

Session No. 11

Course Title: Earthquake Hazard and Emergency Management

Session Title: Earthquake Disaster Response and Recovery

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Time: 180 minutes.

Objectives:

- 11.1 Define disaster response and describe the ways which earthquake disaster response is unique from response to other disasters.
 - 11.2 List the general objectives of earthquake emergency response.
 - 11.3 Identify the specific activities associated with earthquake emergency response.
 - 11.4 Describe hazard management steps that promote effective earthquake disaster response.
 - 11.5 List typical deficiencies in earthquake emergency response.
 - 11.6 Describe innovative tools that are being developed to assist in response efforts.
 - 11.7 Define disaster recovery and discuss major concepts associated with earthquake disaster recovery.
 - 11.8 Discuss specific recovery activities and issues associated with earthquake disaster recovery planning.
 - 11.9 Discuss important keys to effective recovery operations so that economic and social impact will be minimized.
 - 11.10 Describe typical deficiencies in earthquake recovery activities and operation.
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Scope:

The objective of this series of lectures is to introduce the student to the general principals associated with earthquake response and recovery for earthquake disasters. This session also provides information concerning the measures and activities typically involved with earthquake response and recovery and how such measures affect the scale of earthquake disasters.

Important keys for effective disaster response and recovery are presented. A discussion of response activities and issues, followed by recovery, is presented. .

Readings:

Suggested student readings:

Meliti, D. 1999. *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Joseph Henry Press. Chapters 7, 8, and 9, pp. 209-289.

Quarantelli, E. L. 1999. *The Disaster Recovery Process: What We Know and Do Not Know from Research*. Disaster Research Center. Newark: University of Delaware, available from <http://www.udel.edu/DRC/preliminary/pp286.pdf>.

<http://www.fema.gov/rrr/frp/>

Required instructor reading and resources:

Meliti, D. 1999. *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Joseph Henry Press. Chapters 7, 8, and 9, pp. 209-289.

Quarantelli, E. L. 1999. *The Disaster Recovery Process: What We Know and Do Not Know from Research*. Disaster Research Center. Newark: University of Delaware, available from <http://www.udel.edu/DRC/preliminary/pp286.pdf>.

<http://www.fema.gov/rrr/frp/>

Electronic visuals included: [*see Session 11 – Electronic Visuals.ppt*]

11.1 Moderate Failure Severe Disruption (Oakland Bay Bridge)

11.2 Time Required for Lifeline Restoration

11.3 Collapse of Cypress Freeway during 1989 LPE

Handouts Included:

Handout 11.1 Classroom Discussion Assignment 11.1

Handout 11.2 Homework Assignment 11.2

General Requirements:

The session involves discussion of both earthquake response and recovery operations. Objectives 11.1 – 11.6 cover the topic of **response**, and Objectives 11.7 - 11.10 discuss **recovery** activities. The concept of disaster response and recovery already has been introduced to the student in

earlier discussions, especially in Session 8 where the four disaster phases were presented in a general manner. The instructor should repeat this and explain that this session will focus on issues associated **specifically with earthquake disasters**. There also will be overlap with other sessions, e.g., Session 7, in which earthquakes effects were discussed, and we saw that key lifelines, such as major transportation routes, were likely be damaged, even in moderate earthquakes. Such disruption obviously will pose severe impediments to both response and recovery operations. This session also will overlap with Session 14, which will cover earthquake planning, as planning is involved with all phases and aspects of earthquake disasters. Such overlap is purposeful and advantageous in that the most important issues hopefully will be re-emphasized. The students should be encouraged to make the connections among the various sessions and discuss them.

The instructor should begin this session by defining and discussing **earthquake disaster response**. It is important to discuss differences between response to earthquake disasters and other hazards, such as floods or hurricanes (i.e., earthquakes occur with no warning). The instructor should present key issues that promote improved disaster response and, conversely, discuss major challenges and impediments to response. A classroom discussion assignment is included and should be handed out following the end of the discussion of earthquake response (Objective 11.6). The assignment involves a role-playing exercise to be completed by teams of students in which they will be required to consider actions and issues faced by emergency managers.

Following the discussion on disaster response, the lecture should transition to earthquake disaster recovery, beginning with Objective 11.7. The general approach used to discuss earthquake response should be used to present earthquake recovery. That is, **earthquake disaster recovery** should be defined, and then key issues, impediments, and deficiencies presented and discussed. A homework assignment is included and should be distributed at the end of the session. One week should be allowed for completion. Electronic visual images presented in these notes are included in the accompanying file: Session 11 Electronic Visuals.ppt.

Objective 11.1 Define disaster response and describe the ways which earthquake disaster response is unique from response to other disasters.

Requirements:

The content should be presented as lecture.

