

EARTHQUAKE COUNTERMEASURE PLANNING:  
DEVELOPING A MODEL METHODOLOGY FOR AN AMERICAN CITY

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SUMMARY

Planning has traditionally been defined as a rational problem solving process with the following characteristics: (1) it is based on a determination of the current state of the environment; (2) it is future oriented; (3) it is a continuing process which allows for the revision of plans based on new data; (4) it is comprehensive, encompassing major operational elements of the city; (5) it provides for the coordinated response by responsible agencies; and, (6) it provides for a continuing evaluation of the plan. The activities of most local earthquake preparedness agencies do not conform to this definition.

This paper will describe a model preparedness planning process based on the authors research findings which conforms to the definition of planning outlined above.

INTRODUCTION

A review of disaster preparedness activities in California indicates that the concept of "planning" has been redefined by the actors in the earthquake preparedness field. Their primary concern has been the definition of a command structure and coordination of response. They appear to rely heavily on their ability to successfully use improvisation as a basis for their pre-event response preparations. Unfortunately, when the maximum credible earthquake event occurs in California, the dimensions of the resulting crisis would quickly overwhelm most agencies' improvisational response capabilities. It is, therefore, essential that preparedness measures be based on a more rational planning model. This paper describes an exemplary model of a rational planning approach to earthquake preparedness that has been implemented in Japan. Using the Japanese model as a prototype, this paper then describes a similar planning process that is compatible with the American context.

THE JAPANESE MODEL FOR PLANNING

The Japanese have developed a very sophisticated structure for comprehensive earthquake preparedness planning and response which has no parallel in the United States. At the national level, decisions concerning land development policy are influenced by the seismicity of various regions. At the prefecture and municipal level, the preparedness planning, mitigation, and response functions are integrated into the roles of

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numerous city agencies, including general administration, city planning, fire services, public works, and social services. (Ref. 1)

Based on their experience in the 1923 Kanto Earthquake, the Japanese have developed scenarios of expected future events. Comprehensive hazard identification has occurred and risk assessments undertaken resulting in the preparation of detailed loss estimates for the future occurrence of a Kanto "type" event. This research has provided the basis for the implementation of mitigation programs to reduce the identified risks and to prepare the citizenry. A notable example of the success of these Japanese efforts is in the area of fire prevention, where citizen training and structural mitigation programs appear to have reduced or prevented the occurrence of fires after the recent earthquake in Sendai and Akita.

#### ADAPTATION OF THE JAPANESE MODEL

Significant differences between the Japanese and American contexts limit the direct adaptation of the Japanese model to the United States. The frequency of felt events (one approximately every two weeks in Tokyo), the recent history of the catastrophic 1923 Kanto Earthquake, the level of public awareness, and support for preparedness from the political, business, and scientific community, provide a constituency for preparedness that does not exist in the United States. The resources available for preparedness activities reflect this disparity of support: in Tokyo approximately \$100 per capita is spent annually for preparedness, while in California the figure is only 65 cents.

These factors, infrequent history of catastrophic event, lower level of risk, and the resulting lack of both political and monetary support for preparedness efforts, in addition to the cultural and political differences, make direct translation or adaptation of the Japanese preparedness models to the American context inappropriate. They do, however, provide a useful example of an extremely sophisticated planning and preparedness structure that has been implemented, and to a limited degree, tested.

#### PARAMETERS FOR COMPREHENSIVE PREPAREDNESS PLANNING

Comprehensive preparedness planning encompasses both the planning for mitigation and risk reduction, and the development of a capability for coordinated response to the disaster.

#### The Objective of Preparedness Planning

The objective of preparedness planning is, to first identify the probable disaster scenario, and second, to prepare for the expected event by mitigating the potential hazards and preparing a response capability. It is, however, almost certain that the actual disaster event will not correspond with the expected scenario, requiring extensive improvisation by responders. This fact does not, however, lessen the value of pre-event planning and the drafting of a hypothetical planning scenario. The value of the planning scenario is that it provides a means for planners and responders to prepare for what is expected, thereby reducing

the amount of improvisation that will be necessary during the actual crisis. Responders can then focus their attention on those events that were not expected, while the plan and its operating procedures address the expected occurrences. Rather than reducing flexibility, the planning process and plan actually can reduce the workload on the response structure during the disaster.

