the Office of History, Fort Belvoir, VA, Box VIII, file 17–A.

[22]Interview with LTC William T. Coffey, Deputy Commander, San Francisco District (SPN), San Francisco, CA, 23 January 1990, pp. 2–3.

[23]Ibid., p. 4; interview with Richard Young, SPD, San Francisco, CA, 7 November 1989; *Engineer Update*, vol. 13, no. 12, December 1989.

[24]Hecker interview, pp. 3–4.

[25]Ibid., pp. 5–6, 17; SPD *After Action Report*, p. 13; message, SPD Division Engineer to Sacramento, San Francisco, and Los Angeles District Engineers, 23 October 1989, HQ-USACE EOC #247; interview with COL Dennis K. Culp, Deputy Commander, SPD, San Francisco, CA, 18 April 1990, pp. 2, 3; Sacramento District (SPK) SITREP #3, 18 October 1989; interview with BG(P) John Sobke, Commander, SPD, San Francisco, CA, 6 November 1989, p. 20; interview with Dave Fulton, Chief of Construction–Operations Division, SPD, 24 January 1990, p. 5.

[26]SPK, *Public Affairs Report*, March 1990, pp. 3–4; SPK phone log, 17 and 18 October 1989.

[27]Sobke interview, p. 1; SPK, *Public Affairs Report*, p. 5.

[28]Sobke interview, pp. 1–3, 5.

[29]Coffey interview, pp. 4–5; message, SPD Division Engineer to Sacramento, San Francisco, and Los Angeles District Engineers, 23 October 1989; Sobke interview, p. 4; SPD/SPN Staff Journal/Log, 17 October 1989; Hecker interview, p. 9; SPD *After Action Report*, p. 3.

[30]Carlson interview, pp. 22–24; Hecker interview, p. 9; Graham interview, p. 12; Fulton interview, p. 4; Sobke interview, p. 6.

[31]Coffey interview, pp. 8–9; Fulton interview, p. 4.

[32]Coffey interview, pp. 6–7, 9–11; message, SPD-DE to SPK-DE, SPN-DE, and (Los Angeles District) SPL-DE, 23 October 1989.

[33]SPK SITREP #1, 17 October 1989; #3, 18 October 1989; #5, 18 October 1989; *Engineer Update*, vol. 13, no. 11, November 1989, p. 1.

[34]Sobke interview, p. 6; SPD/SPN Staff Journal/Log, 18 October 1989; Sobke, Memorandum for Record, 18 October 1989, SPD EOC #62.

[35]Sobke interview, p. 5; SPD/SPN Staff Journal/Log, 18 October 1989.

[36]HQUSACE, Emergency Operations Center phone log, MAJ Webb, Engineering and Housing Support Center, to Captain Carpenter, 18 October 1989.

[37]Message, Commander, USACE, to SPD, 18 October 1989, HQUSACE EOC #52; message, Commander, USACE, to Commander, SPD, n.d., HQUSACE EOC #63; SPL Operations Log, 18 October 1989, 4:08 P.M.

Organizational Structure

[38]SPD *After Action Report*, p. 19.

[39]Fulton interview, p. 7; Sobke interview, p. 7; SPK phone log, Sobke to COL LeCuyer, 18 October 1989, 9:30 A.M.; and 11:05 A.M.; message, SPD to SPK, SPN, and SPL, 20 October 1989.

[40]Coffey interview, p. 15.

[41]Hecker interview, p. 34; interview with Mike Grebinski, SPD, DFO, Sunnyvale, CA, 7 November 1989, pp. 4–6.

[42]Sobke interview, p. 12; Grebinski interview, pp. 4–7; SPD *After Action Report*, p. 19.

[43]Message, SPD-DE to SPK-DE, SPN-DE and SPL-DE, 23 October 1989.

[44]Culp interview, pp. 4, 8; Fulton interview, p. 10.

[45]Sobke interview, p. 11; Grebinski interview, p. 14; Culp interview, pp. 4–7.

[46]Culp interview, pp. 8, 11.

[47]Hecker interview, p. 43; Grebinski interview, pp. 10, 15.

[48]Hecker interview, pp. 44–45, 47; Fulton interview, p. 11.

Preliminary Damage Assessment

[49]Robert L. Vickers, Regional Director, FEMA Region IX, to BG(P) John Sobke, 18 October 1989, HQUSACE EOC #202.

[50]Sobke interview, pp. 7, 32; "Bay Breeze," SPD Special Earthquake '89 Issue, p. 6; *Engineer Update*, vol. 13, no. 11, November 1989, p. 1.

Individual Assistance Mission

[51]FEMA SITREP, 22 October 1989.