Remarks:

- I. ***Disaster response* activities are actions taken during and immediately after disaster impact, and are designed to protect life and property and control secondary earthquake hazards (e.g., earthquake-induced fires and hazardous materials spills). These actions begin with the warning of an oncoming threatening event or with the event itself if it occurs without warning (i.e., most earthquakes provide no warning).**

A. Disaster response activities typically include:

[Instructor note: The following categories will be covered and discussed in detail during the in-class discussion assignment to be covered at the end of Objective 11.6]

1. Rapid damage assessment.
2. Search and rescue.
3. Emergency medical care.
4. Emergency restoration of essential services.
5. Fire-fighting.
6. Emergency communications.
7. Crisis decision-making.
8. Evacuation, protection of lives and property.
9. The provision of emergency shelter for victims.
10. Debris removal (also associated with recovery).
11. Other activities that take place during the immediate post-impact emergency period.

B. Disaster response also includes **the implementation of disaster preparedness plans and procedures**, thus **overlapping with disaster preparedness**.

C. **Response activities must address the need to deal with both event-generated demands** (i.e., problems directly created by the disaster agent itself, such as injuries and physical damage) and **response-generated challenges** (i.e., the need for rapid situation assessment and for information on which to base decisions; MCEER, 2000).

II. *The federal government, all states, and virtually all communities in the United States have plans for responding to major disasters, including earthquakes, although both the quality of these planning efforts and the demonstrated capacity to respond to major disasters varies considerably nationwide.*

A. Because major disasters, such as a catastrophic earthquake in an urban area, initially overwhelm available resources, **perhaps the most significant challenge facing affected communities in the immediate post-impact period is accurate**

assessment of the situation and prioritization of response needs (MCEER, 2000).

- B. A primary difference** between responding to earthquake events and other natural disasters is that **earthquakes occur without warning and tend to affect a widespread area even if the event is moderate. Also, earthquakes affect above- and below- ground lifelines, and buried utilities and communication systems are more likely to be damaged during these events.**

III. *Fast, reliable damage assessment during earthquakes is vital, but is extremely difficult, particularly in large disaster earthquakes, as summarized in the following excerpt from MCEER's Strategic Plan (2000):*

In the 1995 Kobe earthquake, for example, **the response was delayed and significant problems developed due to government's inability to evaluate the scope and severity of earthquake impacts and to mobilize resources.** The same kinds of problems occurred in the United States following Hurricane Andrew in 1992, when government officials lacked timely, accurate data on the extent and location of damage, and as a result, were slow to recognize the hurricane's near-catastrophic effects. Such problems could have been overcome had there been systems in place to rapidly detect damage and disruption on both macro and micro scales while surmounting the enormous communications and transportation disruptions those disasters produced (MCEER, 2000). Such systems currently do not exist, either in the US or elsewhere. **To avoid repeating these experiences in the next major national disaster, advanced damage-detection methods are needed, and data on damage and other impacts must be incorporated into effective crisis decision support systems.**

- A. Thus, early warning systems** (such as TriNet and ShakeMaps used for early warning as discussed previously in Session 6) and damage assessment/prediction tools (GPS, GIS mapping systems) **that predict and illustrate probable damages from a number of disaster scenarios are critically important.**
- B. One key to enhancing the effectiveness of response and recovery activities is promoting the adoption and use of technologies** e.g., remote-sensing technologies for rapid post-event damage assessment and loss estimation) **that would enable the organizations responsible for coordinating those activities to deal with earthquake-related problems in a timely manner and to make decisions that are based on empirical data and sound management principles (MCEER, 2000).**

Objective 11.2 List the general objectives of earthquake emergency response.

Requirements:

The content should be presented as lecture.

Remarks:

- I. ***To ensure the survival of the maximum number of victims, keep them in the best possible health in the circumstances. Search and rescue operations in collapsed buildings is a particularly difficult challenge, especially in less developed areas where there is less machinery and rescue equipment.***
- II. ***Reestablish self-sufficiency and essential services as quickly as possible for all population groups, with special attention to those whose needs are greatest, the most vulnerable and underprivileged. The continued operation of critical facilities (i.e., hospitals, emergency centers, water treatment facilities, air traffic control towers, etc.) and restoration of lifelines are essential (MCEER, 2000; NRC, 2003).***
- III. ***Inspection and condemnation of damaged infrastructure (especially unstable structures that may be dangerous due to aftershocks) and emergency/temporary repairs should be made where feasible.***
- IV. ***In cases involving population displacements and temporary housing, the aim is to find durable solutions as quickly as possible, while ensuring protection and assistance as necessary in the meantime.***
- V. ***Accomplish all of the above in a “sustainable” manner that contributes to long-term development goals and reduces vulnerability to future damaging earthquakes or other hazards.***

Objective 11.3 Identify specific activities associated with earthquake emergency response.

Requirements:

The content should be presented as lecture.

