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EARTHQUAKE RESPONSE: INTERGOVERNMENTAL  
STRUCTURE AND POLICY INNOVATION\*

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EARTHQUAKE RESPONSE:  
INTERGOVERNMENTAL STRUCTURE AND POLICY INNOVATION<sup>1</sup>

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The Northridge earthquake is the most costly, damaging earthquake in the history of the United States. Over 11,800 people received hospital treatment for earthquake-related injuries in the three-county area shaken by the quake--Los Angeles, Ventura, and Orange--and 57 people died. Approximately 114,039 structures were damaged by the quake, 14,500 receiving either a red or yellow tag<sup>4</sup> from building inspectors. These damaged structures contained over 100,000 housing units; 30,000 of which were vacated or had significant structural damage, and another 30,000 were deemed at risk of being removed from the building stock because of the expense of repairs (Comerio 1995). According to estimates from the Governor's Office of Emergency Services (OES) in January, 1996, approximately \$25 billion in losses due to damaged structures and their contents had occurred<sup>5</sup>. FEMA set aside over \$12 billion to be used for claims for all types of assistance to disaster victims and communities. As of December, 1995, 681,710 applications for state and federal assistance had been received, more than double the amount in any previous single U.S. disaster. The previous

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<sup>4</sup> A Red Tag indicates that a building is extremely hazardous and is unsafe for occupancy or entry; a Yellow Tag signifies that the structure is in a dangerous condition and that entry should be limited.

<sup>5</sup> This figure may continue to rise, however, since additional inspection of steel moment-frame resistant structures has continued throughout the past year.

record for applications was 304,369 following Hurricane Hugo which struck the Carolinas, Puerto Rico and the Virgin Islands in 1989.

In the United States, emergency response to and recovery from large-scale disasters is an intergovernmental effort, involving local, state, and federal government agencies' programs. Although local governments--cities and counties--have the initial responsibility for responding to and managing a disaster, they may request assistance from the state government when their own resources are insufficient to handle the problems produced by the disaster. Similarly, the state government may turn to the Federal government when they believe that the losses and damage caused by the disaster will exceed their capacity to assist the disaster-affected communities in responding to and recovering from the disaster. Only when a state requests and receives a Presidential declaration of disaster are Federal resources made available to the disaster area and its victims. The Northridge Earthquake which occurred on January 17, 1994 was a Federally-declared disaster.

As soon as the shaking stopped, communities in Los Angeles, Orange, and Ventura Counties immediately started to assess the impacts of the earthquake within their own jurisdictions, and started to respond to fires, lifeline outages, transportation disruption, search and rescue requests, security concerns, and emergency medical needs. Almost simultaneously, OES dispatched liaison representatives to each of the three counties' Emergency Operations Centers (EOCs), activated its regional EOC to begin to compile a list of resources needed by these communities and to facilitate their distribution, and began to assess damages and losses caused by the earthquake. It quickly became apparent that the State needed Federal resources because of the magnitude of losses (estimated at that early point to be over \$10 billion), and made a formal request for a Federal declaration. A Federal declaration was signed by President Clinton the same day as the earthquake, making financial assistance, personnel, and material resources available from the Federal government.

Several reports have been written that summarize the emergency response actions taken by local, State, and Federal agencies (cf, Hall 1994; Goltz 1994; Andrews 1994, 1995; Tierney 1994, 1995; FEMA 1994; USGS 1996; EQE 1994). Since that information has been well presented before, we will discuss the unanticipated problems that arose during the emergency and early relief phases of the earthquake and the innovative policies and programs that were devised to resolve those situations. These problems will be divided into two areas--damage assessment and housing issues.

## DAMAGE ASSESSMENT

### Traditional Damage Assessment

In the past, damage assessment for an earthquake has usually referred to the process of quickly surveilling the area affected by the disaster agent to identify the types of problems that are occurring, the likely number of deaths and injuries, and the extent of dollar loss to the built environment in order for affected local governments to assess the scope of the disaster and to determine their capacity to respond to the situation. If the demands exceed their capacity, they can then appeal to their state governments for additional resources, as communities and counties did following the Northridge earthquake. Damage assessment procedures are a very important part of most local governments' disaster response plans. Since the State of California felt it would need additional resources to assist the local governments respond to and recover from the Northridge earthquake, it also had to conduct a damage assessment of the entire affected area before applying to the Federal government for assistance. Similarly, states have incorporated damage assessment into their response plans.

The more quickly the initial damage assessment can be completed at each level of government, the more quickly resources can be deployed to help local governments in these extreme situations. Recently in large-scale disasters, coordinated state and Federal damage assessment teams have been assembled to facilitate this process, assuring that both levels of government have similar information upon which to base their assessments.

While this process is still very important, the Northridge earthquake illustrated how damage assessment processes are changing because of the new technologies that are being used to estimate losses.

