

Rehabilitation

The Setting

When an earthquake or other major disaster strikes, attention is immediately focused on saving lives and minimizing suffering. During the emergency phase, problems are identified, resources are mobilized and deployed, priority is given to meeting the immediate needs of disaster victims. Actions are basically functional in nature - i.e. fire suppression, search and rescue, and emergency medical services - and are carried out by line agency personnel (law enforcement, fire, medical, rescue) and spontaneous volunteers.

The rehabilitation phase places a different set of demands on government. Clear cut objectives and priorities in the emergency phase give way to broader, policy oriented issues in the rehabilitation phase. Different organizations become involved. Government is faced with making decisions - in often stressful conditions - on issues such as public access to disaster sites, condemnation and demolition of unsafe buildings, and establishing priorities for the restoration of basic services. An ad hoc approach is often taken, at least initially. Intense media coverage may also compound the difficulties in adjusting to unprecedented demands on government.

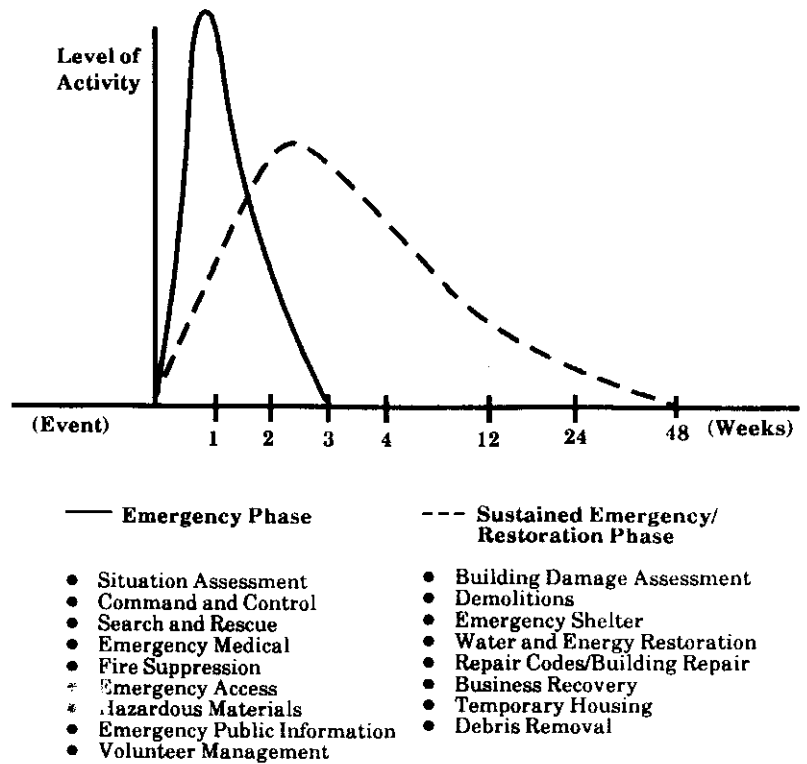
Figure 2 depicts a sample of key functions in the emergency response phase, and the rehabilitation phase. In practice, a fine line exists between the two. The emergency period is characterized by life-saving activities that typically peak during the first days of the disaster. Rehabilitation functions are more complex, involve more groups, and require months - in some cases a year or more - to effectively complete. The important point, however, is that response and rehabilitation is not a linear process. Rehabilitation decisions must be made, and actions taken, as soon as the event occurs. This requires pre-disaster planning and organization.

The following sections examine the key functions and activities that are associated with rehabilitation. For local officials, it is important to know what to expect in the way of problems and issues; to know what steps can be taken prior to an earthquake to facilitate rehabilitation; and to know what steps can be taken after an earthquake to expedite the rehabilitation process.

Building Damage Assessment

After a major earthquake, thousands of buildings can instantly be damaged, some reduced to rubble. In the 1985 Mexico City earthquake, for example, 5,728 buildings were damaged, of which 860 collapsed or partially collapsed and another 2,200 suffered structural damage. In the Central U.S., a similar scenario could prevail following a major earthquake, only on a much broader scale.