#### The Time Constraints on Earthquake Preparedness

Disaster preparedness planning differs significantly from other forms of planning in that the timing of the event being planned for is not predictable. The earthquake may occur in the next century, next year, next week, or in a few minutes. Because of this uncertainty the time available for planning and preparedness should be assumed to be very short. Therefore, the emphasis of the process should be on both interim measures that can be accomplished during the planning process, and longer term measures that can be implemented within one or two years.

#### Interim Hazard Mitigation Measures

While the planning process is being initiated, steps must be taken to protect the city during the interim planning phase. The key element in interim term preparedness is education to improve the adaptive behavior of city staff and citizenry for survival during and immediately after an earthquake. The intent is to both raise the awareness of people to the need to protect themselves and their property, and to create a "surviveable" city staff as a resource during the response period.

#### THE ADMINISTRATIVE STRUCTURE FOR PLANNING

Before a planning process can be undertaken, an administrative structure compatible and supportive to a planning effort should be in place. Unfortunately, such a structure does not presently exist in most local governments. Figure 1 illustrates the typical structuring of earthquake and other disaster planning at the local level. The planning function has been delegated to the police or fire departments, locations appropriate for day-to-day emergency response activities, but remote from the administrative structure of the city and the planning, budgeting, and priority setting activities of the Chief Administrative Officer (CAO). This location is more appropriate for the organization of response activities than it is for pre-event coordination and planning, as the structural arrangement makes it unlikely that one line department will be able to exercise the authority necessary for coordination over other line departments in the city.

A more desirable structure, and one that provides a solution to the problems inherent in the arrangement noted above is the structure that has been adopted by a few communities in California and is illustrated by Figure 2.

In this structure the emergency planning agency is a staff function of the Chief Administrative Officer of the jurisdiction, ensuring that individual departments participate in and coordinate their preparedness