Remarks:

- I. **Specific activities associated with earthquake emergency response:**

[Note: The portion of the following was adapted from the *Church World Service Emergency Response Training Course Manual (CWT/ACT, 2004)*]

- A. **Early Warning** – Early warning refers to arrangements to rapidly disseminate information concerning imminent earthquake motion threats to government officials, institutions, and the population at large in the areas at immediate risk. These warnings normally are generated by new systems such as TriNet, discussed in Session 6. While the warning systems only begin when earthquake shaking starts, it may allow actions such as moving to safer locations or shutting off of gas lines, etc. as the earthquake begins.

- B. Evacuation/migration** – Evacuation involves the relocation of a population from zones at risk of an imminent disaster to a safer location, especially if structures are susceptible to damage from aftershock.
- C. Search and rescue** – Search and rescue (SAR), is the process of identifying the location of disaster victims who may be trapped or isolated and bringing them to safety and medical attention. In the aftermath of earthquakes, SAR normally focuses on locating people who are trapped and injured in collapsed buildings.
- D. Post-disaster assessment** – The primary objective of assessment is to provide a clear, concise picture of the post-disaster situation, to identify relief needs, and to develop strategies for recovery. It determines options for humanitarian assistance, how best to utilize existing resources, or to develop requests for further assistance. The post-disaster assessment must distinguish among pre-disaster chronic conditions, the needs of disaster survivors and their resources.
- E. Emergency relief** – Emergency relief is the provision, on a humanitarian basis, of material aid and emergency medical care necessary to save and preserve human lives. It also enables families to meet their basic needs for medical and health care, shelter, clothing, water, and food (including the means to prepare food). Relief supplies or services typically are provided, free of charge, in the days and weeks immediately following a sudden disaster.
- F. Logistics and supply** – The delivery of emergency relief will require logistical facilities and capacity. A well-organized supply service is crucial for handling the procurement or donation, storage, and dispatch of relief supplies for distribution to disaster victims.
- G. Communication and information management** – All of the above activities are dependent on communication. There are two key aspects to communications in disasters.
 - 1. The equipment essential for information flow, such as radios, telephones, and their supporting systems of repeaters, satellites, and transmission lines.
 - 2. The information management, that is, the protocol of knowing who communicates what information to whom, what priority is given to it, and how it is disseminated and interpreted.
- H. Survivor response and coping** – In the rush to plan and execute a relief operation, it is easy to overlook the real needs and resources of the survivors.
 - 1. The assessment must take into account existing social coping mechanisms that negate the need to bring in outside assistance.

2. On the other hand, disaster survivors may have new and special needs for social services to help adjust to the trauma and disruption caused by the disaster.
 3. Participation in the disaster response process by individuals to aid community organizations is a key to healthy recovery. Through them, appropriate coping mechanisms will be most successfully utilized.
- I. Security** – Security is not always a priority issue after sudden onset natural disasters. Typically, it is handled by civil defense or police departments.
 - J. Emergency operations management** – None of the above activities can be implemented without some degree of emergency operations management. Policies and procedures for management requirements need to be established well in advance of the disaster.
 - K. Rehabilitation and reconstruction** – Rehabilitation and reconstruction complete the disaster response activities and merge with the recovery phase.
- II. Most communities with an emergency response plan for earthquake disasters include the following categories in the response plan:**

[Instructor note: The following categories will be covered and discussed in detail during the in-class discussion assignment to be covered at the end of Objective 11.6. The relative importance of each of these can be considered and discussed in detail at that time. Some of the concepts, especially transportation also are discussed in the following sections that discuss recovery.]

- A.** Health Services.
- B.** Emergency Social Services.
- C.** Law and Order.
- D.** Heavy Urban Search and Rescue.
- E.** Communications.
- F.** Damage Assessment.
- G.** Firefighting/Rescue.
- H.** Transportation.
- I.** Engineering and Construction.

- J. Human Resources.
- K. Coroner/Mortuary.
- L. Hazardous Materials.
- M. Public Information.
- N. Food and Agriculture.
- O. Finance and Insurance.
- P. Utilities.

III. Most disaster response activities are coordinated and conducted at the local and state levels, but the federal government is a key player in *major* disasters, as per the *Federal Response Plan*:

- A. This plan provides the mechanism for coordinating delivery of federal assistance and resources to augment efforts of state and local governments overwhelmed by a major disaster.
- B. The plan is implemented in anticipation of a significant event likely to result in a need for federal assistance or in response to an actual event requiring federal assistance under a presidential declaration of a major disaster or emergency (see <http://www.fema.gov/rrr/frp/>).

Objective 11.4 Describe hazard management steps that promote effective earthquake disaster response.

Requirements:

The content should be presented as lecture.