Figure 2
Emergency and Rehabilitation Phases
Sample Functions



Building damage assessment is a critical function immediately following an earthquake. People need to be kept from entering or using unsafe buildings, and safe shelters need to be found for those persons who are displaced. Buildings requiring repair also need to be identified and repaired for long-term safety. Experience to date, including recent U.S. earthquakes, has shown that local building departments can be overwhelmed by the need for inspections. Additional manpower must be found; in many cases, it will be necessary to look beyond the impacted area to find available structural engineers to carry out the inspections.

Pre-Disaster Actions

Prior to a disaster, there are several steps that local governments can take to increase the efficiency and quality of building damage assessments, as discussed below.

1. In order to deploy limited personnel to the most damaged areas as quickly as possible, local jurisdictions should *undertake pre-disaster vulnerability surveys* of neighborhoods, and perform survivability studies of critical facilities and other large public and private buildings. These surveys of the most hazardous and vulnerable buildings and facilities can be turned into community risk maps to guide local officials in the post-disaster building inspection process.
2. Local government should *officially adopt standard procedures and criteria* to guide the inspection of damaged buildings following a disaster. In the U.S., many high risk jurisdictions follow the ATC-20 Procedures for Post-Earth-

quake Safety Evaluation of Buildings (see reference list). The ATC-20 deals primarily with the technical aspects of making building structural safety evaluations (and not the formidable task of organizing and managing the technical work).

3. The next step is to *train local engineers and other technicians* on the procedures and methodology that will be used to inspect buildings. A recurring problem after many earthquakes is the lack of trained inspectors. The pre-disaster vulnerability studies of hazardous buildings will assist in determining the number of inspectors that will be needed.
4. Managing public access to damaged buildings after an earthquake is a difficult and sensitive problem for local officials. A variety of groups have legitimate needs for entering damaged buildings - homeowners, tenants, public safety officials, contractors, and others. These needs must be weighed against safety concerns. An important pre-disaster step in building damage assessment is the *formulation of public access policies*; these policies should be applied uniformly and consistently following a disaster.

Post-Disaster Actions

Within the first hours or days after the earthquake, a three step evaluation process is recommended to determine the structural safety of damaged buildings in the disaster area, as outlined in Figure 3.

The procedure begins with a reconnaissance of the damaged area, or area suspected of damages. The general level of damage or lack of damage should be noted because this is often an important clue to the likelihood of finding damage evaluation. Rapid Evaluation is first done by examining the outside of the structure. Again, one of the objectives of Rapid Evaluation is to inspect as many structures as possible in the immediate post-event period

The purpose of a Detailed Evaluation is to evaluate safety and recommend a posting classification. The Detailed Evaluation is intended to provide reasonable assurance that the structural system, as well as elements of the building that could cause falling hazards, are sufficiently safe before the building is put back into service. As reflected in Figure 3, the ATC 20 utilizes three categories of structural safety. Inspected (no restriction on use or occupancy); Limited Entry (off limits to unauthorized personnel); and Unsafe (cannot enter or occupy).

Whenever a building has been damaged to such an extent that it is not possible to use visual inspection techniques alone to assess its safety, an Engineering Evaluation is recommended. This is the third, and the most rigorous, of the three evaluation methods under the ATC 20 methodology, and generally requires the services of engineering consultants.

