Contents

PREFACE

This is a manual for a training exercise to help local governments prepare for long-term recovery and rebuilding after earthquakes. It is designed to stimulate local government staff members to think realistically about their responsibilities in the aftermath of a damaging earthquake. We offer this exercise in the belief that a well-prepared city staff can make a big difference in both the quality and speed of recovery and rebuilding. Further, we believe that as staff members begin to understand the complexities of recovery, they will take actions now to reduce the impacts of earthquakes on their communities and ease the burdens of recovery and rebuilding.

The material in this manual draws from the experiences of communities that have suffered earthquakes and recovered: Anchorage, Alaska (1964), Mexico City (1985), and a growing number of California cities – Santa Rosa (1969), San Fernando (1971), Coalinga (1983), Whittier (1987), Ferndale (1992), and the cities damaged in the 1989 Loma Prieta earthquake including Santa Cruz, Watsonville, Los Gatos, San Francisco, and Oakland. These and other cities know about the devastation of earthquakes and the difficult work of recovery. Many staff members in these cities express the wish that they had been better prepared for the tasks of recovery – preparation that this manual is intended to provide.

Today, another group of California cities is starting the long road to recovery from an earthquake. In about 15 seconds of intense ground shaking, the Northridge earthquake thrust the cities of Los Angeles, Santa Monica, Fillmore, Santa Clarita, and others in southern California into the need to rebuild. The tasks of recovery and rebuilding will dominate agendas of public bodies in these cities for months and even years to come. City staff members will make decision after decision under extreme pressure. They too could have been better prepared had they had an opportunity to participate in this exercise prior to the earthquake.

We believe that preparation for recovery and rebuilding can greatly improve both the quality and timeliness of decisions, and decrease the stress inherent in the process. Emergency responders prepare; so, too, should city managers, planning directors, building officials, public works directors, city attorneys, redevelopment directors, and others whose skills and expertise are needed for long-term recovery. This exercise is for them. We hope it educates, encourages mitigation actions, and stimulates further efforts to coordinate now for actions which will be needed after an earthquake strikes.

George G. Mader, AICP, President
Spangle Associates
May 1994

ACKNOWLEDGEMENTS

In creating the exercise, we were greatly helped by a panel of experienced people who reviewed and commented on a draft of the exercise design. The panel members gave freely of their time, experience, and creative ideas. Their comments added depth and realism to the exercise design and we gratefully acknowledge their contributions:

Deborah Acosta, City Manager of Pleasanton, California. City Manager of Los Gatos at the time of the Loma Prieta earthquake in 1989.

Bruce Baird, Coordinator/Instructor, California Specialized Training Institute of the Governor's Office of Emergency Services.

Kenneth Blackman, City Manager of Santa Rosa, California. Planning Director at the time of the Santa Rosa earthquakes in 1969.

Charles Eadie, Planner, City of Watsonville. Planner, City of Santa Cruz at the time of the Loma Prieta earthquake in 1989.

Marjorie Greene, Project Planner, Earthquake Program, Coastal Region, California Governor's Office of Emergency Services.

Pervez Patel, Structural Engineer, Bureau of Building Inspection, City of San Francisco.

Paula Schulz, Manager, Earthquake Program, California Governor's Office of Emergency Services.

The exercise has been tested in six jurisdictions with players too numerous to cite individually. However, we are grateful to them all. They participated with energy, concentration, and enthusiasm throughout a very long eight-hour day. They have convinced us that the exercise is an effective device to enhance awareness of earthquake hazards. Tests were conducted in Pleasanton, California; Los Angeles, California; Evansville, Indiana; Carbondale, Illinois; Cape Girardeau, Missouri; and Paragould, Arkansas. We especially appreciate assistance from Tom Durham, Director of the Central United States Earthquake Consortium, who helped us arrange four tests in the central United States.

The concept and structure for the exercise were worked out by a Spangle Associates team consisting of George Mader, President; Tom Vlasic, Vice President; Martha Tyler, Principal Planner; and Laurie Johnson, Senior Planner. George Mader envisioned the initial exercise concept and provided direction throughout the project. Martha Tyler undertook the considerable task of designing each of the exercise tasks and writing this manual. Tom Vlasic and Laurie Johnson provided substantial input throughout the effort. Laurie Johnson facilitated most of the test exercises and carried out the final production of the manual.

The staff at the OES Coastal Region Earthquake Program helped us find suitable slides and shared early drafts of their report, **Earthquake Recovery: A Survival Manual for Local Government.** This exercise manual can be viewed as a companion to the OES manual.

Work on the project was funded by the National Science Foundation (Grant Number BCS-9025125). We owe appreciation to William Anderson, our NSF program official, who supported our efforts throughout the project. It must be stated, however, that we assume full responsibility for the contents of this manual; it does not necessarily reflect the views of the Foundation.

Introduction

This manual describes an interactive training exercise on earthquake recovery and mitigation. The exercise simulates selected aspects of physical recovery from earthquake damage. The stage is a single local government jurisdiction and the players are its key staff members. Players are guided in creating their own scenario of earthquake damage and then led through a series of tasks related to planning for repairs and rebuilding. This manual contains all the instructions and materials needed to conduct the exercise.

Why an Exercise?

Local police and fire departments know the value of exercises to help them prepare for potential disasters. Through such exercises, they develop techniques to handle extraordinary circumstances, make decisions under extreme pressure, and contain the impacts of a disaster to the extent possible. Experience demonstrates that preparing in advance improves performance when disaster strikes.

Weeks after a damaging earthquake, circumstances are still extraordinary, decisions are made under extreme pressure, and the impacts continue rippling through the community. As the need for emergency responders decreases, a new group of local staff people – managers, planners, building officials, finance officers, engineers, and geologists – face mounting responsibilities. Shouldn't there be an exercise for them, too?

This exercise is primarily for this "second wave" of responders whose actions will play an important role in shaping the rebuilt community. It is designed to provide them with a preview of the issues and problems they will face so that, like the emergency responders, they will be better prepared to serve their community effectively after an earthquake.

How Does the Exercise Relate to Real Time?

The tasks included in the exercise cover a time period extending from a day or two after the earthquake to one or two years. They are arranged in approximate time sequence starting with those that normally must be dealt with first. This linear time sequence of tasks oversimplifies a complex, real situation in which tasks often must be addressed simultaneously.

During the exercise, players are asked to estimate how long they think each task would take after a real earthquake. The estimates will be recorded on the timeline included as an exercise handout. Typical beginning times for each task have already been entered. As the timeline is created, it will show the actual overlapping of the tasks.

In the exercise, each task must be completed within a specified time. The total time to complete the exercise is 8 hours. The amount of time allocated to each task will seem much too short. This simulates, to some degree, the pressure after an earthquake to do an incredible amount of work very quickly.

How Does the Exercise Relate to Actual Recovery?

The exercise simplifies, orders, and rationalizes events during a period of time characterized by incredible confusion and complexity, pressure to do everything at once, and intense emotions. Each task in the exercise is realistic in that it will probably need to be carried out after an earthquake, but not all post-earthquake recovery tasks are included.

The exercise covers key elements of physical recovery after earthquakes. The common links are that all the tasks must be done by local government and potentially affect options for repairs and rebuilding. Housing and business recovery is emphasized more than reconstruction of public facilities. The street network is covered, but other aspects of urban infrastructure, including utilities, are not. All aspects of physical recovery are important; the exercise deals with the most common and those which can be effectively addressed within the format and time limits of the exercise.

By emphasizing physical recovery, the exercise omits large categories of tasks that are often part of post-earthquake response. For example, search and rescue, debris removal, handling the dead, treating the injured, mass care, and psychological counseling are not covered. Economic and fiscal matters are only tangentially included, although they certainly impact physical recovery. FEMA disaster assistance programs and requirements are not incorporated into the exercise, mainly because it would take too much exercise time to explain the details to the players.

The exercise does not reflect the intense political heat surrounding earthquake recovery. Players will need to imagine the political context in their community as they are working the exercise. Political issues pervade every task. After earthquakes, local governments commonly enjoy a brief suspension of political rivalry. Distinctions between the responsibilities of public and private agencies, federal, state, and local governments, and city and county government departments may blur. Every organization and person will be working together to address their common needs. But this does not last long. Pre-earthquake political problems will soon reemerge with more strength than ever, becoming big post-earthquake political problems.

Public participation is also an important fact of post-earthquake recovery. Volunteers who helped with emergency response and earthquake victims may expect to participate in decisions about rebuilding, often leading to large and stormy public meetings. The public may perceive that repairs and rebuilding are taking too long. Anger and frustration stemming from feelings of helplessness will often be vented at local public officials, particularly planners, whose approvals may stand between people and their ability to repair or rebuild damaged homes and businesses.

And finally, the exercise deals with the most common aspects of earthquake recovery. In fact, the unexpected will happen both in terms of the damage and capabilities to respond. A single unexpected structural failure can force replanning an entire section of the community, key staff people may be out of town or unable to deal with the pressure, or adverse weather may delay outside help. Contingencies like these are part of the context of recovery. By learning as much as possible about the “normal” tasks of post-earthquake recovery, local government staffs will be prepared to do these with more ease, giving themselves a better chance of handling the “abnormal” tasks effectively.

Like any exercise, this one is a selective and approximate slice of real experience. Yet, it does introduce a series of interrelated tasks that local governments almost always must face after an earthquake. By going through the exercise, local officials will gain solid information, pertaining directly to their jurisdictions, about the process of recovery and rebuilding, and also how to reduce potential hazards. The exercise will give them the important advantage of forethought when they face the inevitable earthquake, enabling them to help their communities recover and rebuild quickly and effectively.

What Are the Assumptions for the Exercise?

1. The city or county conducting the exercise has an emergency response plan, a general plan, zoning ordinance, and procedures for reviewing land development applications.

2. The jurisdiction is vulnerable to concentrated building damage from shaking and/or damage from ground failure in an earthquake.

3. The players know their community well, but do not necessarily have much knowledge of earthquakes and their impacts.

Facilitator's Instructions

Overview of Exercise Design

This interactive exercise on earthquake recovery and mitigation is organized into a series of tasks which are to be completed in sequence. Each task, labeled by a letter (A–L), has a time limit ranging from 20 to 75 minutes. The tasks are in rough chronological order, but in reality, many would be occurring simultaneously. Each task covers, at least partially, an issue related to planning that typically arises after an earthquake.

The exercise starts right after the earthquake with a damage scenario (A). During this task, the players create a damage scenario based on their best judgement of the areas of the community most likely to be damaged in an earthquake. The scenario is constructed on a map which is used throughout the rest of the exercise.

The next tasks, usually part of emergency response, concern opening emergency shelters (B) and evacuating unsafe buildings, closing unsafe streets, and relocating essential activities (C). Then, more information is collected about both the damage (D) and the geologic stability of ground failure areas (E), and decisions about demolitions are made (F). These actions set the stage for beginning recovery – finding temporary space for displaced businesses and residents (G and H) and adopting procedures to process permits for repairs and early rebuilding (I). The emphasis then turns to planning for rebuilding with a long task to prepare a reconstruction plan for a heavily damaged area (J).

The last step in each of these tasks is to estimate how long it would take to complete the task after a real earthquake. The estimates for each task will be recorded on timeline included as *Handout 2*. In Task K, players will have a chance to compare their estimates with those based on studies of recovery from recent earthquakes and they will also recap decisions made in Tasks A–J. The exercise ends with the development of a set of high-priority actions to reduce earthquake risk (L).

All the tasks can be accomplished using typical local government background documents, such as the general plan and zoning ordinance, supplemented by handouts provided in this manual. A specific product or products will emerge from each task, often providing input to subsequent tasks.

Throughout, it is important to remember that the primary value of the exercise is in the process, rather than in the products. It is designed to familiarize staff members, who may be unfamiliar with their recovery responsibilities, with their likely tasks after a damaging earthquake. As with any exercise, it is a first step. Having learned something of the process and problems, players will need to take further actions to reduce potential damage and prepare for the inevitable tasks of rebuilding.

Overview of this Manual

This manual contains most of the information needed for you to facilitate the tasks and for the players to complete the tasks. In the section labeled **"Exercise Tasks"** you will find a series of tabs identifying each exercise task. Behind each of these tabs is a script, a one-page instruction sheet for doing the task, and, for some tasks, handouts to be used by players during the task.

Scripts. Each task is introduced with a scripted slide show. The script may be read or paraphrased. Each script tells what the task is, why it is important, and how it has been carried out after recent earthquakes. Slides, noted in bold face italics, are used to illustrate the script; these headings are not meant to be read aloud. The section in this manual labeled **"Slides"** contains an index to the slides.

Instructions. The instruction page is to be duplicated and included in the packet for each player. This page states the purpose of the task and lists the materials that will be needed to complete it, including handouts. Then, the specific steps required to do the task are listed, followed by a description of the product or products the task will generate.

Handouts. Handouts, too, should be duplicated and included in the packets. Some provide information essential to the task, such as definitions of seismic hazards and types of hazardous buildings. Others are forms to be filled out as a product of the task.

The final section of this manual, labeled **"Additional Resources,"** lists useful documents on earthquake recovery and mitigation.

Recommended Participants

The exercise has three categories of participants:

- **Facilitator(s) –** the person or persons responsible for organizing the exercise, providing information to the players before, during, and after the exercise, and conducting the actual exercise.

- **Players –** those carrying out the prescribed exercise tasks.

- **Observers –** people invited to learn from the exercise by watching.

Who exactly should participate in each of these categories? The exercise is designed with the following assumptions about participation.

Facilitator(s). The facilitator should be skilled in running meetings and knowledgeable about seismic hazards, long-term recovery from earthquakes, and seismic hazard mitigation. Someone from your state's emergency management agency, hazard mitigation office, or emergency services department could facilitate the exercise for your community. The facilitator could also be a community's emergency services coordinator or other staff member. Because the exercise emphasizes planning issues during recovery, a community's city planner could be an excellent facilitator, either alone or working with someone with emergency management expertise. A consultant with appropriate qualifications is a possible choice. The facilitator must have the full support of the community's chief administrative officer and be authorized to ask assistance from staff members in preparing for the exercise.

Players. The players should include 8 to 12 local government senior staff members, selected by the city or county manager. The staff members who would deal with planning issues after an earthquake should be involved. Examples are the planning director, city or county manager, building official, public works director, emergency services coordinator, city or county engineer, and city or county geologist or consulting geologist, if the jurisdiction has one. It is also helpful, particularly in the early tasks, to involve the police and fire departments. It is wise, however, to alert them that this is not an emergency response exercise and that others on the staff will probably be taking the lead. Members of local political bodies and citizen organizations may also be invited to participate at the discretion of the jurisdiction.

Observers. Allowing non-players to observe the exercise is an effective way to spread the benefit; however, it is optional. The decision would be made by the facilitator and the participating jurisdiction. Observers could be other staff members from participating departments, staff members from non-participating departments, elected or appointed local officials, and community representatives. Staff members from other nearby jurisdictions might also be invited. By including observers, a jurisdiction would be increasing the impact of the exercise as a learning tool.

Recommended Schedule

The exercise can be completed in an 8-hour day. It is fast-paced, calling for intensive effort from the players during the playing period. The schedule is deliberately tight to give players some sense of the pressure and tension that would pervade such tasks after a real earthquake. The recommended one-day schedule is shown on the following page.

As an alternative, a one and one-half day schedule works easily, breaking for the first day after Task J and continuing with Tasks K and L on the second day. One exercise test was done with this format and the final two tasks were conducted during a working lunch.