[52]Tommie Hamner to Sobke, 22 October 1989, Mission Assignment Letter (MAL) R-COE-SPD-4, SPD EOC #253; Culp interview, pp. 17–18.

[53]Gary Campbell notes, 20 October 1990; interview with LTC Timothy P. Mason, Deputy Commander, SPK, DFO, Sunnyvale, CA, 8 November 1989; Culp interview, p. 10; Hecker interview, p. 36.

[54]Message, HQUSACE Emergency Operations Center, 20 October 1989, 9:51 P.M., SPD EOC #89; Fulton interview, p. 18.

[55]LTG Henry Hatch to all Division Commanders, 21 October 1989, HQUSACE EOC #186; SPD Emergency Operations, Memorandum for all USACE Divisions, 21 October 1989, HQUSACE EOC #208.

[56]SPK, *Public Affairs Review*, March 1990, p. 8; Mason interview, pp. 2–3.

[57]*San Francisco Chronicle*, 26 October 1989, section B, p. 5; FEMA SITREP, 27 October 1989.

[58]Mason interview, pp. 1–5.

[59]SPK *Public Affairs Review*, p. 10; interview with Gene Dretke, DFO, Sunnyvale, CA, 8 November 1989, p. 5; Hecker interview, p. 37; Fulton interview, p. 22; interview with Bruce Baughman, FEMA, Washington, DC, 9 February 1990; SPD Emergency Operations, Memorandum for all USACE Divisions, 30 October 1989, SPD EOC #352.

[60]Dretke interview, p. 28; interview with CPT Charles A. Rimbach, Marina Area Office, San Francisco, CA, 7 November 1989, pp. 3–5.

[61]Rimbach interview, pp. 4–5; Dretke interview, pp. 7, 14.

[62]Dretke interview, pp. 6–7; Rimbach interview, p. 10; Mason interview, pp. 6, 20; Culp interview, p. 14.

[63]Mason interview, pp. 6, 11, 20; Dretke interview, pp. 6–7.

[64]Dretke interview, p. 9; Mason interview, p. 17.

[65]Mason interview, pp. 18–19, 22.

[66]Dretke interview, pp. 9–10, 14; Mason interview, p. 23; Culp interview, pp. 15–16.

[67]Mason interview, p. 9; Hecker interview, p. 39; Culp interview, p. 20.

[68]Dretke interview, pp. 15–16; Rimbach interview, p. 19.

[69]SPK *Public Affairs Review*, p. 13; Dretke interview, p. 26.

[70]Rimbach interview, pp. 4–5; Dretke interview, pp. 17–18; Culp interview, p. 16; Fulton interview, p. 19.

[71]*Crosscurrents* (St. Paul District), vol. 12, no. 12, December 1989, p. 5; GAO Report, pp. 48–49.

[72]SPD After Action Report, p. 29; *Engineer Update*, vol. 13, no. 11, November 1989.

[73]SPK, *Public Affairs Review*, pp. 12, 21.

Public Assistance Mission

[74]"Public Assistance Program," n.d., SPD.

[75]Tommie Hamner to Sobke, 15 January 1990, MAL R-COE-SPD-2 Supplement 2, SPD.

[76]Coffey interview, pp. 23–24; Culp interview, p. 23.

[77]Culp interview, pp. 25–26.

[78]Baughman interview.

[79]Memorandum for Record, SPD Emergency Operations, 22 October 1989, SPD EOC #228.

[80]FEMA SITREP, 22 October 1989; Coffey interview, pp. 19–20; Baughman interview.

[81]SPD *After Action Report,* p. 26.

[82]Coffey interview, pp. 27–29; Culp interview, p. 26.

[83]Memorandum of Agreement between FEMA and Department of the Army, 28 June 1988; see also J. Robert Edmisten, Memorandum for Record, 13 September 1988; Baughman interview; Coffey interview, p. 36.

[84]Culp interview, pp. 21–22; Baughman interview; Coffey interview, p. 39.

[85]Coffey interview, p. 32; Baughman interview.

[86]Coffey interview, pp. 33–34; Baughman interview.

[87]Coffey interview, pp. 46, 48, 55.

[88]Culp interview, p. 20; Coffey interview, p. 49; Hecker interview, p. 41.

[89]Coffey interview, pp. 49–52.

Direct Federal Assistance

[90]Vickers to Sobke, 18 October 1989, MAL R-COE-SPD-3; Hamner to Sobke, 22 October 1989, MAL R-COE-SPD-3, SPD EOC #302; Hamner to Sobke, 2 November 1989, MAL R-COE-SPD-3 Amendment 1, SPD; Hecker, Memorandum for Record, Meeting with FEMA Public Assistance Staff, 22 October 1989, SPD EOC #228.