Remarks:

I. Hazard management steps to take to promote effective earthquake disaster response:

[Instructor note: Major portions of the following list were adapted from MSSC (1997)]

- A. Develop an integrated emergency management system at all levels of government and the private sector to protect life, health, property and the environment following an earthquake event.

- B.** Promote community emergency response teams (CERTs) statewide. Train volunteer community emergency response teams statewide.
- C.** Support the formation, training, and funding of urban search and rescue teams. Train and organize specialty teams designed for intense search and rescue to augment local fire departments during major emergencies.
- D.** Promote development of emergency response plans at the state and local levels. Develop comprehensive emergency response plans at state and local levels and test plans through exercises with first responders.
- E.** Promote the selection and training of qualified local emergency response directors and their personnel. Establish minimum job qualifications for local emergency response directors and develop programs for these directors and their personnel.
- F.** Evaluate mass care exercise and training programs for local emergency management and volunteer agencies who respond to disasters. Evaluate and promote coordination of current multi-agency training and exercise programs, specifically between local emergency management and voluntary agencies, under conditions expected after earthquakes. Promote identification of agency mass care roles and responsibilities in the event of a major disaster.
- G.** Expand and promote training in disaster mortuary and identify potential temporary mortuary sites in major population centers. Support pre-disaster identification of temporary mortuary sites that can be accessed immediately in major population centers.
- H.** Enhance communication capability and coordination for emergency response between state and local governments and private groups. Develop viable alternative means of communications between state and local government entities and volunteer organizations.
- I.** Enhance ability of emergency response personnel, materials, and equipment to reach affected areas. Identify and upgrade key transportation routes (roads, air, rail, and water) to areas with a high risk of damage in the event of a major earthquake.
- J.** Promote mutual aid agreements between political subdivisions at local and state levels. Support and encourage the establishment of mutual aid agreements.
- K.** Promote development of effective, coordinated response plans for utilities. Assess and mitigate earthquake risks and damage to utilities.
- L.** Develop the capability to respond to multiple hazardous materials incidents. Determine the potential for hazardous material incidents following an earthquake and develop the necessary emergency response capability.

Objective 11.5 List typical deficiencies in earthquake emergency response.

Requirements:

The content should be presented as lecture.

Remarks:

- I. Emergency management and response systems continue to improve with each earthquake; however, systems can be strengthened further through greater collaboration and partnership with and between public, private, non-profit agencies, and the community (California Seismic Safety Commission [CSSC], 2003). According to CSSC, typical deficiencies in most communities still exist in:**
- A.** Resources needed for better communication during an event.
 - B.** Resources in and coordination between the public and private medical response systems.
 - C.** Resources for sustained search and rescue operations.
 - D.** Adequate and sustained resources for emergency management at all levels of government.
 - E.** Most importantly, reliable and timely damage assessment and decision support systems to accelerate and optimize response activities. In fact, this deficiency is important enough to focus on and list several impediments to the development of knowledge and technologies that improve our ability to reliably and quickly assess damage and optimize response resources:
 - 1. The proprietary and/or classified nature of the software and data needed for rapid post-earthquake loss estimation is another barrier that must be surmounted in order to conduct basic research and move toward the development of enabling technologies. Many remote-sensing technologies have been developed for intelligence and defense purposes, and it is only recently that their use in hazard management has been considered.
 - 2. The difficulties with developing complete inventories of elements in the built environment that are at risk in order to validate advanced damage assessment models constitute yet another set of barriers to research progress. Inventory development is cumbersome and expensive, and data sources that typically serve as the basis for inventories, such as tax

assessor's records, do not take into account all at-risk structures and facilities.

3. Recovery decision modeling likewise is hampered by a lack of comprehensive models that account for regional social and economic earthquake impacts and a shortage of data from which to construct recovery decision support models.
4. Implementation also is more difficult because of the inability of many governmental entities to take advantage of new emergency and recovery management tools due, for example, to lack of funds and trained personnel.

11.6 Describe innovative tools that are being developed to assist in response efforts.

Requirements:

The contents should be presented as lecture. The class discussion assignment (Handout 11.1) should be conducted following this objective.

[Instructor note: Some of this material will also be discussed in future sessions (i.e., Session 14)]

Handouts Included:

Handout 11.1: Classroom Discussion Assignment

Remarks:

- I. *Geographical information systems (GIS) are organized collections of hardware, software, geographic data, and personnel data designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.***
 - A.** These systems can be used with seismic models to forecast damages for earthquake scenarios and display the results in graphical format, such as digitized color maps.
 - B.** Such data are extremely valuable for timely decision-making given a hazard event.
 - C.** Some of these systems can be combined with early-warning systems to create an almost real-time graphical display of the shaking effects in a particular region.
- II. *Global Positioning Systems (GPS) are navigational systems involving satellites and computers that can determine the latitude and longitude of a receiver on Earth by***

computing the time difference for signals from different satellites to reach the receiver.