Exercise Day	
8:00-8:25	Introduction to Tasks
8:25-9:30	Task A.
9:30-9:50	Task B.
9:50-10:10	Task C.
10:10-10:30	Break
10:30-10:55	Task D.
10:55-11:15	Task E.
11:15-11:35	Task F.
11:35-12:00	Task G.
12:00-1:00	Lunch
1:00-1:25	Task H.
1:25-1:50	Task I.
1:50-3:05	Task J.
3:05-3:25	Break
3:25-3:45	Task K.
3:45-5:00	Task L.

Materials Needed for Exercise

To conduct the exercise, you will need to assemble some readily available supplies and standard local documents. Below are lists of materials needed for the exercise.

Supplies. Supplies include slide projector, screen, marking pens, map overlay material (such as acetate, tracing paper, or mylar), tape, and push pins. A flip chart or blackboard might be useful for the recorder to use during the exercise. Also, a display timer, such as a kitchen timer, might be useful for you and the players to keep track of time during the exercise.

Base Maps. One or more copies of a base map of the community is essential. The map should be the largest scale available that can fit on the table which is to be used for the exercise. It should show major properties, highways and streets, major facilities, and if available, parcel boundaries. If the jurisdiction is geographically large, a table-top sized base map probably will not show individual parcels. If this is the case, a set of parcel maps should be available. Map sheets can be assembled during the exercise to cover areas selected by the players for reconstruction planning.

Documents. The instruction sheets contain a list of "materials" to use for each task. Most of these are common local government documents and should be readily available. If documents are not available, the tasks can still be done using the players' knowledge of the community. Documents which should be collected if available are:

- Community plan and plan diagram;
- Earthquake and geologic hazard maps and related information;
- Emergency response plan, including shelter plans;
- Redevelopment plans or downtown plan;
- Zoning maps;
- Procedures for processing planning and building permits;
- Map of existing land use;
- List of unreinforced masonry buildings or other hazardous buildings; and,
- List, and possibly a map, of historic buildings.

Other relevant materials, such as census data and soils and geologic report requirements, may be helpful and should be provided as a resource to the players, if readily available.

Player Packets. You will need to provide each player with an exercise packet, containing a total of 29 pages, including the instructions for each task (12 pages) and handouts (17 pages). You may also wish to provide packets to observers so they may follow the action. The packets should be clipped (not stapled) for easy use and collated to match the sequence of the tasks in the exercise. A complete list of the packet contents and the order in which they should be assembled follows.

Exercise Packet Contents

Handout 1. Exercise Schedule
Handout 2. Earthquake Recovery Timeline
Handout 3. Color Key for Mapping Information
Handout 4. Tasks Leaders and Other Assignments
Handout 5. Recommended Actions
Instructions – Task A. Damage Scenario
Handout A.1. Earthquake Hazards
Handout A.2. Buildings Vulnerable to Earthquake Damage
Instructions – Task B. Emergency Shelter
Instructions – Task C. Closure and Relocation
Instructions – Task D. Damage Assessment
Handout D.1. Damage Assessment
Instructions – Task E. Geologic Evaluation
Handout E.1. Special Controls for Geologic Hazard Areas
Instructions – Task F. Demolition
Instructions – Task G. Temporary Business Sites
Instructions – Task H. Temporary Housing
Instructions – Task I. Permit Processing
Handout I.1. Recommended Changes in Permit Procedures
Instructions – Task J. Reconstruction Planning
Handout J.1. Planning Opportunities
Instructions – Task K. Timing and Recap
Handout K.1. Model Timeline
Instructions – Task L. Reducing Risk
Handout L.1. Checklist of Actions to Reduce Earthquake Risk *(2 pages)*
Handout L.2. High-Priority Action to Reduce Earthquake Risk
Handout L.3. Contacts for Technical and Financial Assistance

Suggestions for Conducting the Exercise

1. For players, select high-level staff persons from 8 to 12 departments to form a small working group in which each player can interact freely with all others. Invite additional staff members to observe.

2. The success of the exercise depends on total concentration of all players for the entire day. If possible, arrange to conduct the exercise away from the normal work place to reduce chances for interruption.

3. Find a room that can be darkened for showing slides. The room should have a table the players can sit around to work on the maps and a wall on which maps may be attached with tape or push pins.
4. Provide for refreshments during the breaks. Thinking burns up energy.

5. The exercise is tightly timed. Let players know that they must be on time for the exercise and clear their schedules to prevent interruptions.

6. Exert control to keep the exercise on the time schedule. Discussion should be discouraged while you are reading the scripts. Discussion can take place while the players are working on the tasks.

7. If the jurisdiction has an older downtown, a clearly unstable hillside, or other area where concentrated earthquake damage is an obvious possibility, it may be possible to anticipate the areas the players will select as having concentrated damage. You may wish to assemble parcel maps for such areas before the exercise. However, it is still important to have parcel maps for the entire jurisdiction available on exercise day to give the players the full range of options in creating their scenario.

8. The scripted slide show can be adapted to match local needs. One useful adaptation is to include slides of local buildings and hazards areas together with slides in Task A. Damage Scenario, showing similar buildings damaged or similar areas with failed ground. The juxtaposition of damaged structures and areas with similar, undamaged examples in the community is a very effective way to add realism to the scenario task.

Checklists

Before Exercise

- ❑ Obtain authorization from CAO, council, or other appropriate body.
- ❑ Set date and time.
- ❑ Reserve meeting room.
- ❑ Determine players and arrange with the CAO for them to participate.
- ❑ Invite observers, if desired.
- ❑ Arrange for slide projector and screen.
- ❑ Obtain materials such as map overlays, marking pens, push pins, and tape.
- ❑ Obtain copies of the jurisdiction base map and parcel maps.
- ❑ Arrange for documents to be provided by jurisdiction as listed on page 5.
- ❑ Assemble player packets.
- ❑ Study task scripts and instructions.
- ❑ Place the slides in order in slide carousels.

During Exercise

- ❑ Use the script and slides to introduce the exercise and each task.
- ❑ Time the tasks.
- ❑ Answer questions and "facilitate" the timely completion of tasks.
- ❑ Help assemble parcel maps after selection of damaged areas in Task A.
- ❑ Oversee creation of the timeline and compare with model timeline.
- ❑ Oversee creation of a set of high-priority actions to reduce earthquake risks.

After Exercise

- ❑ Continue work with players on the high-priority actions to reduce earthquake risk.

Exercise Tasks

The following series of tabbed sections contain most of the information needed for you to facilitate the tasks and for the players to complete the tasks. Behind each of the tabs is a script, a one-page instruction sheet for doing the task, and, for some tasks, handouts to be used by players during the task.

Scripts. Each task is introduced with a scripted slide show. The script may be read or paraphrased. Each script tells what the task is, why it is important, and how it has been carried out after recent earthquakes. Slides, noted in bold face italics, are used to illustrate the script; these headings are not meant to be read aloud.

Instructions. The instruction page is to be duplicated and included in the packet for each player. This page states the purpose of the task and lists the materials that will be needed to complete it, including handouts. Then, the specific steps required to do the task are listed, followed by a description of the product or products the task will generate.

Handouts. Handouts, too, should be duplicated and included in the packets. Some provide information essential to the task, such as definitions of seismic hazards and types of hazardous buildings. Others are forms to be filled out as a product of the task.

SCRIPT—INTRODUCTION TO TASKS
(Time allotted for script: 15 minutes)

Slide 1. Earthquake Recovery and Mitigation: An Interactive Exercise for Local Government.

This is an interactive exercise on earthquake recovery and mitigation designed for local government officials. The exercise introduces you to some of the tasks you will face when a damaging earthquake strikes your community.

Slide 2. Exercise Tasks.

The exercise is organized into a series of twelve tasks which are to be completed in sequence. The tasks are listed on the screen. The tasks are identified by the letters "A" through "L."

The exercise starts immediately after a damaging earthquake has struck your community. In the first task (Task A), you create a damage scenario on a map of your community showing areas you think will be most damaged in an earthquake. The scenario is the basis for the rest of the tasks.

Next come emergency phase tasks: Task B, concerning the opening of emergency shelters; and Task C, dealing with cordoning off unsafe areas, rerouting traffic, and relocating essential activities. Then, more information is collected about both the damage (Task D) and the geologic stability of ground failure areas (Task E). In Task F, you will decide which buildings must be demolished. The next tasks set the stage for early recovery: finding temporary space for displaced businesses and residents (Tasks G and H) and adopting procedures to process permits for repairs and rebuilding (Task I).

The emphasis then turns to planning for rebuilding with Task J to identify opportunities for change and prepare a reconstruction plan for a heavily damaged area. Finally, the recovery portion of the exercise ends with a discussion of how long actual rebuilding will take and a recap of the results of Tasks A through J (Task K). Then we turn our attention to reducing risk: actions that can be taken beforehand to avert earthquake losses and prepare for rebuilding (Task L).

Slide 3. Exercise Schedule.

Here is a schedule of the exercise showing the amount of time allocated to each task. You each have a copy of this schedule in your packet (Handout 1). Times range from 20 to 75 minutes. The amount of time allocated to each task will seem much too short. This simulates, to some degree, the time pressure you will experience after an earthquake.

In addition to time for the tasks, this introduction will take about 20 minutes, and you will have a 20 minute break in mid-morning and mid-afternoon. One hour is allocated for lunch. The entire exercise will take 8 hours and we should be finished by 5:00 this afternoon.

Slide 4. Exercise Purpose.

The primary purpose of the exercise, shown here, is to improve the ability of local governments to recover from damaging earthquakes. Some of the ways this can be accomplished are listed here.

- Training non-emergency personnel in recovery tasks. Fire fighters and police officers receive training to prepare them to handle disasters; most other staff people rarely do. This exercise is designed to train non-emergency staff in tasks that come after emergency workers are through.

- Passing on experience from cities that have rebuilt. An ever-increasing number of jurisdictions have had damaging earthquakes. The exercise content draws from these experiences.

- Providing a chance for hands-on experience. The exercise gives you a chance to apply general information about recovery and rebuilding to your specific circumstances.

- Encouraging preparations for recovery and rebuilding. The exercise will help you see how you can prepare now to handle typical recovery tasks more effectively after an earthquake.

- Encouraging actions to reduce earthquake damage. Once you see how tough recovery will be, you will want to initiate actions now to reduce the potential damage in your community.

Slide 5. Topics not Included.

The exercise covers common elements of physical recovery and rebuilding after earthquakes. However, to create an exercise that can be done in one day, we have left out important aspects of response, recovery, and rebuilding. The slide lists some significant omissions. Most of emergency response is not covered, such as search and rescue, debris removal, treating the injured, and so on. Economic and fiscal matters are only tangentially included, although they certainly impact recovery. Repair or replacement of urban infrastructure, such as transportation and communication networks, utilities, and so forth, is not emphasized in the exercise. FEMA disaster assistance programs and requirements are not incorporated into the exercise, but you need to recognize that FEMA requirements will affect nearly every post-earthquake activity.

Also, the exercise does not reflect the political context in which all recovery decisions will be made. As you work the exercise, it will help to keep in mind the major political issues in your city. After an earthquake, there may be a brief suspension of political rivalries, but this does not last long. Most likely, political animosities will soon reappear enhanced by the stresses of recovery. People are likely to feel that repairs and rebuilding are taking too long and the procedures and permits you require may be seen as obstacles to the quick repair and rebuilding of damaged homes and businesses. What you can and cannot accomplish will depend a great deal on political factors.

Slide 6. Flood Recovery Timeline.

This is a timeline showing typical lengths of time to accomplish the tasks in the exercise after a real earthquake. One reason for showing this now is to indicate how lucky you are that today you get to do the tasks one at a time. As you can see, after a real earthquake, you will be doing many of them simultaneously.

The timeline has a variable scale. The first section covers one week and each box represents a day. The second section covers the 2nd, 3rd, and 4th weeks after the earthquake and each box represents a week. The third section completes the first year after the earthquake. The second month gets two boxes, and after that there are two months per box. The final section goes to 10 years after the earthquake. The second year gets two boxes, and after that there are two years per box.

You have copies of the timeline in your packet with just the beginning times shown for each task (Handout 2). You will be asked to estimate how long you think it would take to complete each task after a real earthquake. Later today, you will have a chance to compare your timeline with this one.

Slide 7. Task Structure.

Each task in the exercise is organized the same way.

Introduction. Each task is introduced with a slide presentation with background information to help you with the task. In many tasks, the slides show how the task has been handled by cities after real earthquakes. The introductions average about 5 minutes.

Instructions. Your packet contains one-page instruction sheets telling you the steps to take to complete each task. You will want to take time to read the instructions before you start work.

Handouts. For some tasks you will find handouts in your packet. Some provide background information to help you do the task; others are tables to be filled out during the task.

Products. You will produce something in every task. Products consist of information added to maps, completed tables, and entries on the Earthquake Recovery Timeline.

Slide 8. What Players Need.

You do not need to be an earthquake or recovery expert to do these tasks. You need working knowledge of your city and some sense of the effects of earthquakes. The actual materials you need are all here and include:

Background Documents. ***(Change to list items actually provided.)*** Community plan and land use diagram, zoning ordinance and maps, census data, maps of geologic hazards, permit procedures, redevelopment plan, and emergency plan. You may also have a list of historic buildings and unreinforced masonry buildings. You can refer to these items throughout the exercise as questions arise.

Base Map and Pens. Here is a base map covering the city. You will be recording information on this map throughout the exercise. You also have a set of colored pens for adding information to the map along with a key indicating the color to use for each category of information to be mapped. The key is in your packet as Handout 3. You also have materials for making overlays.

Observers. All the people in this room are potential resources and you may call on them for help at any time during the exercise.

Slide 9. Getting started.

Before you start the exercise, you need to organize yourselves to do the work. First, you need to select a player to take the lead on each task. The selections can be recorded on Handout 4 in your packet. The task leader will be responsible for keeping the discussion on track, perhaps assigning parts of the task to different players, and helping the group reach some decisions before the timer goes off. We will also ask the leader to give a two-minute (or less) summation of the results at the end of each task.

You also need to select a player to be group recorder. This should be someone whose job responsibility is somewhat peripheral to the topics covered in the exercise. For example, the planning director or building official would not be a good choice, but the city clerk or personnel director might be. This person will fill out the handouts, paying special attention to completing Handout 5. Recommended Actions. The recorder will recap the list of recommended actions as part of Task K.

In addition, you may want to select the artist among you to draw on the map. And, remember the background materials here. Also, don't forget that any of the observers in the room may be used as a resource.

Turn off slide projector; turn on lights.

Now, open your packet and review Handouts 1 through 5. Take a minute to look them over. Then, go right to selecting the players to fill the various roles. We will start the slide introduction to Task A as soon as you have finished the selections.