[91]Message, SPD Emergency Operations to SPN Emergency Operations, 21 October 1989, SPD; message, SPD Emergency Operations to SPN Emergency Operations, 23 October 1989, SPD; message, SPD Emergency Operations to SPN Emergency Operations, 2 November 1989; SPN SITREP #23, 9 November 1989.

[92]SPD *After Action Report,* pp. 26, 28.

[93]Memorandum, Sobke to SPK, SPL, and SPN, 21 November 1989, HQUSACE EOC #478; SPD *After Action Report,* p. 28.

Technical Assistance

[94]Message, SPD to SPK, 21 October 1989, SPD; Rick Britzman and Michael Rutherford, Memorandum for File, 25 October 1989, SPD; Hecker, Memorandum for Record, 22 October 1989.

[95]Hamner to Sobke, 2 November 1989, MAL R-COE-SPD-5; Hamner to Sobke, 7 December 1989, MAL R-COE-SPD-5 Supplement 2; SPD *After Action Report,* p. 31.

[96]"Geologic Hazards Investigation, County of Santa Cruz, California," Disaster Field Office SITREP #39 for Engineer Support Function #3, 11 December 1989, HQUSACE EOC #439.

[97]HQUSACE, Daily Staff Journal.

[98]"Geologic Hazards Investigation," 11 December 1989.

[99]SPD *After Action Report,* pp. 29–31; Tasker, FEMA to Corps of Engineers, SPD EOC #426; LTC William T. Coffey to Fred Keeley, 5 January 1990 SPD.

[100]"Geologic Hazards Investigation," 11 December 1989.

Work for Others

[101]Robert K. Best to Sobke, 26 October 1989, SPD; Lewis A. Whitney, Chief, Engineering Division, Memorandum for Record (MFR), 20 October 1989, SPD.

[102]Best to Sobke, 26 October 1989; Whitney MFR.

[103]Sobke interview, pp. 33–34; Sobke to Best, 31 October 1989, SPD EOC #371.

[104]SPK, *Public Affairs Review,* March 1990, p. 7; SPD *After Action Report,* p. 33.

[105]Hecker interview, pp. 20–21; James E. Roberts, Chief, Division of Structures, CALTRANS to SPK, 20 October 1989.

[106]Daniel J. Dykstra, Jr., Assistant Division Counsel, Memorandum for Record, 25 October 1989, SPD EOC #269.

[107]Sobke to Bruce E. Cannon, Division Administrator, Department of Transportation, Federal Highway Administration, California Division, 2 November 1989, SPD EOC #484.

[108]"Earthquake Damage to Metropolitan Oakland International Airport," 17 October 1989, SPD EOC #143.

[109]"Earthquake Damage to Port of Oakland's Marine Terminal Facilities," 17 October 1989, SPD EOC #143.

[110]Message, SPD Emergency Operations to SPK District Engineer, 21 October 1989, SPD; SPD Emergency Operations to SPK and SPN Emergency Operations, 23 October 1989, SPD EOC #172; message, SPD Emergency Operations to SPK and SPN District Engineers, 30 October 1989, SPD EOC #398; SPD SITREP, 24 October 1989; FEMA SITREP, 24 October 1989.

[111]HQUSACE SITREP #3, 4 January 1990, HQUSACE EOC #480.

Other Corps Activities

[112]*APWA (American Public Works Association) Reporter*, February 1990.

[113]SPN SITREP #6, 20 October 1989, SPD EOC #152.

[114]Sobke, Memorandum for USACE Emergency Operations, 24 October 1989, SPD EOC.

[115]33 U.S.C. 203; Hecker interview, pp. 22, 26–27; Fulton interview, p. 20.

[116]John P. Elmore, Memorandum for SPD Construction–Operations Division, 25 October 1989, SPD EOC #234.

[117]*APWA Reporter*, February 1990; SPD *After Action Report,* p. 34.

[118]COL Galen H. Yanagihara, Memorandum for Commander, SPD, 14 November 1989, SPD EOC.

[119]Elmore, Memorandum for Commander, SPD, 16 November 1989, SPD EOC #565; SPD, Memorandum for Commander, USACE (Emergency Operations), 16 November 1989, SPD EOC #565.

[120]SPD *After Action Report,* p. 35.

[121]Memorandum, Hamner to Region IX, Regional Interagency Steering Committee (RISC), Principal Agencies, National Earthquake Hazards Reduction Program (NEHRP), Region IX, Hazard Mitigation Team (HMT), 25 October 1989.

[122]Attachment to Hamner memorandum, 25 October 1989, "Overview, Post Disaster Mitigation Process"; Robert Edmisten and Paul Komoroske, Memorandum for Record, 16 November 1989; Disaster Field Office, Corps, Executive Summary, 31 October 1989.