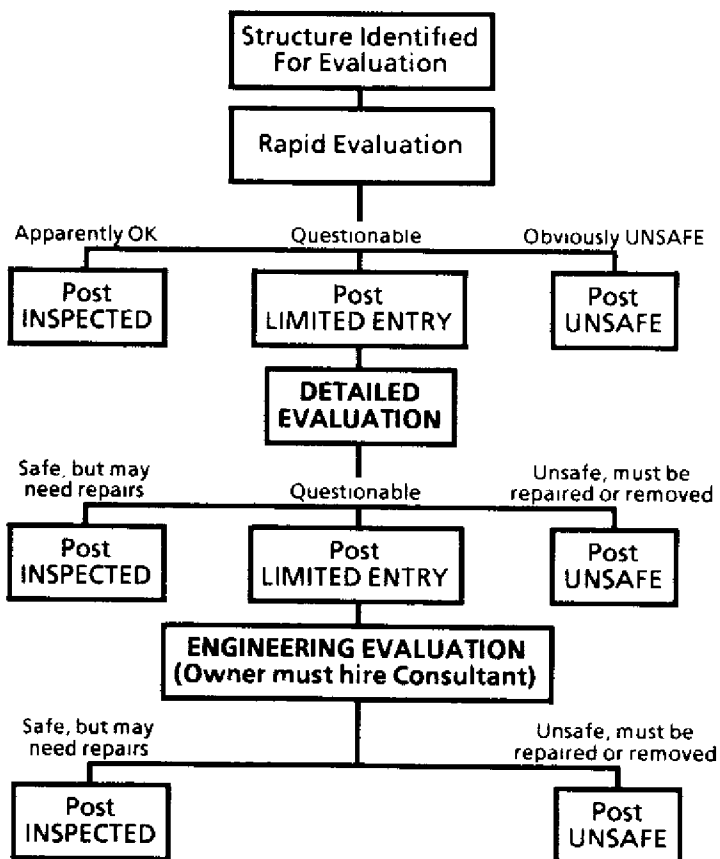
Special Problems to Anticipate

Post-disaster building damage assessment will be one of the most challenging functions that will confront local officials during the Rehabilitation phase. The ATC 20 guidelines represent a technical approach to building damage assessment; in the final analysis, the effectiveness of this (or other) assessment tools will be shaped by a number of factors: cultural, legal, social, economic, environmental, and political. Judging

**Figure 3
Building Evaluation Techniques - ATC 20**

<u>Technique</u>	<u>Required Personnel</u>	<u>Goal</u>
Rapid Evaluation	Building inspectors; Civil/structural engineers; Architects	Rapid assessment of safety Used to quickly post obviously unsafe structures, and to identify buildings requiring Detailed Examination
Detailed Evaluation	Structural engineers*	Careful visual evaluation of damaged buildings and questionable situations. Used to identify buildings requiring an Engineering Evaluation
Engineering Evaluation	Structural engineering consultant*	Detailed engineering investigation of damaged buildings, involving use of construction drawings, damage data, and new structural calculations

*Geotechnical specialists required for assessment of geotechnical hazards



from research findings and recent experience, the following problems can be anticipated with respect to building damage assessment;

- A lack of trained inspectors may slow down the damage assessment process significantly, particularly in major metropolitan areas (i.e. in Latin America) or where damages are widespread (i.e. along the New Madrid fault). Pre-disaster training is critical.
- Aftershocks may pose a major risk to damage assessment teams. Procedures need to be in place that address safety issues. Aftershocks may also require several reinspections.
- The presence of hazardous materials in buildings or the immediate area may create additional risks to damage assessment teams. In San Francisco, inspections following the Loma Prieta earthquake were complicated by the exposure to asbestos, a hazardous material commonly used in older buildings for insulation.
- The behavior of the disaster victims needs to be factored into the building damage assessment process. The teams will run into a range of emotions: fear, anxiety, mistrust, grief, etc. Pre-disaster and post-disaster information campaigns can minimize many of the behavioral, societal, and cultural problems that will surely surface.
- Finally, the length of time that it will take to complete the damage assessment function may itself become a problem or an issue. In Mexico City (1985), teams of engineers and architects from the public and private sectors worked for three months to complete the initial building assessments, a timeframe that will likely be experienced in the Central U.S.

Emergency Shelter and Temporary Housing

A major earthquake near a population center in the U.S. or Latin America may temporarily displace tens of thousands of families and individuals. Housing the displaced is a critical function in the rehabilitation phase of disaster recovery.

A Housing Recovery Typology

The repair and rehabilitation of housing after a disaster follows a well understood process. The first phase - emergency shelter - addresses the immediate needs of disaster victims: shelter, food, clothing, medical care, counseling, and information. In this sense, emergency shelter is a function or service rather than a facility.

Temporary housing is the intermediary or transitional phase between emergency shelter and permanent housing. This phase may involve the repair of lightly damaged residences or the provision of temporary housing such as mobile homes. In Latin America, transitional shelters and camps have been used to temporarily house thousands of displaced families.

Temporary housing is seldom "temporary." For these reasons and others, disaster recovery officials in the U.S. and Latin America have pursued strategies that facilitate the rapid reconstruction of permanent dwellings.