Handout 1

EXERCISE SCHEDULE

			Minutes
8:00 - 8:25	Introduction		25
8:25 - 9:30	Task A.	Damage Scenario	65
9:30 - 9:50	Task B.	Emergency Shelter	20
9:50 - 10:10	Task C.	Closure and Relocation	20
10:10 - 10:30	*Break*		*20*
10:30 - 10:55	Task D.	Damage Assessment	25
10:55 - 11:15	Task E.	Geologic Evaluation	20
11:15 - 11:35	Task F.	Demolition	20
11:35 - 12:00	Task G.	Temporary Business Sites	25
12:00 - 1:00	*Lunch*		*60*
1:00 - 1:25	Task H.	Temporary Housing	25
1:25 - 1:50	Task I.	Permit Processing	25
1:50 - 3:05	Task J.	Reconstruction Planning	75
3:05 - 3:25	*Break*		*20*
3:25 - 3:45	Task K.	Timing and Recap	20
3:45 - 5:00	Task L.	Reducing Risks	75

EARTHQUAKE RECOVERY TIMELINE

TASKS		Day						Week				Month							Year						
		1	2	3	4	5	6	1		2	3	1		2	4	6	8	10	1		2	4	6	8	10
A. Damage Scenario	➡																								
B. Emergency Shelter	➡																								
C. Closure and Relocation		➡																							
D. Damage Assessment					➡																				
E. Geologic Evaluation										➡															
F. Demolition			➡																						
G. Temporary Business Sites										➡															
H. Temporary Housing												➡													
I. Permit Processing										➡															
J. Reconstruction Planning												➡													
REBUILDING														➡											

Handout 3

COLOR KEY FOR MAPPING INFORMATION

Brown	Geologic Hazard Areas
Orange	Concentrated Damage Areas
Purple	Damaged Major Facilities
Blue	Emergency Shelters Alternate Locations for Major Facilities
Red	Cordoned-off Areas Red-Tagged Buildings
Yellow	Yellow-Tagged Buildings
Green	Temporary Business Sites Temporary Housing Sites
Black	Infrastructure

Handout 4

TASK LEADERS AND OTHER ASSIGNMENTS

TASKS	LEADERS
Task A. Damage Scenario	
Task B. Emergency Shelter	
Task C. Closure and Relocation	
Task D. Damage Assessment	
Task E. Geologic Evaluation	
Task F. Demolition	
Task G. Temporary Business Sites	
Task H. Temporary Housing	
Task I. Permit Processing	
Task J. Reconstruction Planning	
Task K. Timing and Recap	
Task L. Reducing Risks	

Mapper: ________________________________

Group Recorder:__________________________

Handout 5

RECOMMENDED ACTIONS

TASKS	ACTIONS	Priority ( )
Task A Damage Scenario		
Task B Emergency Shelter		
Task C Closure and Relocation		
Task D Damage Assessment		
Task E Geologic Evaluation		
Task F Demolition		
Task G Temporary Business Sites		
Task H Temporary Housing		
Task I Permit Processing		
Task J Reconstruction Planning		

SCRIPT—TASK A. DAMAGE SCENARIO
(Time allotted for script: 15 minutes)

Slide A.1. Task A. Damage Scenario.

The first task is to create a damage scenario. The only given is that ___________________ ______________________ *(your city)* has just been struck by a very damaging earthquake, causing extensive damage throughout the city. ____ ______________________________ *(areas)* have been particularly hard hit. Many houses, apartment buildings, and commercial buildings are heavily damaged. Unreinforced masonry buildings and other vulnerable structures fared poorly. Some highway overpasses have collapsed and several public buildings can no longer be used. Landslides and liquefaction failures have occurred in parts of the city.

The rest of this introduction presents information about the effects of earthquakes and the kinds of buildings most vulnerable to earthquake damage. This is to help you decide how a strong earthquake would likely impact your community and where the damage will be located.

Slide A.2. Damage in Long Beach, 1933.

Starting with earthquake effects, we look at this slide showing downtown Long Beach after a moderate 5.9 earthquake in 1933. The damage here was caused by ground shaking; no ground failures contributed to the destruction. Ground shaking causes most earthquake damage. It is especially hard on inadequately constructed buildings, like these unreinforced masonry buildings in Long Beach. Ground shaking damage can also be worse on filled ground, or in areas with deep, soft soils, such as alluvial valleys.

Slide A.3. Fault rupture, San Fernando earthquake, 1971.

Fault rupture also causes earthquake damage. This slide shows fault rupture of the ground surface in the 1971 San Fernando earthquake. Fault rupture is very destructive to structures built across the fault.

Slide A.4. House damaged by fault rupture, San Fernando, 1971.

Here is a house across the street from the fault rupture just shown. The rupture extends through the house damaging it beyond repair.

Slide A.5. Highway damaged by fault rupture, San Fernando, 1972.

Fault rupture is particularly hard on roads, pipelines, and other linear structures that must cross the fault. This shows a buckle in a highway from thrust faulting, also in the San Fernando earthquake.

Slide A.6. Landslide damaged school, Anchorage, Alaska, 1964.

Earthquakes can also trigger landslides causing additional damage. This photo shows the Government Hill landslide in Anchorage in 1964 which tore apart a school building. Because the earthquake occurred on Good Friday, children were not in the school. Landslides are a potential hazard on steep slopes, especially when the ground is saturated.

Slide A.7. Landslide on Route 17, Loma Prieta, 1989.

Earthquake-generated landslides can also damage roads and other lifelines. This huge landslide closed Route 17 over the Santa Cruz Mountains for days after the Loma Prieta Earthquake.

Slide A.8. Liquefaction damage in San Francisco Marina District, 1989.

Ground shaking can cause some soils to flow like a liquid resulting in failure of the ground surface. This is called liquefaction. Liquefaction caused severe damage to these apartment buildings in San Francisco's Marina District in the Loma Prieta earthquake. Note the deformed curbing and sand on the sidewalk in front of the buildings; this is material which temporarily liquefied and flowed out from under the pavement.

Slide A.9. Liquefaction damage to Struve Slough Bridge, Highway 1, 1989.

Railroads, highways, and highway bridges often become impassable due to liquefaction damage. Liquefaction in the soils underneath this bridge over Struve Slough on California's Highway 1 caused it to collapse in the 1989 earthquake. Highway 1 is a major north-south artery along the coast and traffic problems persisted for many months after the quake.

Slide A.10. Tsunami damage in Seward, Alaska, 1964.

This shows damage along the Seward waterfront from a tsunami, or giant sea wave, generated by an earthquake centered in Prince William Sound in Alaska in 1964. Tsunamis and seiches, or waves generated on lakes or enclosed bodies of water, are just two examples of the secondary effects of earthquakes. Others include fires, dam breaks, tank failures, or releases of hazardous materials. You will want to consider these secondary hazards as you create the damage scenario.

Slide A.11. Damaged hotel, San Fernando, 1971.

Now we turn to the kinds of buildings that are especially vulnerable to damage from earthquake ground shaking. This shows an unreinforced masonry building in San Fernando damaged in the 1971 earthquake. The furniture is in place, but the walls are gone. Unreinforced masonry buildings (or URM's) are buildings with brick, stone, or adobe bearing walls. In earthquakes, they tend to shake apart at the seams like this building. By locating your URM's, you locate areas which will surely have damage in earthquakes.

Slide A.12. Damaged reinforced concrete building, Mexico City, 1985.

Reinforced concrete buildings may also be dangerous in earthquakes. This shows typical cross-shaped failures in a reinforced concrete building in Mexico City in the 1985 earthquake. Buildings like this lack the flexibility needed to ride out earthquakes and are susceptible to pancake failures. In California, reinforced concrete buildings built before 1973 may be particularly hazardous.

Slide A.13. Failure of tilt-up industrial building in San Fernando.

This building was a tilt-up. As you can see the wall has completely fallen away, crushing the car parked in the "no parking zone." This occurred in the 1971 San Fernando earthquake. After that, the building code in California was changed, requiring that walls be firmly tied to roofs and floors; however, tilt-ups constructed before the mid-1970's are subject to failures like this.

Slide A.14. Damaged, old wood-frame house in Los Gatos, 1989.

Although wood-frame buildings generally do well in earthquakes, that is not always the case. Here is a historic wood-frame house in Los Gatos wrenched from its foundation in the Loma Prieta earthquake. Older wood-frame buildings are often inadequately tied to their foundations and may literally fall off in earthquakes.

Slide A.15. Damaged, new wood-frame house in San Fernando, 1971.

Even new wood-frame buildings may fail. This new house was destroyed in the 1971 San Fernando earthquake. This kind of failure is common in split-level houses with rooms built over garages. The garage, with its wide opening, lacks shear strength and can collapse in earthquakes.

Slide A.16. Damaged mobile home in Palm Springs, 1992.

This shows a mobile home which fell off its supports during the Palm Springs earthquake. This is a typical failure. Mobile homes have experienced heavy damage in past earthquakes.

Slide A.17. Damaged high-rise building in Mexico City, 1985.

High-rise buildings can be dangerous in earthquakes. This one in Mexico City lost glass windows and suffered failures in concrete beams and supports.

Slide A.18. Damaged irregularly-shaped building, Mexico City, 1985.

Irregularly-shaped buildings may do poorly in earthquakes like this one damaged in the 1985 Mexico City earthquake. They are more difficult to engineer and less predictable in their earthquake performance than rectangular structures.

Slide A.19. Olive View Hospital, soft-story failure, San Fernando, 1971.

This shows Olive View Hospital which was destroyed by the 1971 San Fernando earthquake. This is an example of what is called a "soft-story" failure like the split-level house we saw earlier.

Slide A.20. Detail of Olive View Hospital failure, San Fernando, 1971.

As you can see here, the building was basically supported on columns which failed in the earthquake causing the entire structure to drop. Buildings with open first floors may be vulnerable to failure like this.

Slide A.21. Now begin Task A.

Now it's time to begin Task A and create your own earthquake damage scenario. You have two handouts in your packets summarizing the information just presented—one defining earthquake hazards, and the other defining buildings vulnerable to shaking damage. Now please turn to the instructions for Task A in your packet. Take time to read the steps before you begin. Please ask for help, if you need it. You have 50 minutes to complete the task.

INSTRUCTIONS—TASK A. DAMAGE SCENARIO
(Time to complete the task: 50 minutes)

Purpose

To identify the significant impacts of the earthquake, using your best judgement based on the information you have available.

Materials

1. Base map of the community showing parcels, highways, streets, and major facilities.
2. Earthquake and geologic hazard maps and related information.

Handouts

A.1. Earthquake Hazards.
A.2. Buildings Vulnerable to Earthquake Damage.

Steps

1. Based on the information provided, and knowledge of the community, identify on the base map:
   a) at least one area where you expect landslides, liquefaction failures, and/or fault ruptures. These areas should be outlined and numbered. In later tasks, they are referred to as Geologic Hazard Area 1, 2, 3, and so forth **(brown)**.
   b) at least two groups of blocks where you expect concentrated building damage. At least one commercial and one residential block group should be included. These areas should also be outlined and numbered. In later tasks, they are referred to as Concentrated Damage Area 1, 2, 3, and so forth **(orange)**.
   c) major facilities such as hospitals, schools, government buildings, and high-rise buildings that you think are now at least temporarily unusable **(purple)**.
   d) highway overpasses, roads, and other transportation facilities which might have collapsed or been left impassable by the earthquake **(black)**.
2. Could any of this damage have been avoided? On *Handout 5. Recommended Actions,* list actions you can take now to avert damage in future earthquakes.
3. Estimate how long you think it would take in a real earthquake to complete the initial damage survey and report the results. Draw a line in the appropriate place on *Handout 2. Earthquake Recovery Timeline* to record your estimate.

Products

1. Base map showing the major impacts of the earthquake, including Geologic Hazard and Concentrated Damage areas.
2. Entry on *Handout 5. Recommended Actions.*
3. Entry on *Handout 2. Earthquake Recovery Timeline.*

Handout A.1

EARTHQUAKE HAZARDS

HAZARDS	DESCRIPTION	VULNERABLE AREAS
Enhanced Ground Shaking	Shaking of unusually strong intensity, long duration, or long period which is very damaging to structures.	Alluvial valleys; areas near streams and rivers; areas with deep, soft soil or unengineered fill; areas close to the fault.
Fault Rupture	Breaks in the ground surface from movement on a fault that can tear apart structures built on the fault.	Identified fault zones; areas near active faults.
Landslides	Downslope movement of soil and/or rocks shaken loose by the earthquake.	Slopes identified as unstable; often slopes over 30%.
Liquefaction	Sandy soils flowing like liquid when shaken. Occurs in saturated soils between clay layers and can cause collapse or tilting of overlying buildings.	Areas identified as having high water table and sand layers in clay soils; areas near bodies of water, streams, and rivers.
Tsunami	Huge sea waves caused by undersea landslides, fault rupture, or shaking.	Identified tsunami runup areas, coastal zones, beaches.

Handout A.2

BUILDINGS VULNERABLE TO EARTHQUAKE DAMAGE

BUILDINGS	DESCRIPTION	PROBLEMS
Unreinforced Masonry (URM)	Buildings with brick, stone, or adobe walls without any steel rods or other reinforcement. Can be warehouses, factories, retail and office buildings, apartment buildings, and public buildings such as city halls, libraries, and churches. Usually built before 1940 and often historic.	Very susceptible to shaking damage; unable to resist side to side movement. Walls often are not adequately tied to roofs and floors and tend to fall outward. Parapets and exterior decoration may fall.
Reinforced Concrete	Buildings with cast-in-place, reinforced concrete floors and roof slabs supported by concrete columns. Walls can be of reinforced concrete, masonry or other material. Older ones (in California, those built before 1973) may be particularly dangerous.	Often lack ductility, i.e., they break when bent or deformed. They can drift sideways pounding adjacent buildings during ground shaking. "Pancake" failures are common.
Tilt-ups	Buildings with reinforced concrete walls poured horizontally on site and then "tilted up" into place. Originally most were industrial buildings, but now also office and commercial buildings. Particularly hazardous if irregular in shape.	Walls fall away when not adequately tied to floors and roof, causing roof and floors to collapse.
Wood Frame	Most houses and small commercial buildings have wood frames. In California, those built after 1940 are generally safe in earthquakes. Earlier buildings may be poorly tied to foundations.	Old wood-frame buildings may slide or fall off foundations; cripple walls may fail; chimneys often fall causing damage to building.
Mobile Homes	Metal manufactured houses capable of being transported on wheels.	Frequently fall off foundations in earthquakes.
Other Buildings: High-rises Irregularly-shaped Soft Story	Buildings sometimes hazardous regardless of construction material are: buildings over 6 stories; L-, H-, or U-shaped buildings, domes, or other non-rectangular buildings; multi-level buildings with large, lower-level openings, such as split-level houses built partly over garages.	High-rises may crack, collapse, contort, lose glass and exterior decoration, and bang against adjacent buildings. Irregular buildings are harder to design for earthquake resistance and their performance is less predictable than rectangular buildings. Full or partial building collapse occurs when an unbraced opening fails.

SCRIPT—TASK B. EMERGENCY SHELTER
(Time allotted for script: 5 minutes)

Slide B.1. Task B. Emergency Shelter.

Task B is to estimate shelter needs and identify safe buildings and locations for shelters. Emergency shelters address the immediate and pressing human needs for food, shelter, and care after an earthquake. This is the first step in a long road to recovery for the victims of an earthquake.

Slide B.2. Red Cross disaster services center.

The Red Cross is responsible under federal charter for setting up and managing emergency shelters. This shows a Red Cross disaster services center tent set up in Watsonville right after the Loma Prieta earthquake. Red Cross mobilizes quickly and is typically on the scene very soon after a disaster.

Slide B.3. Emergency shelter at civic auditorium, Santa Cruz, 1989.

The slide shows an emergency shelter at the civic auditorium in Santa Cruz after the Loma Prieta earthquake. Shelter locations are usually predetermined. Schools, churches, armories, and other public buildings can be used, but schools are the most common. Under California state law, all public schools are possible shelter sites. If shelter costs are to be reimbursed by FEMA, Red Cross must approve shelter sites before they are opened.

Slide B.4. Tents in yards, Coalinga, 1983.