[123]GAO Report, p. 62.

Conclusion

[124]Carlson interview, pp. 17–18; Hecker interview, pp. 27, 33.

[125]GAO Report, p. 5.

[126]Grant C. Peterson, Associate Director, State and Local Programs and Support, FEMA, Memorandum for Catastrophic Disaster Response Group, n.d., HQUSACE EOC #453; Hamner to Sobke, 27 December 1989, SPD; Hecker, Memorandum for Record, 26 January 1990, SPD EOC.

[127]Hecker interview, p. 27.

[128]Graham interview, p. 4; SPK, *Public Affairs Review,* March 1990, p. 7; Hecker interview, pp. 29–30.

[129]Sobke interview, pp. 17–19.

[130]GAO Report, pp. 22, 30; Carlson interview, p. 45; *The New York Times,* 19 October 1989, section B, p. 15.

[131]Sobke interview, p. 26.

[132]SPK, *Public Affairs Review,* March 1990, p. 25; Larry L. Erwin to MG Patrick J. Kelly, 17 November 1989, HQUSACE EOC #482.

[133]LTG Hatch, Memorandum for See Distribution, 20 December 1989.

[134]Sobke interview, p. 36.

People Interviewed

Bruce Baughman	FEMA, Washington, DC, 9 February 1990
Colonel Albert E. Carlson	Deputy Chief of Staff for Operations, Sixth Army, 26 January 1990
Lieutenant Colonel William T. Coffey	Deputy Commander, San Francisco District, 23 January 1990
Colonel Dennis K. Culp	Deputy Commander, South Pacific Division, 18 April 1990
Gene Dretke	Disaster Field Office, Sunnyvale, CA, 8 November 1989
J. Robert Edmisten	South Pacific Division, 7 November 1989
Dave Fulton	Chief of Construction–Operations Division, South Pacific Division, 24 January 1990
Major General Todd P. Graham	Deputy Commander, Sixth Army, 25 January 1990
Mike Grebinski	Disaster Field Office, Sunnyvale, CA, 7 November 1989
Edward Hecker	Chief, Emergency Management Branch, South Pacific Division, 25 January 1990
Carl Kress	South Pacific Division, 26 January 1990
Lieutenant Colonel Timothy P. Mason	Deputy Commander, Sacramento District, 8 November 1989
Captain Charles A. Rimbach	Marina Area Office, San Francisco, CA, 7 November 1989
Brigadier General(P) John Sobke	Commander, South Pacific Division, 6 November 1989
Richard Young	South Pacific Division, 7 November 1989

Acronyms and Abbreviations

APWA	American Public Works Association
BART	Bay Area Rapid Transit
BG	Brigadier General
CALTRANS	California Department of Transportation
CDRG	Catastrophic Disaster Response Group
CIP	Cataloging in Publication
CRC	Crisis Response Cell
DAC	Disaster Application Center
DCO	Disaster Control Officer
DFO	Disaster Field Office
DOD	Department of Defense
DOMS	Directorate of Military Support
DSR	Damage Survey Report
EDT	Eastern Daylight Time
EHSC	Engineering and Housing Support Center
EOC	Emergency Operations Center
EP	Engineer Publication
EPA	Environmental Protection Agency
ESF	Emergency Support Function
EST	Eastern Standard Time
FAA	Federal Aviation Administration
FCO	Federal Coordinating Officer
FEMA	Federal Emergency Management Agency
FORSCOM	U.S. Army Forces Command
GAO	General Accounting Office
GSA	General Services Administration

HMT	Hazard Mitigation Team
HQUSACE	Headquarters, U.S. Army Corps of Engineers
IA	Individual Assistance
IDT	Indefinite Delivery Type
LTC	Lieutenant Colonel
MAL	Mission Assignment Letter
MFR	Memorandum for Record
MLLW	Mean Low Low Water
NEHRP	National Earthquake Hazards Reduction Program
NOAA	National Oceanographic and Atmospheric Administration
OES	[California State] Office of Emergency Services
OMB	Office of Management and Budget
PA	Public Assistance
PDA	Preliminary Damage Assessment
PDT	Pacific Daylight Time
RISC	Regional Interagency Steering Committee
SAD	South Atlantic Division
SBA	Small Business Administration
SITREP	Situation Report
SPD	South Pacific Division
SPK	Sacramento District
SPL	Los Angeles District
SPN	San Francisco District
TAG	Technical Advisory Group
USACE	US Army Corps of Engineers
VHF	Very High Frequency
WES	Waterways Experiment Station

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The Office of History has also published *The U.S. Army Corps of Engineers Response to the* Exxon Valdez *Oil Spill*, by Janet McDonnell. Copies are available from the publications depot.

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