- A. Remote sensing via satellite and ground level (and subsurface) sensing via seismographs brings real-time warnings of quakes and their related hazards.
- B. GPS technology can detect land movement by monitoring changes in the position of ground-based stations monitored by satellites. Satellite imagery, GPS, and computer models also are leading to better land-use practices.
- C. For example, the World Bank is planning to assist countries such as Honduras and Turkey with a credit that will finance mapping of vulnerable areas, using GPS technology to help develop effective monitoring systems to forecast natural hazards, including earthquakes, and to plan appropriate land use.

III. *Infrastructure and asset management* system is an operational package that enables the systematic coordinated planning and programming of investments or expenditure, design, construction, maintenance, rehabilitation and renovation, operation, and in-service evaluation of physical facilities. The system usually is a computer-based database of facilities. These tools can be used in earthquake hazard operations to:

- A. Minimize costs.
- B. Maximize benefits.
- C. Maximize safety.
- D. Minimize disturbance to daily life.
- E. Minimize response time.

[Instructor note: conduct classroom discussion using Handout 11.1]

Objective 11.7 Define disaster recovery and discuss major concepts associated with earthquake disaster recovery.

Requirements:

The content should be presented as lecture, supplemented by electronic visuals.

Electronic Visuals Included:

Electronic visual 11.1 Moderate Failure Severe Disruption (Oakland Bay Bridge)

Electronic visual 11.2 Time Required for Lifeline Restoration

Electronic visual 11.3 Collapse of Cypress Freeway during 1989 LPE

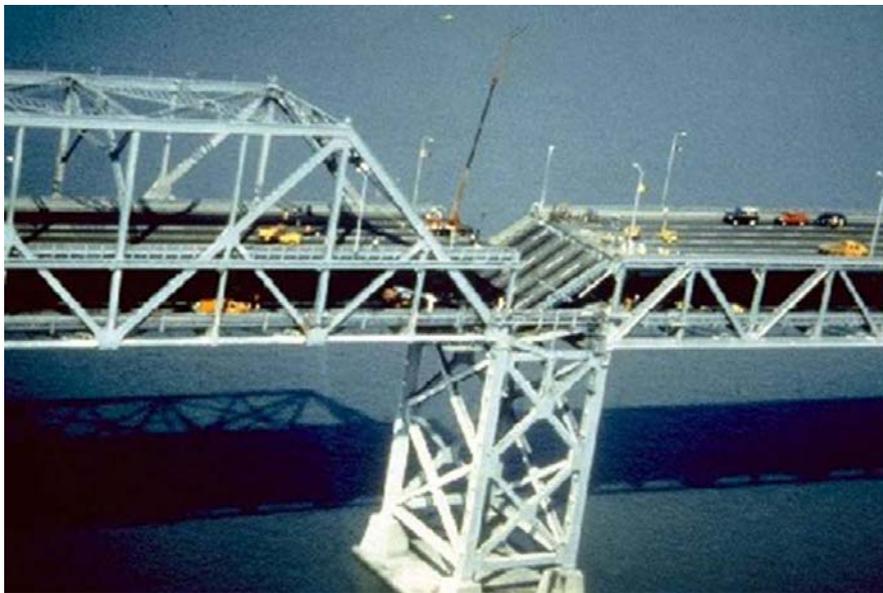
Remarks:

I. Recovery is the phase of earthquake management that aims to restore communities affected by disasters to a normal regime of social and economic activity. It involves not only repairing or replacing physical infrastructure damaged during an earthquake, but also rebuilding the economic strength and social stability of a community through appropriate financial and regulatory programs.