Not all displaced people use shelters. As shown here, in Coalinga, displaced homeowners pitched tents in their yards. Some also lived on their properties in RV's loaned to victims by a manufacturer. According to the Red Cross, about 25 percent of the people displaced by any disaster (including earthquakes) seek public shelter. The rest find shelter with family or friends or make other arrangements. Lower-income people and people without family or social ties in the community are most likely to need shelter.

Slide B.5. Tents in Watsonville park, 1989.

Sometimes, tents in parks are used for emergency shelter. In this picture taken about 3 weeks after the Loma Prieta earthquake, we see tents set up in a community park in Watsonville. This type of sheltering is often preferred by immigrants from countries with buildings poorly constructed for earthquakes. They have often heard of or been through earthquakes with heavy life loss from collapsing buildings and may be afraid to enter any building after an earthquake. To them tents seem safer.

Slide B.6. Now begin Task B.

Now turn to the instructions for Task B. You have 15 minutes to complete it.

INSTRUCTIONS—TASK B. EMERGENCY SHELTER
(Time to complete the task: 15 minutes)

Purpose

To determine emergency shelter needs and how to meet them.

Materials

1. Base map with damage information from Task A.
2. Emergency response plan.

Steps

1. Based on the information from Task A and the impact of the earthquake on residential areas, make a judgement about how many housing units are uninhabitable or inaccessible and how many people are without shelter (number of households X persons per household). Assume that 25 percent of displaced people will need publicly-provided emergency shelter. Enter your number below.

   Number of people needing emergency shelter: ____________

2. On the base map outline the shelter locations designated in your emergency response plan, if the information is in the emergency response plan; otherwise, use your knowledge of existing land uses to identify sites **(blue)**.
3. Decide how many shelters to open to accommodate those in need, using the best information you have about shelter capacities. Then choose which shelters to open, reviewing the damage information to make sure that you select ones that are safe to use. Fill in the selected sites on the base map **(blue)**.
4. Discuss any problems you identified in planning for emergency shelter, and on *Handout 5. Recommended Actions,* list actions you can take now to improve your ability to shelter displaced people.
5. Estimate when you think the last emergency shelter will be closed. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. Base map showing location of possible emergency shelters and the ones you have opened.
2. Entry on *Handout 5. Recommended Actions.*
3. Entry on *Handout 2. Earthquake Recovery Timeline.*

SCRIPT—TASK C. CLOSURE AND RELOCATION
(Time allotted for script: 5 minutes)

Slide C.1. Task C. Closure and Relocation.

Task C deals with controlling access to potentially dangerous areas, buildings, roads, and highway structures, pending further study. The purpose of access control is to prevent further death or injury, particularly during aftershocks. The task also asks you to identify alternate traffic routes and sites for relocation of essential activities displaced from damaged buildings.

Slide C.2. Early posting in Watsonville, 1989.

This shows a hand-written sign put in place quickly in Watsonville after the Loma Prieta earthquake to keep people out of the heavily damaged downtown area. Immediately after an earthquake, people spontaneously evacuate collapsed and distorted buildings and buildings with an obvious odor of gas. Emergency workers, both official and volunteer, also make decisions on the scene, helping people to evacuate seriously damaged buildings. Signs like this signal the beginning of the later, official process of determining where it is safe for people to be.

Slide C.3. Downtown Coalinga cordoned off, 1983.

This is downtown Coalinga after the 1983 earthquake cordoned off with yellow tape. The tape can be strung quickly around dangerous areas and buildings to control access. Road blocks installed at intersections also control access and redirect traffic. Large areas may be cordoned off initially because of uncertainty about the dangers. As engineers evaluate buildings, and dangerous buildings are repaired or demolished, the size of cordoned areas can be reduced.

Slide C.4. Chain-link fence, downtown Santa Cruz, 1989.

If hazardous conditions require controlled access for weeks, or even months, a more substantial means of control is needed. This shows a chain-link fence installed around Pacific Garden Mall in Santa Cruz after the Loma Prieta earthquake. The fence is not permanently anchored, making it easy to move as the size of the fenced area changes.

Slide C.5. Access control at chain-link fence.

Some access to the area is allowed to emergency workers, structural engineers, and business owners through the checkpoint shown here. People want access to their properties very soon after an earthquake, almost regardless of condition or risk. Within days of an earthquake, you will be making decisions about who can enter cordoned areas, for how long, and under what conditions. This is a very emotional and difficult management task.

Slide C.6. One-way traffic on Route 17 in Santa Cruz Mountains.

You may also need to redirect or manage traffic flow on damaged roads and highways. This shows cars being led by a pilot car around the slide on Route 17 after the Loma Prieta earthquake. The highway had been completely closed by the landslide shown earlier. At this time, one lane was reopened and the slide debris was still being cleaned up.

Slide C.7. Failure to the Cypress freeway structure, Oakland, 1989.

This shows the failed Cypress freeway structure in Oakland. Most earthquake damaged roads can be quickly patched up and reopened, but the loss of a major freeway section can take years to replace. In the meantime, alternate routes must be found. Alternate traffic routes established in both Oakland and San Francisco after Loma Prieta were still in place more than four years later and rebuilding had just begun.

Slide C.8. Damaged Oakland City Hall, 1989.

Loss of other public facilities also brings the need for immediate adjustments. This is the Oakland City Hall built in 1914. It suffered major damage in the 1989 earthquake; you can see the “X” crack visible at the base of the clock tower which is symptomatic of the serious structural failure throughout the building. The city hall was vacated shortly after the quake and remained closed. Repair and retrofit are not expected to be complete until 1995. Space for the hundreds of displaced office workers had to be found immediately after the earthquake.

Slide C.9. Now begin Task C.

Now, turn to the instructions for Task C. Your primary tool is the base map. You have 15 minutes to complete this task.

INSTRUCTIONS—TASK C. CLOSURE AND RELOCATION
(Time to complete the task: 15 minutes)

Purpose

To secure unsafe areas and structures, reroute traffic, and relocate essential activities.

Materials

1. Base map with damage information.

Steps

1. On the base map, outline areas to be cordoned off. Include:
   a) blocks with concentrated building damage where you think buildings could collapse in aftershocks or otherwise threaten public safety **(red)**.
   b) areas in, or next to, landslides, liquefaction failures, or fault ruptures which may be unsafe because of potential additional ground failure **(red)**.
2. On the base map, identify:
   a) highways, streets, and bridges that need to be closed for public safety. Also show alternate routes **(black)**.
   b) major buildings and public facilities that must be evacuated for public safety **(purple)** and alternate locations for essential functions which are displaced **(blue)**.
3. What problems cordoning off areas, rerouting traffic, providing traffic, providing access, and relocating essential services do you foresee? Could any be averted by planning ahead? On *Handout 5. Recommended Actions,* list actions that might be taken now to avoid the problems identified.
4. Estimate how long you think the cordoned-off areas will remain closed. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. Base map marked to show cordoned areas; closed highways and streets and alternate routes; major buildings and public facilities closed and sites for relocation of activities.
2. Entry on *Handout 5. Recommended Actions.*
3. Entry on *Handout 2. Earthquake Recovery Timeline.*

SCRIPT—TASK D. DAMAGE ASSESSMENT

(Time allotted for script: 5 minutes)

Slide D.1. Task D. Damage Assessment.

Task D is to assess the earthquake damage. This task fine tunes the damage scenario completed in Task A, looking beyond areas to individual buildings. After a real earthquake, detailed damage assessments of all damaged buildings are required for disaster assistance. You also need this information to grasp the magnitude of the needed recovery and rebuilding effort.

Slide D.2. Inspector at work in Hollywood after Northridge earthquake, 1994.

Here are building inspectors assessing damage in Hollywood after the Northridge earthquake in 1994. Damage assessment is usually carried out by building inspectors, civil and structural engineers, and sometimes architects—persons with sufficient training to allow them to distinguish dangerous from insignificant structural damage. Often local jurisdictions do not have enough qualified people to assess damage and must look for outside help. In California, the state has an arrangement with the Structural Engineers Association of California (SEAOC) to send engineers to stricken communities to help assess damage.

Slide D.3. Red tag.

The assessment results in the posting of all inspected buildings, usually with a red, yellow, or green tag. Here you see a red tag. This means "unsafe, do not enter or occupy." When in doubt, it is wise to err on the side of safety by using a red tag. It can be changed later to yellow or green based on more careful evaluation.

Slide D.4. Red-tagged house in Los Gatos, 1989.

And here is a red-tagged house in Los Gatos damaged in the Loma Prieta earthquake. As you can see, the house is severely contorted and may not be repairable.

Slide D.5. Yellow tag.

This shows a yellow tag which means "limited entry, off limits to unauthorized personnel."

Slide D.6. Yellow-tagged house in Ferndale, 1992.

And here you see a yellow-tagged house in Ferndale damaged in the Cape Mendocino earthquake in April 1992. You can see damage around the foundation, but it is not as serious as the damage to the Los Gatos house. The homeowners will probably have to hire a structural engineer to evaluate the house before they can repair and reoccupy it.

Slide D.7. Green tag.

This shows a green tag which means “inspected, no restriction on use or occupancy.” The actual colors used depend on the color paper available at city hall at the time of the earthquake. In Ferndale, blue tags were used instead of green and pink is a common substitute for red.

Slide D.8. Green-tagged house in Ferndale, 1992.

And, here is a green-tagged house, also in Ferndale. Although it has some damage, the inspectors did not judge it dangerous and this house may be occupied without restriction.

Slide D.9. Damaged historic house in Ferndale, 1992.

This shows a lovely restored Victorian severely damaged in Ferndale in the 1992 Cape Mendocino earthquake. Procedures for handling damaged historic buildings are more complex than for non-historic structures. Local governments are constrained by both federal and state regulations from permitting the demolition of historic buildings after disasters. So, it is important to identify historic buildings in the damage assessment.

Slide D.10. Removing belongings from damaged building, Santa Cruz.

The tagged system does not determine the fate of buildings, but determines conditions for entry of buildings until more definitive evaluations can be done. This slide shows people removing inventory from damaged businesses in downtown Santa Cruz. The buildings are red- or yellow-tagged and the area cordoned off as unsafe. As noted before, public decisions to permit such access are very difficult.

Slide D.11. Now begin Task D.

Please turn to the instructions for Task D to conduct your own damage assessment. You will also find Handout D.1.—a table to record the information. You have 20 minutes to complete this task.

INSTRUCTIONS—TASK D. DAMAGE ASSESSMENT
(Time to complete the task: 20 minutes)

Purpose

To determine the number of damaged buildings that are unsafe to reoccupy, either because they are in danger of collapse in an aftershock or are threatened by adjacent unsafe structures.

Materials

1. Base map with damage information.
2. Existing land use map or general plan land use diagram.
3. Lists of URM's (or other hazardous buildings) and historic buildings.

Handout

D.1. Damage Assessment

Steps

1. Based on information on the base map, a list of URM's, and your knowledge of the community's building stock, fill in *Handout D.1. Damage Assessment.* First, estimate the number of structures in each major land use category (residential, commercial, industrial, public) that will need to be inspected, and then estimate how many structures within each category you expect to be red-, yellow-, and green-tagged.
2. On the base map, using your best judgement, color parcels with red-tagged buildings **red** and parcels with yellow-tagged buildings **yellow.** Using the list of historic buildings, place a **black "H"** on parcels with historic buildings that are red- or yellow-tagged.
3. Could you be better prepared to conduct a post-earthquake damage assessment? On *Handout 5. Recommended Actions,* list actions that might be taken now to make this task easier after an earthquake.
4. Estimate how long you think it will take to assess all the building damage. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. *Handout D.1* classifying damaged buildings into four land use categories and three damage inspection categories.
2. Base map marked to show parcels with red- and yellow-tagged buildings, noting which are historic.
3. Entry on *Handout 5. Recommended Actions.*
4. Entry on *Handout 2. Earthquake Recovery Timeline.*

Handout D.1

DAMAGE ASSESSMENT

	RED-TAGGED	YELLOW-TAGGED	GREEN-TAGGED	TOTALS
Residential				
Commercial				
Industrial				
Public				
TOTALS				

Enter the number of buildings you think are in each damage category.

Definitions of Tagging System

Building Conditions	Tag Color	Meaning
Collapse, partial collapse, or building off foundation. Building or story noticeably leaning. Severe racking of walls, obvious severe damage and distress. Severe ground or slope movement present.	RED	UNSAFE No entry.
Damaged, but need more review to determine safety.	YELLOW	LIMITED ENTRY Enter at own risk.
No apparent structural hazard.	GREEN	INSPECTED Unrestricted entry.

SCRIPT—TASK E. GEOLOGIC EVALUATION
(Time allotted for script: 5 minutes)

Slide E.1. Task E. Geologic Evaluation.

In Task E you take a detailed look at the Geologic Hazard Areas identified in Task A and decide how to handle repairs and rebuilding in these areas. When ground failures have occurred, geologic studies may be needed to determine the potential for further failures. You may need to delay decisions on permitting repairs and rebuilding until geologic studies are completed.

Slide E.2. "Red Zone" in Santa Cruz Mountains.

This shows a map of part of the Santa Cruz Mountains drawn immediately after the Loma Prieta earthquake. The cross-hatched area is called the Red Zone, which encompasses most of the observed ground failures near the earthquake's epicenter. Initial geologic evaluation after an earthquake is usually done quickly by local geologists, often working as volunteers. They plot landslides, rock falls, ground cracks, and evidence of fault rupture quickly, before nature or man disturbs the record. The maps can then be used to delineate hazardous areas, like the Red Zone shown here, in which occupancy and repairs should be controlled. Typically, the areas are drawn large to encompass all land with a potential problem.

Slide E.3. Areas of critical concern within Red Zone.

This shows the next stage of evaluation in the Santa Cruz Mountains. Here is a map of part of the Red Zone showing "areas of critical concern" in yellow. This is a refinement of the Red Zone, reducing the size of the potentially hazardous area. In Santa Cruz County, most geologic hazards policies applied to these "areas of critical concern."

Slide E.4. Trench to locate fault.

Usually in areas with geologic hazards, property owners are required to obtain site-specific geologic information to determine if structures can be safely rebuilt and to establish siting and design conditions for repairs and rebuilding. This shows a trench dug across a suspected fault to determine the fault location. If an active fault trace is located, buildings can usually be safely set back from the trace.

Slide E.5. Geologist in bore hole.

Other kinds of subsurface investigation may be required. In this slide, a geologist is inside the bore hole reading the soils for his partner on top to record. The geologist in the hole is also taking soil samples for laboratory analysis to assess the potential for landsliding or liquefaction.

Slide E.6. Geologist out of bore hole.

And here is the geologist coming out of the bore hole. Often subsurface studies are not needed to determine the safety of a site for rebuilding. But in areas with ground disturbance, you almost always need a qualified geologist or engineering geologist to evaluate the situation before issuing permits for repairs or rebuilding. After the Loma Prieta earthquake, FEMA funded regional geologic studies in the Red Zone near the epicenter, but individual property owners are usually responsible for such studies.

Slide E.7. Collage of headlines re Santa Cruz Mountain rebuilding.

This collage of headlines about rebuilding in the Santa Cruz Mountains illustrates some of the policy issues that can come up when you are dealing with ground failures. In such areas, you may recommend that the city council delay or prohibit rebuilding of severely damaged buildings, apply special study and design requirements, or even order the demolition of intact buildings. You will find that such recommendations, no matter how justified for safety, will be controversial.

Slide E.8. Now begin Task E.

Now turn to the instruction page for Task E. You will also find a table for recording your decisions about special controls for each Geologic Hazard Area (Handout E.1). You now have 15 minutes to complete the task.