Phase 3 in the housing recovery typology is the establishment of permanent housing, a long-term process that offers significant opportunities for upgrading community housing and infrastructure. This phase is discussed in the following chapter on "Reconstruction."



Children populate the emergency shelters after Mexico City quake.

Some Trends and Issues

Generally, earthquakes and other major disasters are taking an increasing toll on housing in the U.S. and Latin America. There are several reasons for this. Increased urbanization and industrialization, particularly in Latin America, have led to denser populations, mostly tenants. Acute housing shortages that existed before an earthquake are only exacerbated following the event.

Inappropriate building technologies contribute to the problems. In the Central U.S., for example, residential units are typically not secured to their foundations; it is anticipated that there will be a substantial demand for temporary housing following even a moderate earthquake on the New Madrid fault.

Arguably, the populations in our urban centers are not equipped to cope with the range of problems associated with housing recovery. As populations become increasingly mobile, family ties weaken. In the U.S., disaster victims become dependent on the government and the Red Cross for shelter assistance after a disaster. Studies and recent experience reaffirm the vulnerability of "special needs" populations - including the elderly, disabled, and poor.

Pre-Disaster Actions

A number of steps can be taken by housing officials and hazard managers before an earthquake strikes to facilitate rehabilitation and reconstruction in the housing sector, including the following:

1. *Conduct housing vulnerability studies* The nature and scope of potential housing problems can be determined through pre-disaster planning, and an examination of the problems and issues that have surfaced in recent earthquakes. Vulnerability studies should focus on the jurisdiction's housing stock (including multi-family buildings, low-income residency hotels, and other residences); and demographic data (including ownership patterns, income distribution, cultural diversity, etc.). The question of ownership or tenancy becomes an issue particularly when families left homeless after a disaster are renters, squatters, or homeless.

The product of these studies can be a series of overlays, readily adaptable to geographic information systems, that profile the community's housing patterns, the number of shelters that may be required following an earthquake, and the range of services that will be required to support the displaced population

2. *Coordinate all organizations with housing responsibilities.* Numerous organizations and agencies have a role in the provision of post-disaster shelter and housing, pre-disaster coordination can minimize confusion and conflict. Coordination should include: identification of programmatic and funding responsibilities and authorities of local jurisdictions, community organizations, the Red Cross, and housing authorities (local, State, federal and national)
3. *Anticipate problems associated with temporary housing.* Temporary housing is a difficult, complex proposition. At least two important factors need to be considered in pre-planning for temporary housing: first, temporary housing often becomes permanent; and secondly, temporary housing programs that involve the relocation of victims to tent cities beyond the disaster area often run into problems, in many instances, these transitional housing projects are located far from sources of employment.

In the pre-disaster planning, identify and maintain a list of potential sources of local temporary housing that might be usable for an extended period of time after the emergency shelters have closed. In rural areas, there are benefits to collaboration among communities in identifying government owned housing, motels, hotels, apartment buildings and other potential sources of temporary housing.

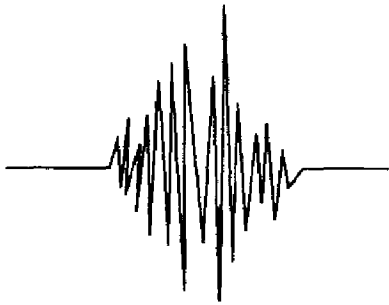
Post-Disaster Actions

One of the greatest challenges that will face local officials following an earthquake or other major disaster is: "how to meet the shelter needs of potentially thousands of displaced victims?"

Each disaster will present unique shelter and temporary housing problems. The reason - people differ, therefore their requirements will differ. Rural victims, for example, tend to be more self-sufficient than their urban counterparts. Many would argue that disaster victims in the U.S. have higher expectations of their government than do victims of Latin American earthquakes. In any event, while victim's expectations and behavior

will differ from disaster to disaster, the issues that will confront local officials are remarkably consistent. Key post-disaster actions are discussed below.