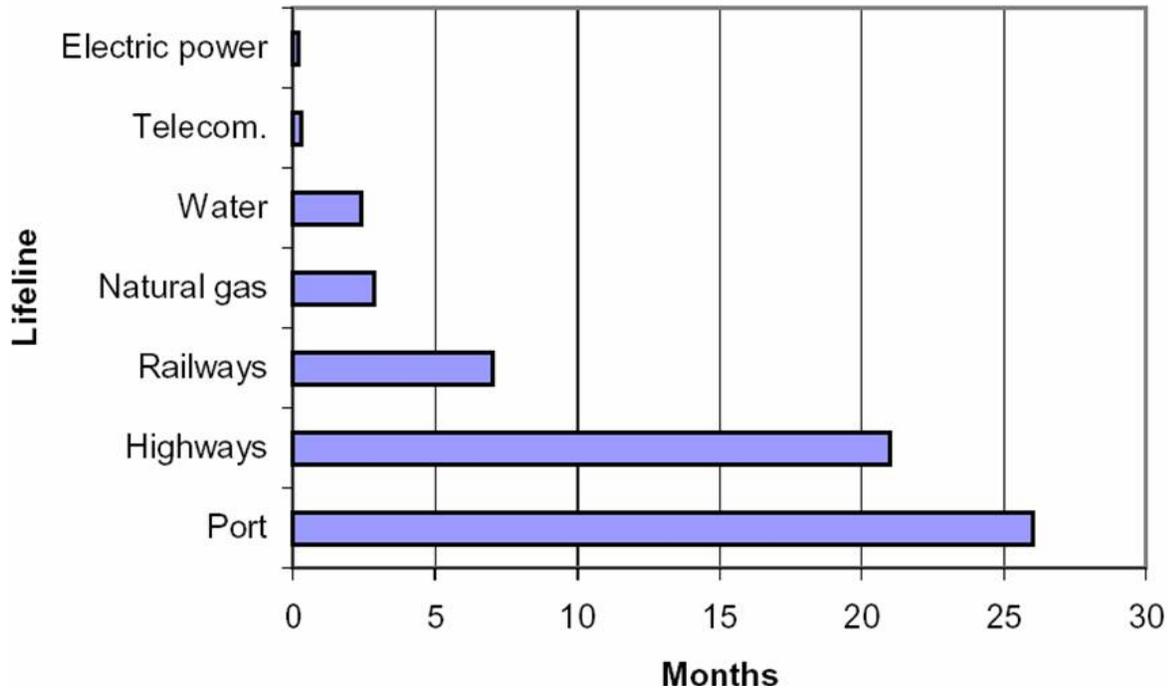
II. Recovery activities consist of actions taken to return to (or, ideally, exceed) pre-earthquake levels of activity and productivity.

A. These actions include restoring, repairing, and reconstructing **lifelines and buildings**, undertaking measures to overcome earthquake-induced economic downturns, and providing financial assistance to compensate for losses.

As discussed earlier in Session 7 regarding the effects of earthquakes upon lifelines, **transportation systems have an especially large impact on both the response and recovery efforts.** Damage to **transportation systems is particularly important because the repair times for these systems typically is much longer than for other lifelines, as shown in the visuals (see Chang, 2000).** [Visuals 11.1, 11.2, 11.3]



Visual 11.1 – Photo of upper deck of Oakland Bay Bridge that slipped off its bearing seat during the 1989 Loma Prieta EQ. This was a moderate structural failure (inadequate beam seat width), but the disruption in the Bay area was severe. More than one month was required for repair. Photo credit: CalTrans.



Visual 11.2 – Graph illustrating time required for repair of lifelines following the 1995 Kobe, Japan Earthquake. Note that the transportation facilities required much longer repair times. Visual from Chang (2000).



Visual 11.3 – Collapsed upper deck of the Cypress Freeway due to 1989 Loma Prieta Earthquake. The earthquake destroyed a 1¼-mile section of Interstate 880. This was a major artery in the Oakland-Alameda area east of San Francisco. The poor seismic performance of this freeway promoted the entire 5.2 mile-long section to be rebuilt. This project was very expensive (\$1.2 billion) and was not completed until September 1998, nearly nine years after the earthquake (FHWA, 2004). Photo credit: CalTrans.

- B. The recovery period typically is the time in which decisions are made about adopting new mitigation measures with the long-term objective of increasing the earthquake resistance of the built environment (Mileti, 1999).**
- III. If undertaken properly, recovery strategies can contain indirect and induced earthquake losses, shorten the recovery period for affected social units, and avoid future losses through improvements in mitigation (Mileti, 1999).**
- IV. *Earthquake disaster recovery* involves long-term efforts to:**
 - A. Reconstruct and restore the earthquake-stricken area, e.g. through repairing or replacing homes, businesses, public works, and other structures.**
 - B. Deal with the disruption that the disaster has caused in community life and meet the recovery-related needs of victims.**
 - C. Mitigate future hazards.**
- V. Although the four disaster phases (preparedness, mitigation, response, and recovery) may appear to be stages in a sequence, they actually overlap and merge. For example, *decisions that have an impact on earthquake recovery often are made very soon after the disaster strikes, while the emergency response is still ongoing.***
- VI. In the U.S., recognition has grown that it is highly desirable to plan for recovery before an earthquake occurs, and some communities (e.g., especially following the City of Los Angeles) have begun to move in this direction (Mileti, 1999). However, *at present, earthquake response planning is much more extensive and more thoroughly institutionalized than recovery planning.***
- VII. While we increasingly recognize that coordinated strategies are needed to manage recovery following major earthquakes and other disasters, in order to minimize long-term negative social and economic impacts, there is a lack of adequate data and tools to support recovery decision-making (MCEER, 2000).**
- VIII. *Recovery activities are related to mitigation. Effective mitigation can have a significant effect on a community's ability to recover swiftly from an earthquake.* For example, a high level of earthquake insurance lessens the financial burden on individuals and governments to replace damaged property, and frees up resources that can be applied to other aspects of the recovery effort.**
- IX. The recovery from a major earthquake transcends jurisdictional boundaries.**
 - A Reconstruction usually needs to be planned and carried out by groups of jurisdictions at least at the regional level (i.e., see activities by ABAG at <http://www.abag.ca.gov/bayarea/eqmaps/eqmaps.html>). **Plans should be made ahead of time for rebuilding the infrastructure.****