INSTRUCTIONS—TASK E. GEOLOGIC EVALUATION
(Time to complete the task: 15 minutes)

Purpose

To determine the safety of geologic hazard areas for rebuilding and to set conditions for rebuilding in such areas, pending further investigation.

Materials

1. Base map with damage information.
2. Information on geologic and earthquake hazards.

Handout

E.1. Special Controls for Geologic Hazard Areas.

Steps

1. Using the best information you have about the possible impacts of geologic hazards, select controls you will use for issuing permits to repair and rebuild in each Geologic Hazard Area outlined in **brown** on the base map. Use the table in *Handout E.1* to record your decisions.
2. What problems in geologically hazardous areas and in establishing conditions for rebuilding in these areas do you foresee? Could any be averted by planning ahead? On *Handout 5. Recommended Actions,* list actions that might be taken now to avoid the problems identified.
3. Estimate how long you think it will take to complete an initial geologic review of the Geologic Hazard Areas and establish conditions for rebuilding. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. *Handout E.1. Special Controls for Geologic Hazard Areas.*
2. Entry on *Handout 5. Recommended Actions.*
3. Entry on *Handout 2. Earthquake Recovery Timeline.*

Handout E.1

SPECIAL CONTROLS FOR GEOLOGIC HAZARD AREAS

SPECIAL CONTROLS	AREA 1	AREA 2	AREA 3	AREA 4
Minor repairs OK; no major repairs or rebuilding pending further study.				
Minor repairs OK with favorable geology report; no major repairs or rebuilding pending study.				
Minor and major repairs OK with favorable geologic report; no rebuilding pending study.				
Moratorium on all repairs and rebuilding.				
Other (specify).				

For each Geologic Hazard Area, check the appropriate box to indicate the special controls you think should apply to repairs and rebuilding.

SCRIPT—TASK F. DEMOLITION
(Time allotted for script: 5 minutes)

Slide F.1. Task F. Demolition.

This task is to decide which damaged buildings must be demolished to protect public safety and make way for rebuilding. Demolition decisions establish the slate for rebuilding. They are increasingly controversial and constrained by federal and state regulations.

Slide F.2. Debris removal in San Francisco, 1989.

Demolition occurs in stages. The slide shows the initial stage of demolition underway in the Mariana District of San Francisco a few days after the 1989 earthquake. Here, collapsed buildings are being demolished in what is essentially a part of debris removal necessary to clear the streets and eliminate unsafe conditions. This usually happens within days of the earthquake under emergency powers.

Slide F.3. Demolition of Cooper House in Santa Cruz.

After the damage assessment has been completed, demolition of red-tagged buildings deemed to threaten public safety may be ordered. Such an order resulted in the demolition of the historic Cooper House in Santa Cruz, shown here, about a month after the Loma Prieta earthquake.

Slide F.4. Later demolition, Whittier, 1987.

Later, property owners may seek permits to demolish buildings, particularly if they discover that the costs to repair exceed the costs to clear the site and rebuild. These decisions are also influenced by planning regulations, such as parking requirements and floor area ratios, and building code provisions. Here is a building coming down in Whittier after the 1987 earthquake.

Slide F.5. Damaged Embarcadero Freeway, San Francisco.

Finally, public bodies sometimes order the demolition of damaged, but repairable, structures to achieve significant community objectives. This shows the damaged Embarcadero Freeway at the end of Market Street in San Francisco. The Ferry Building is in the background.

Slide F.6. Embarcadero Freeway being demolished.

And here is the Embarcadero Freeway being demolished in the fall of 1991, about two years after the earthquake. Again you see the Ferry Building. The decision to demolish was not solely a technical or economic one, but reflected a political consensus that removing, rather than repairing, the freeway provided a welcome chance to redesign part of San Francisco's waterfront.

Slide F.7. Facade of County Bank building in Santa Cruz.

All demolition decisions are potentially controversial, especially when historic buildings are involved. A community which has just experienced the loss of familiar landmarks readily fights to preserve what remains. This shows a compromise made in Santa Cruz which lost many of its historic buildings. This damaged County Bank building was demolished except for the facade. The facade is now incorporated into a new building.

Slide F.8. Debris removal after 1985 Mexico City earthquake.

Demolition always results in a debris disposal problem. This shows trucks lined up to take debris to dump sites outside of Mexico City 5 months after the 1985 earthquake there. Few large U.S. cities have sufficient land-fill capacity to accept rubble after an earthquake. It makes sense to plan ahead for disposal.

Slide F.9. Now begin Task F.

Your job now is to decide which buildings must be demolished. Turn to the instructions for Task F. You have 15 minutes to complete the task.

INSTRUCTIONS—TASK F. DEMOLITION
(Time to complete the task: 15 minutes)

Purpose

To determine which buildings should be demolished.

Materials

1. *Handout D.1. Damage Assessment* from Task D.
2. Base map with damage information.

Steps

1. Using the information you recorded on *Handout D.1. Damage Assessment* and the damage information on the base map, determine which buildings must be demolished. Identify them on the base map with a **black "X".** Include the following:
   a) at least one-third of the red-tagged buildings, considering those most likely to threaten public safety. You may need to select these arbitrarily.
   b) at least one red- or yellow-tagged historic building.
   c) at least two red- or yellow-tagged buildings to be removed to create planning opportunities.
   d) at least one significant highway structure.
2. What problems demolishing buildings do you foresee? Could any be averted by planning ahead? On *Handout 5. Recommended Actions,* list actions that might be taken now to avoid the problems identified.
3. Estimate when the last earthquake-related demolition will occur. Enter the estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. Base map identifying buildings and other structures to be demolished.
2. Entry on *Handout 5. Recommended Actions.*
3. Entry on *Handout 2. Earthquake Recovery Timeline.*

SCRIPT—TASK G. TEMPORARY BUSINESS SITES
(Time allotted for script: 5 minutes)

Slide G.1. Task G. Temporary Business Sites.

In Task G, you will select sites for temporary business locations. Businesses that cannot open their doors soon after an earthquake usually fail, losing clients to competing businesses often in other jurisdictions. Quickly providing a place where displaced businesses can set up shop can help prevent business failures.

Slide G.2. Business operated on sidewalk, Coalinga, 1983.

Not all damaged businesses will needed new locations. Some, like this hardware store in Coalinga, will be able to patch up and reopen quickly, if only on the sidewalk. Local government can help this process by quickly removing debris and shoring damaged buildings so that commercial streets can be opened. Later they may clear the way for using public land, such as parks or parking lots, for temporary structures.

Slide G.3. Pavilions in Santa Cruz, 1989.

A wide range of temporary structures have been successfully used including pavilions, trailers, and public buildings. These pavilions successfully housed restaurants, a hardware store, a bookstore, and a variety of small shops displaced from Pacific Garden Mall in Santa Cruz. They were erected by local unions on a city parking lot, one block from the mall. The last one was removed in 1993.

Slide G.4. Trailers in Whittier, 1987.

This shows trailers used in Whittier after the 1987 earthquake. They were also located on a city parking lot in the damaged commercial area. Trailers were also used in Coalinga. Also in Coalinga, some former downtown businesses operated in the local community college gym.

Slide G.5. Gap for Kids sign in Santa Cruz, 1989.

Stores that are part of a chain have more resources for recovery than small local businesses. This shows downtown Santa Cruz with a sign indicating that Gap for Kids was in business. Most other stores in the district were not.

Slide G.6. Criteria for temporary business sites.

Good temporary business sites are vacant, accessible, and safe from further earthquake damage in aftershocks. They should be close to the damaged commercial district to encourage retention of patrons. The sites should be readily provided with utilities and plenty of parking. If private land is used, it is best if it is planned and zoned for commercial uses.

Slide G.7. Now begin Task G.

The instruction page for Task G tells you how to find temporary business locations. You have 20 minutes to complete the task.

INSTRUCTIONS—TASK G. TEMPORARY BUSINESS SITES
(Time to complete the task: 20 minutes)

Purpose

To provide sites and facilities for business operations until damaged commercial buildings can be repaired or replaced.

Materials

1. *Handout D.1. Damage Assessment*.
2. Base map with damage information and demolitions.
3. Community plan, redevelopment plan, or downtown plan.
4. Zoning maps.

Steps

1. Assume that at least 25 small businesses have been displaced and the owners cannot find suitable vacant space to relocate. The 25 businesses require about 2,000 square feet each. Select suitable sites for temporary commercial structures providing at least 50,000 square feet of space. Look for vacant and available sites; sites that are accessible, free from hazards from nearby buildings, and close to pre-earthquake locations; and, sites with utilities available, and plenty of parking. Outline the sites in green on the base map.
2. Could the businesses in your community be better prepared to survive an earthquake? On *Handout 5. Recommended Actions*, list actions that might be taken now to improve post-earthquake business survival.
3. Estimate how long you think the temporary space will remain in use. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. Base map showing sites selected for temporary business structures.
2. Entry on *Handout 5. Recommended Actions*.
3. Entry on *Handout 2. Earthquake Recovery Timeline*.

SCRIPT—TASK H. TEMPORARY HOUSING
(Time allotted for script: 5 minutes)

Slide H.1. Task H. Temporary Housing.

In Task H, you estimate the need for temporary housing and identify sites suitable for temporary housing structures. Temporary housing bridges the gap between the time emergency shelters close and permanent repairs and rebuilding are done. It is important to help keep that gap as short as possible for as many people as possible.

Slide H.2. Minor repairs being made to house.

After an earthquake, the first step is to seek permanent rehousing of as many households as possible. This shows a homeowner making minor repairs to a house in Ferndale right after the earthquakes there. By expediting permitting for minor repairs to homes and apartments, the need for temporary housing can be reduced.

Slide H.3. Vacancy sign.

Another approach is to relocate people to vacant apartments, or hotel or motel rooms in the community. Housing vouchers are sometimes issued by HUD to help families pay for this kind of temporary housing.

Slide H.4. Unreinforced masonry residential hotel.

However, in some cases, you may have no alternative but to provide temporary housing structures. Generally low-income households have the greatest and longest need for temporary housing. For example, most residents of the damaged St. George Hotel in Santa Cruz, shown here, were low-income elderly people with inadequate resources to pay market-rate rents. The St. George was demolished and during the more than 3 years it took to rebuild, its former residents needed temporary housing.

Slide H.5. FEMA trailers in Coalinga, 1983.

You may need to create a temporary housing development using trailers, RV's, prefab housing, or some other easily erected structure. Here is a FEMA trailer park in Coalinga which provided housing to earthquake victims for more than two years after the 1983 earthquake. FEMA may not provide trailers in the future and this source of temporary housing should not be relied on. You may need to find a local source for trailers, or seek other ways to meet the need for temporary housing. The FEMA trailers are now gone from this Coalinga site, which was privately owned, but it is still a mobile home park. Once the infrastructure for housing is in place, such property typically continues to be used for similar housing.

Slide H.6. Criteria for temporary housing sites.

Good temporary housing sites are vacant, accessible, and safe. They can be easily provided with utilities. If possible, they should be close to public services and the former neighborhoods of those being housed. Available public land is often used giving public control over reuse of the property when housing is removed. If private land is used, it should be planned and zoned for housing.

Slide H.7. Now begin Task H.

In the next 20 minutes, you are to estimate the need and select sites for temporary housing. Please turn to the instructions for Task H.

INSTRUCTIONS—TASK H. TEMPORARY HOUSING
(Time to complete the task: 20 minutes)

Purpose

To shelter people unable to find housing after the emergency shelters have closed and before damaged housing is repaired or replaced.

Materials

1. Number of people needing emergency shelter from Task B.
2. Base map with information and demolitions.
3. *Handout D.1. Damage Assessment.*
4. Community plan.
5. Zoning maps.

Steps

1. Review *Handout D.1. Damage Assessment* and your estimate of shelter population from Task B. From this information and your general knowledge of population characteristics such as income, ethnicity, age, and special needs, estimate the number of households needing temporary housing. Assume that at least 10 percent of the shelter population (divided by persons per household) or 30 households (which ever is higher) will need temporary housing structures.
2. Select sites to be used for trailers, prefab housing, or other forms of temporary housing. Consider that the selected sites could continue to be used for housing after the need for temporary housing has passed. Outline the selected temporary housing sites in **green** on the base map.
3. Does your community have adequate housing programs now which could be used to aid earthquake victims? On *Handout 5. Recommended Actions,* list actions that the community might take now to help people bridge the gap between emergency shelters and permanent rehousing.
4. Estimate how long you think temporary housing will be needed. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. Base map showing sites selected for temporary housing.
2. Entry on *Handout 5. Recommended Actions.*
3. Entry on *Handout 2. Earthquake Recovery Timeline.*

SCRIPT—TASK I. PERMIT PROCESSING
(Time allotted for script: 5 minutes)

Slide I.1. Task I. Permit Processing.

Task I is to estimate work load and staff needs to process permits for repair and rebuilding after an earthquake and recommend procedures for handling the work load. After an earthquake, the number of applications for building permits is many times the usual volume. You may face pressures to compromise standards and cut short your review to speed the permitting process. Yet, the safety of the rebuilt community depends on observing good building practices and competent review of permit applications.

Slide I.2. House with fallen chimney, Ferndale, 1992.

Usually some changes in procedures are needed after an earthquake. Some cities have authorized building officials and others to issue permits for minor repairs in the field during damage assessment. This house in Ferndale with a fallen chimney might be a candidate for such an "instant permit." Other cities have hired consultants to supplement their staffs. Most have waived building permit fees for a period of time.

Slide I.3. Earthquake Recovery Center, Santa Cruz County, 1990.

Santa Cruz County established a totally separate permit process to handle applications for repairs and rebuilding after the Loma Prieta earthquake. This shows a staff person at the County's Earthquake Recovery Center tracking permit applications. The center was staffed by a consultant team under direction of county staff, and handled all building permit applications, plan checks, and inspections for earthquake repairs and rebuilding for almost two years, while the regular county staff continued to process permits unrelated to earthquake damage.

Slide I.4. Booklets at Earthquake Recovery Center.

This shows booklets distributed by the center to help applicants with repairs. Eight months after the earthquake, the center was receiving 90 to 115 permits per week and conducting over 300 inspections. The goal was to complete all reviews in 10 working days, and this was usually achieved except for geologic review which added another 3 to 5 days.

Slide I.5. Damaged unreinforced masonry building, Whittier, 1987.

A difficult question regarding the process will be what standards to require for the repair of buildings which did not meet building code standards before an earthquake. This shows an unreinforced masonry building damaged in the Whittier earthquake. Should the city allow it to be repaired to its pre-earthquake condition? This is just one example of hard issues that come up about issuing permits. New standards will not be popular with building owners, but may be essential to protect public safety in future earthquakes.

Slide I.6. Now begin Task I.

Please turn to the instructions for Task I. You will also find in your packet Handout I.1.–a table to record your recommendations for changes in procedures. You have 20 minutes to complete this task.

INSTRUCTIONS—TASK I. PERMIT PROCESSING
(Time to complete the task: 20 minutes)

Purpose

To develop the organization and procedures to handle plan checking, permitting, and inspection for earthquake repairs and rebuilding.

Materials

1. *Handout D.1. Damage Assessment.*
2. Base map showing damage information and demolitions.
3. Procedures for processing planning and building permits.

Handout

I.1. Recommended Changes in Permit Procedures.