### Loss Estimations

Several types of loss estimation methodologies exist (NAS 1989) to predict the extent of losses that are likely to result from some future earthquake. These methodologies use a scenario earthquake, often the most likely damaging earthquake that could strike a region. Most of the estimated losses are based on the effects of ground shaking to buildings and other structures. Some also include estimates of deaths and injuries according to the functions of the buildings damaged and the time of day of the scenario event. These estimates have been used to both enhance disaster response planning of local governments and to provide some general guidance for mitigation efforts.

At the time of the Northridge earthquake, the State of California had a new type of loss estimation procedure under development. These estimates would be generated immediately following a damaging earthquake, using actual seismicity data to model building and lifeline damage as well as estimate casualties in near real-time. Since this procedure, called the Early Post-Earthquake Damage Assessment Tool (EPEDAT) is GIS-based, it would estimate and graphically display expected intensity, damage, and injury patterns for the affected area<sup>6</sup>.

On the day of the earthquake, the contractor developing EPEDAT was able to provide the State with an initial intensity map for Los Angeles County within several hours. Using actual seismicity data from another pilot project, CUBE (the Caltech/USGS Broadcast of Earthquakes<sup>7</sup>), this intensity map was expected to provide the State with information to identify areas that were hardest hit in order to target emergency response efforts and resources.

Based on this map, a preliminary total damage estimate was produced on January 18 of \$15-17 billion. However, because the model was untested, the State felt the estimate was too narrow and expanded the estimate to \$15-30 billion in the preparation of its Preliminary Damage Assessment (PDA) for the Federal government. This was the first time that a PDA had been based on a model estimate rather than on field observations only (EQE 1994), providing more credible estimated losses than those produced by "back of the envelop" estimates. In other words, the enhanced model estimates were used in lieu of more traditional damage assessment procedures.

Within three days after the earthquake, EPEDAT estimates were developed for the number of victims that would have been killed, injured, or displaced by the earthquake. While the estimates of the numbers of people who would have been killed or injured were within the range projected but greatly exceeded the actual numbers, the number of displaced persons (those who sought emergency shelter due to damaged residences) turned out to be overly conservative (EQE 1994).

Within five days after the earthquake, a second intensity map was provided to the State. This map was a refinement of the earlier map and was based on zip code areas. This map was used to identify possible locations for the Disaster Application Centers (DACs), to identify areas for shelters based on probable high

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<sup>6</sup> For a fuller explanation of this methodology, see EQE 1995.

<sup>7</sup> For a fuller discussion of the use of CUBE in the Northridge earthquake, see USGS 1996.

numbers of people displaced from their damaged homes, and to "fast-track" the Disaster Housing Assistance Program (which will be discussed in the section on Housing Issues) (Goltz 1996).

By January 25, using revised models and additional available databases, a refined loss estimate of \$13-22 billion for Los Angeles and Ventura Counties was calculated (Goltz 1996). It is felt that this estimate is still too broad and the methodology needs to be refined to narrow it, making it more useful for decisionmakers.

### HOUSING ISSUES

Providing both emergency shelter and replacement housing became major issues for all local governments in both Los Angeles and Ventura Counties. Initially, over 100,000 people were believed to have evacuated their residences due to concerns about the safety of the structures. As of April, 1994, 88,000 people still had not returned to their damaged homes, 57,000 of whom were at that time living with friends or relatives in the area (Tierney 1995).

Providing emergency shelter was an especially difficult problem for the City of Los Angeles, where most of the displaced persons resided. Although the City began opening shelters by 10:00 a.m. on the day of the earthquake, the number of people needing shelter exceeded the City's ability to provide shelter by 13,000, a situation which remained for the next several days. By January 21, there were a sufficient number of shelters open to provide indoor housing for anyone that wanted to use the facilities. On January 23, 44 shelters in the City were serving 14,000 victims. The shelters remained open until February 19 (Canfield 1994).

Although establishing shelters and assisting victims find replacement housing was a part of the City of Los Angeles' disaster response plans, the Northridge earthquake produced three problematic situations that were dealt with in innovative ways.

#### Transitional Housing Centers and Reassurance Teams

One very well documented finding in the disaster literature is the relatively low use of formal shelters, most people relying on friends and relatives to provide at least temporary shelter following a disaster. However, when a disaster strikes a major urban area, the number of victims seeking emergency shelter rises. This was definitely the situation faced by the City of Los Angeles following the Northridge earthquake.

However, the City faced an additional problem, one which also arose following both the Whittier Narrows and Loma Prieta earthquakes. Many victims were reluctant to seek shelter indoors

(where all of the formal Red Cross shelters were), opting instead to remain outdoors. They feared that their homes or apartments were not safe to return to; and they also did not trust that the indoor shelters were safe places to take refuge in. As a consequence, most camped out in open spaces--parks, parking lots, recreational areas, or vacant lots--even though they did not have camping gear that would keep them out of the cold, rainy January weather.

Although the City had initially not wanted to encourage these informal camps, they began to distribute family-sized tents to those outside of the shelters on January 19, partly because of growing concern about the non-formally sheltered victims' health, many of whom were children. Locations of these "unofficial" shelters were documented and, in some of the larger camps, security, medical, and feeding assistance were also provided. Simultaneously, the City also began to establish formal refuge centers (or "tent cities" like those constructed after Hurricane Andrew) which were either adjacent to a formal shelter or which were run by the Salvation Army. In this way, victims would have all available services and resources available to them in safer conditions. These two types of "transitional housing centers" eventually housed 14,000 victims.