- B. This initially entails developing an appropriate way for expediting the review of applications for rebuilding immediately after an earthquake. But beyond this, **governments should have some sense, based on a realistic earthquake scenario, of the likely effect that a major earthquake would have on the infrastructure.** They should know which facilities would survive and which would not, and plan accordingly.

Objective 11.8 Discuss specific recovery activities and issues associated with earthquake disaster recovery planning.

Requirements:

The content should be presented as lecture.

Remarks:

- I. **Disaster recovery planning basically involves asking “What ifs” to prevent later “If onlys” (CSSC, 2000).**
- II. **Studies have found that pre-disaster planning can save lives and injuries, limit property damage, and minimize disruptions, enabling communities to recover more quickly (MCEER, 2000).**
- III. **Planning for recovery has a number of components. The following general planning steps are adapted from the *California Seismic Safety Commission Strategic Plan (2003)*:**
 - A. **Planning for “Business Continuation:”** Business continuation planning is aimed at allowing an organization to resume its regular business activities as quickly as possible after a disaster. In the case of governments, this means being able to continue to provide essential services to the public with as little disruption as possible. This is not just a matter of marshalling physical resources; it also involves providing the appropriate authorities with human resources to enable government and business to continue under extreme conditions.
 - B. As with other aspects of emergency preparedness, business continuation planning should be an ongoing program from which an organization develops and modifies its continuation plans. And to be fully effective, it should involve all members of the organization.
 - C. **Dealing with Building Damage:** Repairing and rebuilding damaged buildings is one element that covers the entire recovery cycle. Initially, the concern is to prevent further loss of life or injury, particularly from aftershocks following the initial seismic activity. Damage to structures must be assessed and buildings

posted to indicate which buildings are safe to use. A system of inspecting and posting key buildings is therefore essential if injury and loss of life are to be minimized.

D. Inspections often take the form of two main evaluations: one rapid and one detailed:

1. A rapid evaluation is carried out to identify and post apparently safe and obviously unsafe structures, and to designate buildings whose strength and safety cannot be determined without a more thorough examination. These evaluations usually are done by local building inspectors, assisted by volunteer civil/structural engineers, architects, building contractors, and other individuals.
2. A detailed evaluation is carried out to evaluate and post buildings of questionable safety, usually those that have already been posted as "Limited Entry." Detailed evaluations are designed to be performed by volunteer engineers within a few hours or days after the rapid evaluation phase, and are intended to provide reasonable assurance about whether a building can be returned to or not.
3. The effectiveness of any post-earthquake structural assessment program depends on effective protocols for the assessment. As well, it depends on a trained and accessible core of volunteer engineers with the necessary authority, supplies, and equipment to perform their function.

E. Removing Debris: A major earthquake is likely to cause a significant amount of damage, so debris removal is a key element of recovery (as well as of response).

1. Initially, streets must be cleared quickly to allow emergency vehicles access to help the injured and extinguish fires.
2. Subsequently, removing what is left of destroyed buildings allows reconstruction to begin earlier. The personnel and equipment of governments and private sector companies probably will be needed to remove debris.
3. Suitable places to dump earthquake rubble will have to be identified so that environmental problems and higher future costs for cleanup can be avoided. Therefore, it is important for governments to identify potential disposal sites in advance, and to plan for the logistics of moving debris to them.

4. The authority to make decisions about the disposition of debris should be assigned before the event, since such decisions will have to be made quickly once the emergency has occurred.
- F. **Rebuilding:** Building regulations need to be established to enable the rebuilding process to proceed as quickly as possible. In the meantime, temporary housing must be found for the homeless. Health and safety information must be distributed among the population to minimize the risk of a disease outbreak resulting, for example, from drinking contaminated water.
 - G. **An effective rebuilding program needs to be supervised by a reconstruction authority.** Such an agency may act for a number of governments, and the creation of one should be contemplated as part of a long-term recovery plan.
- IV. ***Economic Recovery:* To find out how best to revive the economy, impact studies have to be carried out to identify how damaged the various elements are, what needs repair, and how the repairs can be made. Only then can appropriate financial assistance programs be put into place.**

Objective 11.9 Discuss important keys to effective recovery operations so that economic and social impact will be minimized.

Requirements:

The content should be presented as lecture.