Steps

1. Based on *Handout D.1. Damage Assessment* and demolition information on the base map, estimate the number of building permit applications you expect for repairs and rebuilding. Assume that some proportion of green-tagged and uninspected buildings will also need permits for repairs. Enter your estimate on *Handout I.1.*
2. From Step 1 above and your knowledge of the permit process, estimate the staff needed to handle the work load and recommend how to acquire extra staff. Enter your estimate on *Handout I.1.*
3. Complete *Handout I.1.* listing changes in permit procedures to expedite permits for repairs and rebuilding.
4. Are there changes in your existing policies and regulations that could be made now to improve permit processing for post-earthquake repairs and rebuilding? On *Handout 5. Recommended Actions*, list actions that might be taken now to make this task easier after an earthquake.
5. Estimate how long expedited permit procedures will be needed. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. Estimates of work load and staffing needs to process permits for repairs and rebuilding recorded on *Handout I.1.*
2. Recommendations for changes in procedures on *Handout I.1.*
3. Entry on *Handout 5. Recommended Actions.*
4. Entry on *Handout 2. Earthquake Recovery Timeline.*

Handout I.1

RECOMMENDED CHANGES IN PERMIT PROCEDURES

ISSUES	RECOMMENDED CHANGES
Projects requiring building permits	
Information required with application	
Geotechnical review	
Architectural and design review	
Non-conforming uses	
Fees	
Turnaround time	
Other (list)	

Expected Number of Building Permit Applications: ______________________

Estimated Number of Staff Needed to Process Applications: _______________

SCRIPT—TASK J. RECONSTRUCTION PLANNING
(Time allotted for script: 15 minutes)

Slide J.1. Task J. Reconstruction Planning.

Task J is a major element of this exercise. In it, you will draw on all the information you have developed so far to identify planning opportunities inherent in the rebuilding process, and to prepare a reconstruction plan for at least one heavily damaged area. This task marks the beginning of a planning and rebuilding process that will dominate staff and political time for several years to come.

This introduction is longer than the others. It provides a brief overview of the experiences of U.S. cities in planning and managing rebuilding after earthquakes. We hope it will illustrate some of the pitfalls and potentials inherent in the process. We will go through the earthquakes and rebuilding experiences in chronological order starting with the 1964 Alaska earthquake.

Slide J.2. Damage on 4th Street in Anchorage, 1964.

The largest earthquake to strike the country this century was the 1964 Alaska earthquake rated as a Richter Magnitude 8.4. This is damage in downtown Anchorage caused by a massive landslide taking out buildings on Fourth Street. The left side of the street is sliding towards the port of Anchorage.

Slide J.3. Model of plan for rebuilding all of downtown Anchorage.

Planners often get excited about the opportunity to start from scratch after an earthquake, and plan for major shuffling of land uses. This happened in Anchorage with a plan to completely redevelop the downtown. Here is a model of an elaborate rebuilding plan prepared by a consultant team very quickly after the earthquake.

Slide J.4. Diagram of adopted plan for Fourth Street.

Like most such plans, the elaborate Anchorage plan did not come to pass. Instead, the city adopted a more modest plan shown here. The plan covers only the area affected by the Fourth Street slide. It is based on recommendations of the Army Corps of Engineers for stabilizing the slide. The green area is a buttress to stabilize the slide. The plan calls for light-weight buildings on top of the buttress. New roads on either side of the buttress join to cross a bridge to the port area.

Slide J.5. 4th Street buttress.

This shows the buttress as it appeared almost 15 years after the earthquake. It has instruments embedded in it which are monitored to be sure it remains stable.

Slide J.6. Mall built on top of buttress.

Here is a mall built on top of the buttress, on the side of 4th Street that slid. It is a low, light-weight building in accordance with the Army Corps of Engineers recommendations. On Fourth Street, Anchorage ended up with much safer development than before the earthquake.

Slide J.7. Damage in downtown Santa Rosa, 1969.

Turning to an earthquake closer to home. This shows damage to unreinforced masonry buildings in downtown Santa Rosa in two moderate 1969 earthquakes.

Slide J.8. Map of expanded Santa Rosa redevelopment area.

The city responded by expanding an existing redevelopment area and preparing a plan featuring a new shopping mall with pedestrian links to the repaired and strengthened downtown commercial buildings.

Slide J.9. Retrofit buildings in downtown, 1979.

A major feature of Santa Rosa's recovery effort was a program requiring the retrofit of the remaining unreinforced masonry buildings in downtown. These buildings, shown in 1979 (10 years after the earthquake), have been retrofitted. Note the cross braces in the windows of the building on the right.

Slide J.10. Retrofit buildings and site cleared for new mall, 1979.

A parallel effort has been the extension of redevelopment and the construction of a new shopping mall linked to the downtown. The slide shows retrofit buildings in part of the existing downtown next to land cleared for the mall. It was taken in 1979.

Slide J.11. Downtown Santa Rosa in 1986 showing new mall.

This shows the same street taken from the other direction. The entrance to the new mall is at the end of the street. This was taken in 1986 (more than 15 years after the earthquake) and the street trees have had about 7 years to mature. Recovery has been accomplished, but the strengthening of buildings is still going on.

Slide J.12. Damage in downtown Whittier, 1987.

Again a change of scene. This is downtown Whittier, called Uptown, after the 1987 earthquake. Unreinforced masonry buildings had been cosmetically upgraded without structural strengthening before the earthquake. Few survived and the city's investment in rehabilitation was lost.

Slide J.13. Plan for rebuilding "uptown."

And this is the plan adopted to guide rebuilding of Uptown. The plan does not propose major land use changes. Rather, it emphasizes restoring Uptown as it was before the earthquake. The plan recommends that new buildings be designed to be compatible with the undamaged and repaired buildings in Uptown. Brick facades are favored.

Slide J.14. Model buildings–all brick facade.

This model of a new building was submitted to the city. It features a brick facade as called for in the plan.

Slide J.15. Revise model–brick trim.

The owner found that a brick facade would be very expensive to build and proposed this alternative to the original design featuring brick trim.

Slide J.16. First downtown building constructed–no brick.

As further evidence of the compromises that often must be made in face of economic realities, here is the first new building constructed in Uptown after the earthquake. Note, no brick.

Slide J.17. Damaged Pacific Garden Mall in Santa Cruz.

And now we will turn to several examples from the Loma Prieta earthquake. This shows Pacific Garden Mall in Santa Cruz soon after the earthquake. The mall was created around 1970 with a one-way winding road, plenty of space for pedestrians, and restored, but not strengthened, buildings–many of them URM's. It was the center of community life in Santa Cruz and was virtually destroyed in the earthquake.

Slide J.18. Collage of issues addressed by Vision Santa Cruz.

Santa Cruz embarked on a complex and long planning process to determine the future of the mall. This collage hints at some of the issues. A committee of 36 people called "Vision Santa Cruz" was formed to give direction to the rebuilding effort.

Slide J.19. Model of downtown showing existing and proposed buildings.

As planning proceeded, citizens began constructing a model of the downtown to help them visualize the possibilities. This slide shows a part of the model on display in downtown Santa Cruz in 1992. The buildings in white are proposed buildings. When a new building is proposed, the applicant is expected to construct a model for the display.

Slide J.20. Opportunity sites, Santa Cruz.

After "Vision Santa Cruz" finished work on goals for rebuilding, the city retained consultants to define how the committee's goals could be met. This shows a diagram of "opportunity sites" done as part of this planning effort. Santa Cruz took more than two years with intensive citizen participation to complete the plan for rebuilding.

Slide J.21. Sign showing rebuilding underway, Santa Cruz, 1992.

This shows rebuilding underway in early 1992 in downtown Santa Cruz. Little rebuilding had occurred before this because the city completely replaced sewer and water lines, roads, and sidewalks along the mall. The infrastructure was old and in poor condition before the earthquake, and not worth repairing afterward. Little private rebuilding took place until the infrastructure was replaced.

Slide J.22. One of the first new buildings in downtown Santa Cruz, 1992.

Here is one of the first new buildings to open up in downtown Santa Cruz in early 1992. Prospects are good for a completely rebuilt downtown which is much safer than before the earthquake, but it is not going to happen as fast as the people and businesses in Santa Cruz would like.

Slide J.23. Damage in downtown Watsonville, 1989.

Now, we move south on Highway 1 to Watsonville. Its downtown area also was severely damaged in the earthquake as shown here.

Slide J.24. Inventory being moved from Ford's Department Store.

Here we see the removal of inventory from Ford's Department Store, the main downtown retail outlet. Although it doesn't look damaged in this view, the building had to be demolished.

Slide J.25. Sketch from a ULI workshop held in Watsonville.

The Urban Land Institute held weekend long work shops in both Santa Cruz and Watsonville to explore options for rebuilding. This shows a sketch created during the Watsonville workshop of downtown Watsonville rebuilt with a "Mexican Mercado" theme. Local residents really like the idea.

Slide J.26. Sign indicating rebuilding coming.

This sign indicates that new buildings are coming to Watsonville. But the mercado idea fell by the wayside as building proposals came in to essentially replace what was there before the earthquake.

Slide J.27. New Ford's department store open for business, 1992.

Here in early 1992 is the new Ford's department store at its original site and open for business. The town celebrated the return of Ford's to downtown, but it was not there for long. Ford's, which lost three stores in the Loma Prieta earthquake, filed for bankruptcy, citing the impact of the earthquake and the high cost of rebuilding the Watsonville store–the only one it chose to rebuild. Watsonville must still struggle with the fact that the earthquake changed the economics of doing business in downtown.

Slide J.28. Suggestions for reconstruction planning.

This slide summarizes a few suggestions from these examples to keep in mind as you start working on plans for rebuilding a damaged part of ______________________________ (*your city*).

- Be sure new and repaired buildings are safer.
- Avoid grandiose plans. Rebuilding plans should address only the specific needs of rebuilding.
- Capitalize on achievable opportunities. These will be specific and clearly related to the earthquake damage.
- Use redevelopment powers. Most rebuilding plans are redevelopment plans using tax increments to help finance public improvements.
- Understand and accept economic realities. Earthquakes change the economics of doing business. It is rarely possible to simply restore things as they were.
- Work closely with the private sector. Remember that local governments plan, but the private sector will do most of the rebuilding.

Slide J.29. Now begin Task J.

With that as background to stimulate thinking, you are ready to create your own plans for ______________________________ *(your city)*. Please turn to the instructions for Task J and Handout J.1. The handout is a table to help you identify opportunities for land use change. You have about 60 minutes to identify opportunities and create a reconstruction plan for a heavily damaged area of the city.

INSTRUCTIONS—TASK J. RECONSTRUCTION PLANNING

(Time to complete the task: 60 minutes)

Purpose

To identify opportunities for land use change and prepare a reconstruction plan for a damaged part of your community.

Materials

1. Base map showing parcels.
2. *Handout D.1. Damage Assessment.*
3. *Handout E.1. Special Controls for Geologic Hazard Areas.*
4. Community plan, redevelopment plan, and other plans.
5. Zoning maps.

Handout

J.1. Planning Opportunities.

Steps

1. Using the information accumulated on the base map and your knowledge of the community and its plans, identify opportunities for changes in land use and structures throughout the community that could improve seismic safety and achieve other community objectives. List the planning opportunities on *Handout J.1.*
2. Select at least one of the Concentrated Damage Areas or Geologic Hazard Areas for which you will prepare a Reconstruction Plan. Discuss the policies that should apply to rebuilding. Sketch the proposed land uses on an overlay of the base map. If appropriate, use a more detailed base map of the area you have selected.
3. What problems did you have in preparing a reconstruction plan? On *Handout 5. Recommended Actions*, list actions that might be taken now to prepare for this task.
4. Estimate how long you think it would take before reconstruction plans are adopted following an earthquake, allowing for full public participation. Record your estimate on *Handout 2. Earthquake Recovery Timeline.*

Products

1. *Handout J.1. Planning Opportunities.*
2. Overlay of base map showing land uses for the reconstruction plan.
3. Entry on *Handout 5. Recommended Actions.*
4. Entry on *Handout 2. Earthquake Recovery Timeline.*

Handout J.1

PLANNING OPPORTUNITIES

TYPES OF OPPORTUNITY	POTENTIAL OPPORTUNITIES
Reducing risks from earthquakes and other hazards.	
Eliminating non-conforming uses.	
Correcting plan/zoning inconsistencies.	
Realigning or improving roads.	
Improving housing conditions or affordability.	
Enhancing the local economy.	
Upgrading inadequate commercial, industrial, or public facilities.	
Improving urban design.	
Providing open space.	
Preserving historic buildings.	
Other (list).	

SCRIPT—TASK K. TIMING AND RECAP
(Time allotted for script: 5 minutes)

Slide K.1. Task K. Timing and Recap.

This is a summary task. It has two aspects. First, you will explore just how long it is likely to take to recover and rebuild from the earthquake and second, you will review the results of your work on Tasks A–J.

Slide K.2. Earthquake Recovery Timeline.

Throughout the exercise, you have been creating a timeline like this with estimates of how long you think each task would take in real life. Now, you will be reviewing your estimates and considering how long it will take before rebuilding is complete. Generally, actual rebuilding takes longer than a community expects and this fact often causes political problems. It helps to have a realistic notion of timing at the outset.

Slide K.3. Exercise in Los Angeles, California.

Here are players doing this exercise in Los Angeles. Like them, you have grappled with many issues about recovery after an earthquake. Part of this task is to stop and review your experience so far today. What is the result of your efforts? Do you have a new sense of what it might be like if a damaging earthquake struck ______________________________ *(your city)?* Did you become aware of problems that you can address now, before an earthquake?

Slide K.4. Now begin Task K.

You have 15 minutes to complete the timeline and recap your work so far. The instruction for Task K and the model timeline (Handout K.1) are in your packet.

INSTRUCTIONS—TASK K. TIMING AND RECAP

(Time to complete the task: 15 minutes)

Purpose

To estimate how long recovery and rebuilding will take and review the major results from working Tasks A–J.

Materials

1. *Handout 2. Earthquake Recovery Timeline* showing estimates for Tasks A–J.
2. *Handout 5. Recommended Actions.*

Handout

K.1. Model Timeline.