Because the City still felt that victims' needs could be better met in the formal, indoor shelters than in the encampments, the City established "reassurance teams" to encourage people to either return home, go to the Red Cross-run indoor shelters, or go to "refuge centers." Beginning on the day after the earthquake, these teams began visiting every camp to talk with victims to try to overcome their fears. The teams were composed of building inspectors, Red Cross volunteers, housing department employees, members of the clergy, mental health workers, and translators (since many of those camping out were Spanish-speaking). If victims' concerns were about the safety of their residences, the inspectors with the teams often went immediately to the victims' home and did a structural safety inspection, often resulting in the inspector being able to reassure the victim that the home was safe to reoccupy. Largely because of the success of these teams, all of the transitional housing centers were closed without incident on February 10.

#### Establishing the Housing Task Force

The displacement of victims from their damaged homes was a serious problem, not just for Los Angeles but for all of the affected cities and counties. Acknowledging this problem, OES took the lead in establishing an intergovernmental Housing Task Force on January 20. The task force consisted of representatives from the City of Los Angeles, Los Angeles County, the Red Cross, the

California Department of Housing and Community Development, OES, FEMA, and HUD (the Federal government's Department of Housing and Urban Development). This was the first time in a major disaster that an intergovernmental, coordinated approach to housing needs had been used (Andrews 1994).

The task force had two main objectives: (1) to get people into the shelters and registered at the Disaster Application Centers, and (2) to get people out of the temporary shelters and into replacement housing (Tierney 1994).

Because of the sharing of information, the reassurance team concept was extended to other communities in Los Angeles and Ventura Counties that were also experiencing the establishment of informal camps of victims reluctant to enter shelters. Also, the City of Los Angeles had established a process of trying to match up victim families in need of temporary or replacement housing with landlords who had vacant rentals that were undamaged by coordinating with landlord associations and property management companies.<sup>8</sup>

Also, because of the Task Force, HUD began working closely with the City of Los Angeles to try to accommodate the low cost housing needs of poorer victims in need of replacement housing. Although HUD does not have any specific disaster-related programs, HUD was providing the City with more CDBG funds that they could use for enlarging their pool of Section 8 rent vouchers, and reissuing the vouchers that the City currently had for shorter periods of time, thus increasing the total number of vouchers available. Applicants must meet low income criteria to be eligible for Section 8 vouchers. They then pay 30% of their income for rent, with the remainder of the rent being paid by HUD. To be eligible for one of the disaster-specific vouchers, the applicant must certify that the unit they lived in was damaged; since the FEMA inspections for this program would take too long, the City streamlined the process to allow victims to "self-certify" initially to allow them to move more quickly into replacement housing (a formal inspection would then have to be done within a certain period of time). Eventually, this process was also used by the Housing Authorities in Santa Monica, Los Angeles County, and Ventura County to meet the housing needs of lower income victims.

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<sup>8</sup> Luckily, at the time of the quake, the City had a sufficiently high vacancy rate in the San Fernando Valley--about 30,000 units--to be able to relocate most victims in the same general area as their damaged home.



### Use of EPEDAT to "Fast-Track" Housing Program

One of the uses of the zip code-based shaking intensity maps produced by EPEDAT was to identify areas where damaged housing was more likely to have occurred during the Northridge earthquake. In fact, the intensity map became a major tool to streamline FEMA's Disaster Housing Assistance Program (Section 408A).

This program allows renters and homeowners to cover rental costs for two to three months if they can not live in their homes while disaster damage is being repaired. In previous disasters, displaced victims would have to wait for a formal inspection of their homes to be done, certifying they could not live in the home, before this assistance was made available. Because of the very large number of displaced persons from the Northridge earthquake, this would have slowed the process of moving victims from shelters into temporary rental replacement housing.

Once a victim had applied for housing assistance, either at a DAC or through teleregistration, and it was determined that their damaged residence was in a zip code that had been assigned an MMI of 8 or more on the EPEDAT map, their application was immediately processed and a check was mailed without waiting for the formal inspection (FEMA 1994). There were about 66 zip codes throughout the affected area that fell into this "fast-track" category. An evaluation of this procedure showed that it worked quite well; out of the 49,000 checks issued using this procedure, about 90% were eligible after inspections were completed (EQE 1994).

### CONCLUSION

We believe it is important to acknowledge that every disaster presents unique problems that even the most well developed emergency response plans have not anticipated. For this reason, we want to stress that a formal disaster response plan should be, at best, a stable platform which provides a decisionmaking structure and process that allows for the deployment of material and human resources to meet both the expected and unique needs that any specific disaster creates for those responding to the emergency. The examples given here illustrate the need for flexible organizational and programmatic response to disaster-induced needs, making use of new technologies and methodologies as well as innovative organizational structures and policy modifications.

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