Remarks:

- I. **Recovery once was viewed as a linear phenomenon, with discrete stages and end products. Today it is seen as a process that entails decision-making and interaction among all stakeholders such as households, businesses, and the community at large (MCEER, 2000).**
 - A. **Many of the decisions associated with recovery are ones of government policy.** How quickly recovery can or should take place, and how the costs of recovery will be distributed within the community, largely are determined by government decisions. Therefore, it is important that governments give considerable thought to the types of decisions they will have to make and how they will carry them out.
 - B. **Recovery appears to be most effective when community-based organizations assume principal responsibility, supplemented by outside technical and financial assistance (Mileti, 1999).** Perhaps a further shift will be needed – away from an exclusive focus on restoring damaged structures toward effective

decision-making at all levels. Outside technical assistance can help strengthen local organizational and decision-making capacity (Mileti, 1999).

II. According to MCEER (2003) and MSSC (1997), additional general measures key to effective *earthquake disaster recovery* are:

- A. **Provide Accurate and Timely Information:** Establish a coordinated public information strategy to provide accurate and timely recovery and mitigation information to public and private sectors through all available means.
- B. **Identify suitable, earthquake resistant short- and long-term shelters and coordinate agreements for their use.**
 - 1. **Earthquake resistant** short- and long-term sheltering facilities (think about aftershocks) are required following a major disaster.
 - 2. Plan for the construction of long-term temporary housing. Develop contingency plans for the location, design and construction of long-term temporary housing. Long-term temporary housing will be needed for victims displaced by a major earthquake.
- C. **Promote funding and training of post-earthquake building inspection volunteers.**
 - 1. Continue to train volunteers throughout the jurisdiction to make rapid visual examinations of buildings.
 - 2. By using a system already in place for training, certifying, and mobilizing volunteers, structures that are safe for occupancy can be rapidly identified after an earthquake or other disaster. This will permit housing and jobs to be quickly restored.
- D. **Enhance the ability of individuals and small businesses to recover from an earthquake disaster.**
 - 1. Enable small businesses to recover from an earthquake and to access funding at the federal and state levels in a timely manner so that economic recovery progresses.
 - 2. For instance, develop guidelines to accelerate the permitting and rebuilding process so that disruption of individuals and businesses is minimized, rapid personal and economic recovery is assured, and the adverse economic impact of an earthquake will be reduced in the affected area.

- E. Support identification of facilities and methods for disposal of uncontaminated debris and hazardous materials from collapsed structures.** Prepare a plan for disposal of hazardous materials, contaminated and uncontaminated debris. Coordination will result in improved and efficient, coordinated disposal of hazardous materials and uncontaminated debris.
- F. Enhance ability to provide crisis counseling to individuals in affected areas.** Develop a network of trained counselors who will respond to and provide counseling to residents in affected areas. Residents, particularly children, probably will have trouble understanding and coping with the emotional trauma following a major earthquake.

Objective 11.10 Describe typical deficiencies in earthquake recovery activities and operation.

Requirements:

The content should be presented as lecture. The homework should be distributed following the completion of this objective.

Handouts Included:

Handout 11.2 -Homework Assignment 11.2

Remarks:

- I. Recovery methods have improved with each earthquake; however, there are still a number of deficiencies that impair effective and speedy recovery and have resulted in unacceptable levels of personal and financial loss (Mileti, 1999).**
- II. According to Mileti (1999), deficiencies typically exist in:**
 - A.** Funding for effective management of the recovery process (including mitigation).
 - B.** Adequate interim shelter and housing, particularly for those with special needs.
 - C.** Plans and resources to accommodate interim and long-term and post-earthquake housing..
 - D.** Adequate knowledge and preparation by the public, business, and service sectors for effective recovery.
- III. Recovery planning has been given less than adequate attention in the context of overall earthquake planning (Mileti, 1999).**

- A. Failure to plan for recovery can mean that the recovery process may take much longer than otherwise might be required.
 - B. The lack of recovery planning weakens a community's ability to plan for effective mitigation,** as the potential costs of economic and social restoration will not be known with any accuracy.
 - C. While it is difficult to assign a value to human life, communities and the public will want to know the cost-benefit implications of different ways to mitigate purely economic risks.**
 - D. Prolonged economic instability makes it difficult for the community to regain its former competitive advantages, and can hold back the rate at which the economy is rebuilt.
- IV. Local leaders too often fail to take advantage of the recovery period to reshape their devastated communities to withstand future events (Mileti, 1999).**
- A. Most local disaster plans need to be extended, not only to explicitly address recovery and reconstruction, but also to identify opportunities for rebuilding in safer ways and in safer places.
 - B. Again, as noted above, the recovery period following one disaster is often a time for considering how to mitigate losses!!**

[Instructor note: distribute Handout 11.2 (Homework Assignment) and allow one week for completion]

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