Steps

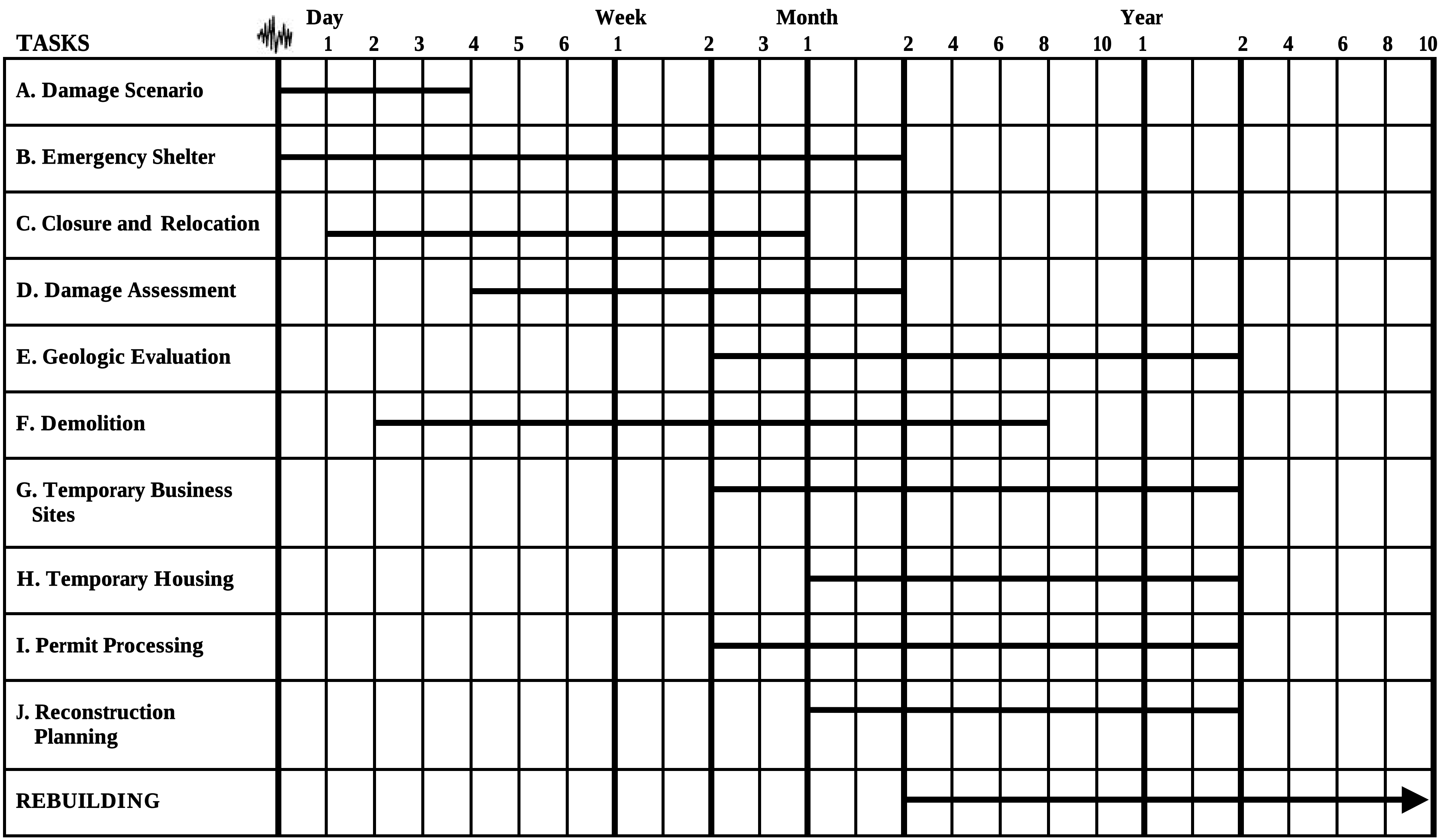
1. Review your entries on the timeline. How long do you think it will take to complete rebuilding? Enter a rebuilding line on *Handout 2. Earthquake Recovery Timeline* and compare your estimate with *Handout K.1. Model Timeline.*
2. Listen to the recorder recap the recommended actions discussed in Tasks A–J and listed on *Handout 5. Recommended Actions.* Discuss the actions and make changes in the list as needed.

Products

1. Completed *Handout 2. Earthquake Recovery Timeline.*
2. Completed *Handout 5. Recommended Actions.*

Handout K.1

MODEL TIMELINE



SCRIPT—TASK L. REDUCING RISKS
(Time allotted for script: 15 minutes)

Slide L.1. Task L. Reducing Risks.

Task L is the final and very important task of this exercise. In it, you will explore how recovery and rebuilding can be made easier by reducing damage potential and preparing for recovery in advance of an earthquake. This is the task to consider actions now that can lighten the burdens of recovery and rebuilding after an inevitable earthquake.

Slide L.2. Risk reduction categories—Existing Development highlight.

There are many ways to reduce the risks of earthquakes. Here is one useful framework for categorizing them. Actions to reduce earthquake risk are broken down into the categories of existing development, future development, emergency services, and education and public information. We will turn first to the category, existing development.

Slide L.3. Types of existing development.

Existing development includes buildings, critical structures, infrastructure, and building contents. There are many ways to reduce earthquake hazards in existing development. Let's look at some examples, to give you an idea of the possibilities.

Slide L.4. Portland building inventory.

An important step is to inventory existing development. This map presents a general inventory of hazard zones and building types in Portland, Oregon. It shows the dominant building type for each block in the city. Next, Portland will need to estimate the number of each type of building and evaluate the structural safety of important individual buildings.

Slide L.5. Building in Los Angeles (MacArthur Park) undergoing retrofit.

After a building has been identified as hazardous, you may decide to reinforce it, or require it to be reinforced, so that it can withstand earthquake shaking. This shows a building in Los Angeles being reinforced. In this case, an entire apartment building is being brought up to modern code standards.

Slide L.6. Los Angeles building showing anchors (heart-shaped).

Sometime, as in this case, a more limited reinforcement can be done. These are anchors (again on a building in Los Angeles) which are used to tie the walls to the floors of the building. This level of retrofit is designed to prevent building collapse and consequent loss of life.

Slide L.7. Salt Lake City and County Administration Building.

Historic buildings are important symbols of the community's past. Residents typically want to strengthen and preserve historic structures. Here is a view of the historic Salt Lake City and County Administration building. A seismic base isolation system was installed in the basement of this building. It was the first such system installed in this country and, because the system is largely hidden from view, it is becoming a preferred method for reinforcing historic structures. The historic city halls of both Oakland and Los Angeles are undergoing similar reinforcements (1994).

Slide L.8. Mexico City school with braces.

Critical structures and infrastructure are high on most lists of strengthening priorities. This shows a school in Mexico City after the 1985 earthquake. Bracing has been added to improve earthquake resistance.

Slide L.9. Hayward City Hall.

Relocation is sometimes an option for reducing risk. Another way is to reduce or change the occupancy of buildings identified as hazardous. Here is the former city hall of Hayward, California, which is located right on the Hayward fault. The city decided to build a new civic center located some distance away from the fault. This building is now being used for very low occupancy uses. The city has plans to eventually remove it and use the site for parking or a green belt.

Slide L.10. "Phoenix" pump boat on San Francisco Bay, 1989.

Sometimes the best way to handle lifelines is to provide for alternative or redundant supplies. In order to avoid another conflagration like the one following the 1906 earthquake, San Francisco has developed a complex emergency water supply system. For areas near the city's waterfront, fire boats on the bay can pump water to augment underground water systems. This boat was used to pump water for the fire that broke out in the city's Marina District following the 1989 Loma Prieta earthquake.

Slide L.11. Toppled shelves in Whittier earthquake.

Usually the best way to reduce risks from falling building contents is to secure them. These shelf units at the California State University at Los Angeles library toppled like dominoes during the moderate Whittier earthquake, spilling their contents onto the floor. Luckily, no one was standing between the shelves at the time of the quake. Anchoring and securing shelves and equipment can be an inexpensive way to save lives and reduce damage, or at least avoid a big mess. The contents of modern buildings are often more valuable than the building itself.

Slide L.12. Slide L.2 with Future Development highlighted.

Our second category for reducing earthquake risks is future development. This means guiding new development to reasonably safe locations and adopting and enforcing appropriate codes for new construction.

Slide L.13. Natural hazard map for San Jose, California.

The basic idea in risk reduction through planning for future development is to consider geologic and seismic hazard information as one factor in determining land use. This shows a natural hazards map for the City of San Jose, California. The darker, shaded areas are lands susceptible to landslides and other hazards.

Slide L.14. Land use diagram for San Jose, California.

With hazards information, land use plans can be prepared which concentrate development in the safest areas. Here is a diagram showing planned land uses for San Jose. Most of the areas shown as hazardous on the previous map are planned for open space or some low-intensity use.

Slide L.15. Photo of hillside in San Jose, California.

This shows a hillside designated for open space and low-density residential use in San Jose.

Slide L.16. Land movement potential map, Portola Valley, California.

Land development policies can be implemented with regulations controlling the type and density of development in unstable areas. This map of Portola Valley, California, is called the "Land Movement Potential Map." It was prepared by a geologist and delineates many categories of land stability.

Slide L.17. Land movement potential matrix, Portola Valley, California.

This matrix relates the map categories to land uses--houses, roads, utilities, and water tanks. A "Y" means "Yes"—the use is permitted in the ground movement category. An "N" means "No"—the use is not permitted in the ground movement category. "Y?" or "N?" mean that site investigations will usually be required by the Town before deciding the acceptability of a proposed use. If the use is permitted, the hazards must be mitigated through careful engineering and design. The ground movement potential map and matrix are adopted as part of Portola Valley's development regulations.

Slide L.18. Cover of UBC.

No matter how carefully sites for development are selected, risk reduction will not be fully effective unless buildings are designed and constructed to appropriate seismic safety standards. The first requirement is adoption of a building code with seismic provisions, like the Uniform Code shown here.

Slide L.19. Plan check in process in Los Angeles.

The next requirement is thorough checking of plans for new construction or renovations. Qualified professional are needed to review building plans for conformity with codes and regulations. Here, Los Angeles building officials are meeting directly with a building owner's engineer to discuss the plans for seismic reinforcement of a building. Such meetings are important in the city's effort to educate building owners, architects, and engineers about seismic design.

Slide L.20. Town official on field check of new construction.

The last requirement is effective monitoring of construction to be sure that it is done according to approved plans. Here is a town official in Portola Valley conducting a periodic field check of a new residence under construction.

Slide L.21. Slide L.2 with Emergency Services highlighted.

Now we switch to the third category of risk reduction—emergency services. Emergency services include fire suppression, search and rescue, evacuation, medical care, mass care (water, flood, and shelter), and emergency communications. Local governments need to plan for these functions after a disaster.

Slide L.22. Cover of an earthquake response plan.

Earthquake emergency response plans detail the tasks to be done immediately after an earthquake. The typical plan lists responsibilities for each department or agency, the location and source for equipment and supplies, and how communications will be handled. Businesses, industries, and apartment associations also need to prepare emergency response plans. Now, we will see a few slides showing the problems that need to be addressed in emergency response plans.

Slide L.23. Search and rescue, collapsed Cypress freeway, 1989.

Here workers are searching for trapped victims on the collapsed Cypress freeway structure after the 1989 Loma Prieta earthquake. Rescue must be accomplished within 48 to 72 hours. Rescue crews need training and specialized equipment.

Slide L.24. Firefighting in San Francisco's Marina District, 1989.

Here we see firefighters battling blazes at an apartment building in San Francisco's Marina District, ignited by the Loma Prieta earthquake. Assuring adequate water and equipment to fight post-earthquake fires is a major emergency planning task.

Slide L.25. Red Cross disaster services van, 1994 Northridge earthquake.

Communities can also plan in advance to meet the needs of homeless after an earthquake. Schools and other public buildings may be pre-designated as emergency shelters. Other needs, including tents, blankets, food, clothing, and items related to mass care, can often be stockpiled for use when a disaster strikes. Here we see a Red Cross disaster services van distributing food to displaced victims of the 1994 Northridge earthquake. Local government will need to coordinate with the many non-profit and other public agencies responding to the disaster.

Slide L.26. Communications van, Cypress freeway, 1989.

Good communications among the agencies responding to an earthquake disaster are essential. An emergency communications system can be established in advance. This shows a mobile communications van used in California after the Loma Prieta earthquake.

Slide L.27. Training exercise underway is Los Angeles.

Here is a training exercise underway in Los Angeles. This is a full simulation exercise, Hollywood style, including burning buildings, firetrucks, and dramatic rescues by stunt men. Emergency response planning and training improves your ability to respond to a damaging earthquake, restore essential services, and speed the recovery of your community.

Slide L.28. Slide L.2 with Education and Public Information highlighted.

It takes effort, commitment, and resources to reduce earthquake hazards. None are likely to be available unless civic leaders and the public at large are aware of the risks and what can be done about them. Education and public information, the fourth and final element, is a critical part of any earthquake risk reduction program.

Slide L.29. Daly City, California, Fire Department display at local shopping mall.

Education and information about earthquake risk reduction has several target audiences. The general public, businesses, employees, and special populations (such as children and the elderly) need to be informed about what to do before, during, and after an earthquake. Here we see shoppers browsing at an earthquake information display at a local shopping mall. This display is part of an earthquake education program sponsored by the fire department of Daly City, California.

Slide L.30. Instruction for planners in Watsonville, California.

Classes and workshops are needed for the many professionals who have a role in earthquake hazard reduction. They include geologists, engineers, architects, planners, building inspectors, emergency responders, and teachers. Here we see Watsonville's city planning director leading a field trip with a group of city planners and sharing her experiences in rebuilding following the 1989 Loma Prieta earthquake.

Slide L.31. Now begin Task L.

You have 60 minutes to detail earthquake risk reduction actions you believe ________________________________ (your city) should take. The instructions and three handouts are in your packet. Handout L.1. lists possible risk reduction measures organized according to the four categories we just reviewed. This is a resource to help you consider a full range of options. Handout L.2. is provided for you to develop your high-priority recommendations. Also, Handout L.3. Contacts for Technical and Financial Assistance is provided for you to complete and refer to, as you continue earthquake risk reduction efforts in your community. Now, please turn to Task L.

INSTRUCTIONS—TASK L. REDUCING RISKS
(Time to complete this task: 60 minutes)

Purpose

To detail earthquake risk reduction actions your community will take to reduce future earthquake losses and ease the burdens of post-earthquake recovery and rebuilding.

Handouts

L.1. Checklist of Actions to Reduce Earthquake Risk (2 pages).

L.2. High-Priority Action to Reduce Earthquake Risk.

L.3. Contacts for Technical and Financial Assistance.

Steps

1. Based on the slide introduction and your review of *Handout L.1. Checklist of Actions to Reduce Earthquake Risk,* brainstorm to expand *Handout 5* and add details to the mitigation actions you have identified. Take about 10 minutes for this step.
2. Check the most important actions on *Handout 5,* in the column provided. Be sure to check at least as many actions as the number of players around the table. Take about 10 minutes for this step.
3. Assign each checked item to a player who will complete *Handout L.2. High-Priority Action to Reduce Earthquake Risk* for that item. Take about 15 minutes to complete *Handout L.2.*
4. Ask each player to summarize his or her entries on *Handout L.2.* Discuss and make any revisions desired by the group. The completed versions of *Handout L.2.* resulting from the process form the beginning of an earthquake risk reduction program for your community. Take about 20 minutes for this step.
5. Seek information from those present at the exercise to fill out *Handout L.3. Contacts for Technical and Financial Assistance.* Take about 5 minutes for this step.