1. *Conduct building damage assessment of structures and facilities that have been designated as emergency shelters.* Potential shelters should be a high priority post-disaster inspection
2. *Conduct public information campaign.* Confusion and dissatisfaction with the emergency sheltering system may result from misconceptions. The public must be informed about what to expect from the sheltering system (what they will get, what they should take, what emergency services are provided). Post-disaster information can be disseminated not only through emergency public information sources, but also community based organizations (CBO's).
3. *Contact and include community based organizations in the emergency shelter operation.* Each community has a unique social and cultural fabric that needs to be understood in the provision of emergency shelter and temporary housing. Community based organization's typically serve as advocates for vulnerable populations on a daily basis; these groups have an important role in post-disaster housing programs.
4. *Identify the full range of options for temporary housing* A large urban earthquake will place pressing demands on local officials to locate and secure suitable temporary housing for potentially thousands of disaster victims. Creativity and flexibility are essential. Options to explore should include conversion of warehouse space, mass producing small prefab units, incentives for shared housing, and using vacant land in a community for temporary housing.
5. *Relocate victims only in cases where public safety is jeopardized* There is a temptation following a major disaster to relocate affected populations to transitional camps or shelters. Whenever possible, the policy should be to locate shelters as close to pre-disaster homesites, jobs, services, and social facilities. Preserving family and neighborhood relations should be an important criterion in establishing post-disaster shelters.



Case Study: 1985 Mexico City Earthquake

Mexico City officials pursued a truly innovative housing rehabilitation and reconstruction strategy following the destructive earthquake of September 19, 1985 (magnitude 8.1; 4,500 killed, 50,000 homeless; 95,000 housing units lost or seriously damaged).

Most families that lost housing in the Mexico City earthquake lived and worked downtown, were renters, and occupied older, high density buildings. A majority were older residents who had lived in the area for two decades or more.

Just three weeks after the earthquake, the government established the Renovacion Habitacional Popular (RHP) as an autonomous agency with a mandate to rebuild and reorganize urban areas damaged by the earthquake, restore the original neighborhood's social and economic networks, and to construct nearly 50,000 dwellings. Among the unique features of the RHP:

- The government provided land to the affected families through an expropriation process, thereby insuring the families that they could rebuild in the immediate vicinity of their old neighborhoods;
- Economic aid was offered to families who found temporary housing on their own to rent or share;
- The beneficiaries of the program - primarily low-income - would repay only the direct building costs;
- While the dwellings were being constructed, roughly 20,000 temporary shelters were constructed in the immediate vicinity of the rebuilding project, thus ensuring that social and economic disruption would be held to a minimum.

What distinguishes the Renovacion Habitacional Popular initiative from any other was the involvement of over 100 organizations in the decision-making process - neighborhood associations, tenement groups, church organizations, local housing authorities, and others. In essence, the affected population had direct input into shaping a large scale, community-based reconstruction program that was designed to preserve and protect the physical and social patterns of urban life that existed before the disaster.

Public Facilities and Services

In a major earthquake, hurricane or other rapid-onset disaster, the government itself may become the victim. Agencies may be forced to operate from widely scattered, makeshift locations with little or no notice, inadequate communications, and shortages of supplies and staff. Normal intergovernmental processes come to a halt, services must become improvised.

The bottom line is - the public facilities and services that our societies have come to depend on, at home and the workplace, are vulnerable to the effects of earthquakes and other hazards.

Fortunately, loss estimate studies are available that provide hazard managers with detailed information on the impact of earthquakes and other hazards on roads, bridges, water supply systems, energy systems, communications systems, hospitals, and other essential or "critical facilities." These facilities and services are "critical" in the sense that, by virtue of their size, function or service area, their loss or impairment would seriously impede emergency response and recovery operations and disrupt vital socio-economic activities. The restoration of these facilities is also fundamental to the short-term revitalization of a local economy following a disaster.

Pre-Disaster Actions

Armed with information on damage scenarios for various magnitude earthquakes, local officials are positioned to undertake a series of pre-disaster planning steps for the rehabilitation of public facilities and services.

1. *Establish priorities for the rehabilitation of facilities and services.* In a major earthquake that impacts a broad area (such as a New Madrid earthquake), the prioritization of critical facility restoration becomes more important. Factors to be considered include: repair time; ownership (government versus private); and nature of service (i.e. administrative versus direct service).
2. *Coordinate recovery planning with general land-use planning for the community.* Table top exercises with local