Products

1. Completed *Handout 5. Recommended Actions* with high-priority actions checked.
2. Completed *Handout L.2. High-Priority Action to Reduce Flood Risk*. Together, these pages form the beginning of an earthquake risk reduction program for your community.
3. Completed *Handout L.3. Contacts for Technical and Financial Assistance.*

Handout L.1

CHECKLIST OF ACTIONS TO REDUCE EARTHQUAKE RISK

Existing Development	**(_)**
Inventory existing buildings, critical facilities, infrastructure, historic buildings, hazardous materials, building contents, etc.	
Assess vulnerability of existing development including sites, structures and contents.	
Post buildings identified as hazardous.	
Reinforce hazardous structures or infrastructure.	
Relocate buildings or infrastructures.	
Reduce occupancy of hazardous buildings.	
Demolish or remove hazardous buildings or infrastructure.	
Redevelop areas with geologic hazards or concentrations of hazardous buildings.	
Establish alternative infrastructure systems or facilities.	
Secure non-structural hazards, such as building contents, computer equipment, furniture, records, etc.	
Regulate hazardous materials.	
Other	

New Development	**(_)**
Obtain geologic and seismic hazards maps.	
Assess seismic and geologic hazards of building sites for new development.	
Use seismic information to prepare land use plans.	
Adopt and enforce land development regulations.	
Adopt and enforce building code with seismic provisions.	
Design new facilities for seismic safety.	
Other	

Emergency Services	**(_)**
Prepare emergency response plans. Consider search and rescue, evacuations, hazardous materials, etc.	
Stock emergency supplies/equipment.	
Set up emergency communications.	
Train emergency personnel and other staff for emergency roles.	
Plan for rapid restoration of service and continued operation.	
Coordinate emergency response plans with other public and volunteer agencies.	
Other	

Education and Public Information	**(_)**
Educate the public, businesses, employees, families, and special populations about what to do before, during, and after an earthquake.	
Educate professionals about how to reduce earthquake risks (e.g. geologists, engineers, architects, planners, building inspectors, etc.)	
Work with the local media to improve coverage of earthquake issues.	
Work with schools to remedy structural and non-structural hazards, and develop earthquake safety programs.	
Work with volunteer organizations to promote earthquake safety.	
Establish a local earthquake education program or committee to guide education efforts.	
Other	

Handout L.2

HIGH-PRIORITY ACTION TO REDUCE EARTHQUAKE RISK

Title of the Action (from *Handouts 5 and L.1*):

Descriptions and Steps to Carry Out the Action:

Agencies Responsible for Carrying Out the Action:

People and Organizations to be Involved in Decisionmaking:

Resources Needed (funds, expertise, equipment, etc.):

Possible Sources for Resources:

Schedule:

Year to Start ______________________

Year to Complete ________________________

Handout L.3

CONTACTS FOR TECHNICAL AND FINANCIAL ASSISTANCE

The true measure of effectiveness of the earthquake recovery and mitigation exercise, which you have just completed, will be in the actions that your community now takes. Throughout the day, you have identified potential problems that your community is likely to face following an earthquake. You have also identified a series of high-priority actions that will lessen the impact of those problems, if you pursue them prior to the next earthquake.

FEMA, your state emergency management agency, and your state earthquake program manager stand ready to help you carry out these actions. Below is a list of agencies to contact for technical and financial assistance to help your community meet its earthquake hazard reduction goals. Add the appropriate names and telephone numbers to the list with the help of those present at the exercise. Then, keep this page with your copies of *Handout L.2.* You are now ready to begin implementing the actions!

FEMA REGIONAL OFFICE (location): ____

Telephone Number: ____

FEMA Hazard Mitigation Officer: ____

Telephone Number: ____

FEMA Earthquake Program Manager: ____

Telephone Number: ____

STATE EMERGENCY MANAGEMENT AGENCY (location): _______________________

Telephone Number: ____

State Hazard Mitigation Officer: ____

Telephone Number: ____

State Earthquake Program Manager: ____

Telephone Number: ____

Slide Index

A complete listing of slides used in the exercise follows. Unless otherwise noted, the slides are by Spangle Associates. Other sources are noted with numbers in parentheses and full citations are given at the end of this section.

Introduction

1. Earthquake Recovery and Mitigation: An Interactive Exercise for Local Government.
2. Exercise Tasks.
3. Exercise Schedule.
4. Exercise Purpose.
5. Topics not Included.
6. Earthquake Recovery Timeline.
7. Task Structure.
8. What Players Need.
9. Getting started.

Task A. Damage Scenario

A.1. Task A. Damage Scenario
A.2. Damage in Long Beach, 1933. (1)
A.3. Fault rupture, San Fernando earthquake, 1971. (2)
A.4. House damaged by fault rupture, San Fernando, 1971. (2)
A.5 Highway damaged by fault rupture, San Fernando, 1971. (3)
A.6. Landslide damaged school, Anchorage, Alaska, 1964. (3)
A.7. Landslide on Route 17, Loma Prieta, 1989. (4)
A.8. Liquefaction damage in San Francisco Marina District, 1989. (4)
A.9. Liquefaction damage to Struve Slough Bridge, Highway 1, 1989. (5)
A.10. Tsunami damage in Seward, Alaska, 1964. (3)
A.11. Damaged hotel, San Fernando, 1971. (6)
A.12. Damaged reinforced concrete building, Mexico City, 1985. (7)
A.13. Failure of tilt-up industrial building in San Fernando. (6)
A.14. Damaged, old wood-frame house in Los Gatos, 1989. (3)
A.15. Damaged, new wood-frame house in San Fernando, 1971. (2)
A.16. Damaged mobile home in Palm Springs, 1992. (8)
A.17. Damaged high-rise building in Mexico City, 1985.
A.18. Damaged irregularly-shaped building, Mexico City, 1985.
A.19. Olive View Hospital, soft-story failure, San Fernando, 1971. (2)
A.20. Detail of Olive View Hospital failure, San Fernando, 1971. (2)
A.21. Now begin Task A.

Task B. Emergency Shelter

B.1. Task B. Emergency Shelter.
B.2. Red Cross disaster services center. (8)
B.3. Emergency shelter at civic auditorium, Santa Cruz, 1989. (9)
B.4. Tents in yards, Coalinga, 1983.
B.5. Tents in Watsonville park, 1989.
B.6. Now begin Task B.

Task C. Closure and Relocation

C.1. Task C. Closure and Relocation.
C.2. Early posting in Watsonville, 1989.
C.3. Downtown Coalinga cordoned off, 1983.
C.4. Chain-link fence, downtown Santa Cruz, 1989.
C.5. Access control at chain-link fence.
C.6. One-way traffic on Route 17 in Santa Cruz Mountains. (8)
C.7. Failure of the Cypress freeway structure, Oakland, 1989.
C.8. Damaged Oakland City Hall, 1989. (10)
C.9. Now begin Task C.

Task D. Damage Assessment

D.1. Task D. Damage Assessment.
D.2. Inspector at work in Hollywood after Northridge earthquake, 1994.
D.3. Red tag.
D.4. Reg-tagged house in Los Gatos, 1989. (5)
D.5. Yellow tag.
D.6. Yellow-tagged house in Ferndale, 1992.
D.7. Green tag.
D.8. Green-tagged house in Ferndale, 1992.
D.9. Damaged historic house in Ferndale, 1992.
D.10. Removing belongings from damaged building, Santa Cruz.
D.11. Now begin Task D.

Task E. Geologic Evaluation

E.1. Task E. Geologic Evaluation.
E.2. “Red Zone” in Santa Cruz Mountains.
E.3. Areas of critical concern within Red Zone.
E.4. Trench to locate fault.
E.5. Geologist in bore hole.
E.6. Geologist out of bore hole.
E.7. Collage of headlines re Santa Cruz Mountain rebuilding.
E.8. Now begin Task E.

Task F. Demolition

F.1. Task F. Demolition
F.2. Debris removal in San Francisco, 1989. (3)
F.3. Demolition of Cooper House in Santa Cruz. (9)
F.4. Later demolition, Whittier, 1987. (11)
F.5. Damaged Embarcadero Freeway, San Francisco.
F.6. Embarcadero Freeway being demolished. (12)
F.7. Facade of County Bank building in Santa Cruz.
F.8. Debris removal after 1985 Mexico City earthquake.
F.9. Now begin Task F.

Task G. Temporary Business Sites

G.1. Task G. Temporary Business Sites
G.2. Business operated on sidewalk, Coalinga, 1983.
G.3. Pavilions in Santa Cruz, 1989.
G.4. Trailers in Whittier, 1987.
G.5. Gap for Kids sign in Santa Cruz, 1989. (8)
G.6. Criteria for temporary business sites.
G.7. Now begin Task G.

Task H. Temporary Housing

H.1. Task H. Temporary Housing.
H.2. Minor repairs being made to house.
H.3. Vacancy sign.
H.4. Unreinforced masonry residential hotel.
H.5. FEMA trailers in Coalinga, 1983.
H.6. Criteria for temporary housing sites.
H.7. Now begin Task H.

Task I. Permit Processing

I.1. Task I. Permit Processing.
I.2. House with fallen chimney, Ferndale, 1992.
I.3. Earthquake Recovery Center, Santa Cruz County, 1990.
I.4. Booklets Earthquake Recovery Center.
I.5. Damaged unreinforced masonry building, Whittier, 1987. (11)
I.6. Now begin Task I.

Task J. Reconstruction Planning

J.1. Task J. Reconstruction Planning
J.2. Damage on 4th Street in Anchorage, 1964. (2)
J.3. Model of plan for rebuilding all of downtown Anchorage.
J.4. Diagram of adopted plan for 4th Street.
J.5. 4th Street buttress.
J.6. Mall built on top of buttress.
J.7. Damage in downtown Santa Rosa, 1969. (13)
J.8. Map of expanded Santa Rosa redevelopment area.

J.9. Retrofit buildings in downtown, 1979.
J.10. Retrofit buildings and site cleared for new mall, 1979.
J.11. Downtown Santa Rosa in 1986 showing new mall. (14)
J.12. Damage in downtown Whittier, 1987. (11)
J.13. Plan for rebuilding "uptown." (11)
J.14. Model buildings—all brick facade. (11)
J.15. Revise model—brick trim. (11)
J.16. First downtown building constructed—no brick. (11)
J.17. Damaged Pacific Garden Mall in Santa Cruz. (8)
J.18. Collage of issues addressed by Vision Santa Cruz.
J.19. Model of downtown showing existing and proposed buildings.
J.20. Opportunity sites, Santa Cruz.
J.21. Sign showing rebuilding underway, Santa Cruz, 1992.
J.22. One of the first new buildings in downtown Santa Cruz, 1992.
J.23. Damage in downtown Watsonville, 1989.
J.24. Inventory being moved from Ford's Department Store.
J.25. Sketch from a ULI charrette held in Watsonville. (15)
J.26. Sign indicating rebuilding coming.
J.27. New Ford's department store open for business, 1992. (8)
J.28. Suggestions for reconstruction planning.
J.29. Now begin Task J.

Task K. Timing and Recap

K.1. Task K. Timing and Recap.
K.2. Earthquake Recovery Timeline.
K.3. Exercise in Los Angeles, California.
K.4. Now begin Task K.

Task L. Reducing Risks

L.1. Task L. Reducing Risks.
L.2. Risk Reduction Categories—Existing Development highlighted.
L.3. Types of existing development.
L.4. Portland building inventory.
L.5. Building in Los Angeles (MacArthur Park) undergoing retrofit.
L.6. Los Angeles building showing anchors (heart-shaped).
L.7. Salt Lake City and County Administration Building. (16)
L.8. Mexico City school with braces.
L.9. Hayward City Hall.
L.10. "Phoenix" pump boat on San Francisco Bay, 1989. (8)
L.11. Toppled shelves in Whittier earthquake. (7)
L.12. Slide L.2 with Future Development highlighted.
L.13. Natural hazard map for San Jose, California.
L.14 Land use diagram for San Jose, California.
L.15. Photo of hillside in San Jose, California. (17)
L.16. Land movement potential map, Portola Valley, California.
L.17. Land movement potential matrix, Portola Valley, California.

L.18. Cover of UBC.
L.19. Plan check in process in Los Angeles.
L.20. Town official on field check of new construction.
L.21. Slide L.2 with Emergency Services highlighted.
L.22. Cover of an earthquake response plan.
L.23. Search and rescue, collapsed Cypress freeway, Loma Prieta earthquake. (8)
L.24. Firefighting in San Francisco's Marina District, 1989. (8)
L.25. Red Cross disaster services van, 1994 Northridge earthquake.
L.26. Communications van, Cypress freeway, 1989. (8)
L.27. Training exercise underway in Los Angeles. (8)
L.28. Slide L.2 with Education and Public Information highlighted.
L.29. Daly City, California, Fire Department display at local shopping mall. (8)
L.30. Instruction for planners in Watsonville, California.
L.31. Now begin Task L.

Sources

(1) Robert Reitherman, The Reitherman Company, Half Moon Bay, California, originally provided for a workshop, *Earthquake Hazard Mitigation Programs at the Community Level*, prepared for Earthquake Program, Coastal Region, California Governor's Office of Emergency Services, 1986.
(2) Original source uncertain.
(3) National Oceanic and Atmospheric Administration, National Geophysical Data Center, Boulder, Colorado. Slide A.14 is by E.V. Leyendecker and slide F.2 is by D. Perkins, both of the U.S. Geological Survey.
(4) U.S. Geological Survey, *Color Photographs showing Examples of Structural Damage and Surficial Effects of the M7.1 October 17, 1989 Loma Prieta California Earthquake,* Open File Report 89–687.
(5) William Cotton, William Cotton & Associates, Los Gatos, California.
(6) Slide taken by Spangle Associates from a photograph in Jennings, Paul C., editor, *Engineering Features of the San Fernando Earthquake, February 9, 1971.* California Institute of Technology, Pasadena, California.
(7) EERI, *Slides on Structural and Nonstructural Failures in Past Earthquakes,* assembled by Walt Hays, U.S. Geological Survey.
(8) California Governor's Office of Emergency Services, Coastal Region, Earthquake Program.
(9) Slides taken by Spangle Associates from a photo in the *Santa Cruz Sentinel.* Permission granted by the *Sentinel* for use in this collection.
(10) Slide taken by M. Tibby. Provided by David Messinger, David L. Messinger and Associates, Oakland, California.
(11) Elvin H. Porter, Planning Director, City of Whittier, California.
(12) California Department of Transportation (Caltrans), District 4.
(13) Slide from the collection of the late Henry J. Degenkolb, H.J. Degenkolb Associates, San Francisco, California.
(14) Department of Housing and Redevelopment, City of Santa Rosa.

(15) Slide taken by Spangle Associates from the cover of Urban Land Institute, *An Evaluation of Development Potential and Downtown Redevelopment Strategies for the City of Watsonville,* Panel Advisory Service Report of a panel meeting in Watsonville, March 18–23, 1990.

(16) Edmund Allen, Allen & Bailey Engineers, Salt Lake City, Utah.

(17) Kay Duffy, Midpeninsula Open Space District.

Additional Resources

Additional information on earthquake recovery and mitigation can be obtained from a number of publications. Three of the most useful, based on California experiences, are:

Earthquake Recovery: A Survival Manual for Local Government, September 1993, Earthquake Program, Coastal Region, California Governor's Office of Emergency Services (OES), 101 8th Street, Suite 152, Oakland, CA 94607, (510) 540-2713.

This manual is an excellent companion to the exercise. It draws from experiences in the same California earthquakes to outline recovery issues under five major categories: recovery management and financing, rebuilding and construction, housing recovery, recovery of public facilities and services, and business recovery. The manual provides detailed information, including sample forms and model ordinances, pertaining to many of the tasks of this exercise.

California at Risk, Reducing Earthquake Hazards 1992–1996, 1992 edition, Report No. SSC 91–08, 182 pages. California Seismic Safety Commission, 1900 K Street, Suite 100, Sacramento, CA 95814, (916) 322-4917.

This document is the California state program for addressing earthquake hazards. It lists a series of initiatives in five categories of earthquake risk reduction: existing vulnerable facilities, emergency response management, disaster recovery, and research/information/education. The program lists the state agencies responsible for carrying out each initiative and a time schedule for completion. The program is regularly updated and progress on previous initiatives is noted. This publication is a good model for both the content and organization of earthquake risk reduction programs applicable to all levels of government.

California at Risk, Steps to Earthquake Safety for Local Government, 1988, Report No. SSC 88–01, 55 pages. California Seismic Safety Commission, 1900 K Street, Suite 100, Sacramento, CA 95814, (916) 322-4917.

This report describes how local governments can address each of the earthquake risk reduction categories in **California at Risk.** It includes sources of additional information and an Earthquake Safety Self-Evaluation Checklist to help local jurisdictions review what they have done to improve seismic safety and what remains to be done.