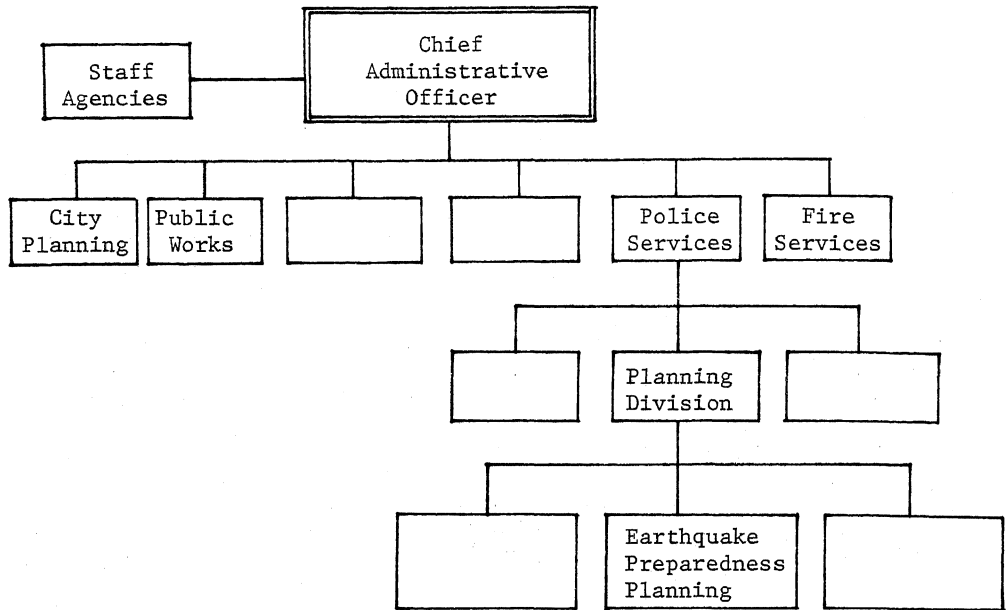


Figure 1 -- Typical Local Administrative Structure

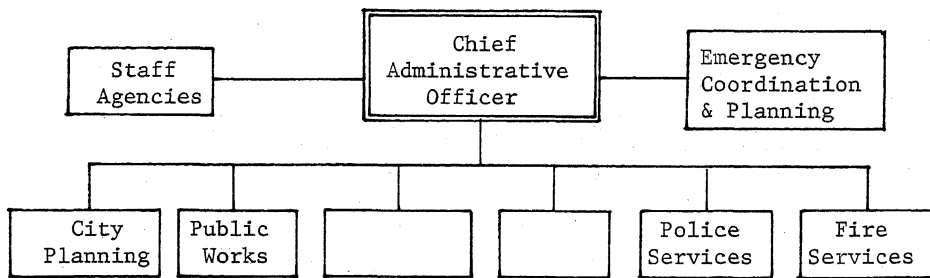


Figure 2 -- Proposed Administrative Structure

planning. This structure would also allow for the shifting of the role of "lead agency" during the various phases of a disaster without changing the overall structure of authority.

Changing the role of "lead agency" in response to the needs of a phase of the disaster and the expertise of the various city departments would place those most experienced with the requirements of each phase in a more prominent role. Robert Kates and others have identified five phases of a disaster (Ref. 2). Figure 3 suggests a possible structuring of the "lead agency" role through these five phases.

	DISASTER PHASE				
	Pre-Disaster	Earth-quake	Response	Recovery	Reconstruc-tion
Lead Agency	Planning	None	Fire	Planning	Planning
Support Agencies	Fire		Police	Public Works	Public Works
	Public Works		Public Works	Fire	Fire
	Police		Planning	Police	Police

Figure 3 -- Determination of Lead Agency by Disaster Phase

While the flexibility suggested by the above model would focus the skills of the various city departments on the needs of disaster planning and response, it would also necessitate a clearly defined command and administrative structure to be successfully implemented.

#### THE PLANNING PROCESS

It is first necessary to distinguish between earthquake preparedness "planning" and "a plan." Earthquake disaster preparedness is an ongoing process; a process that produces a plan document. Since a city is in a constant state of change both growing and declining at the same time, the planning process must continue to adjust and update the "plans" to reflect the current state of the city; therefore, the plan documents should have a very limited "shelf-life." Before the planning process can be initiated, the process itself must be defined and the structure for planning created which will charge certain city departments or individuals within those departments with the responsibility for specific planning and implementation activities.

#### Phase I -- Problem Identification

The initial planning activity is information gathering; for without

an information base there can be no planning. In addition to geologic data describing the physical environment of the city, data describing the city's population, building stock, commercial and industrial activities and processes, infrastructure, and resource base should be collected. An analysis of this data base will identify the issues to be addressed during the remainder of the planning process. As issues or problems are identified, additional data collection may be necessary as in the case of hazardous buildings surveys indicating the need for detail structural evaluation of specific buildings. This initial phase of the planning process will culminate with the documentation of the existing hazards and the assessment of the risks resulting from such hazards. Such a risk assessment will provide the background information necessary for the development of a scenario of the probable disaster event, including estimates of structural damage, disruption of life-lines, and loss of life.

#### Phase II -- Development of Alternative Strategies

As problems or issues are identified, short-term, interim, and long-term solutions must be sought. This second phase of the planning process involving research and development focuses on the identification and development of alternative problem-solving strategies. The objectives of these strategies should be the mitigation of hazards where possible, and the reduction of risk to the jurisdiction's population. Possible strategies could include adoption of land-use policies to limit development in areas susceptible to ground failure, hazardous structure abatement, development of specific earthquake disaster emergency operating procedures, "hardening" emergency facilities, or community education and preparedness.

#### Phase III -- Evaluation and Selection of Earthquake Preparedness Strategies

Once alternative preparedness and mitigation strategies are identified, they are evaluated in relation to the previously identified problems, and selections of the optimum mitigation policies and programs made. This is often both a technical and political decision making process, accounting for the social, economic, and political realities of the city, and results in a set of strategies and associated policies which address the needs of the jurisdiction identified in Phase I while fitting within its economic and social "context." Specific programs are then developed within the scope of the selected policies. These programs constitute the preparedness "plan."

#### Phase IV -- Implementation, Evaluation, and Feedback

The set of strategies and their associated policies and programs constituting the plan is then implemented by the various city departments. As this implementation process proceeds, new information about the city will be generated. This information will be added to the data being provided by an ongoing evaluation of the effectiveness of the programs being implemented. This new information then becomes the basis for an ongoing adjustment or "fine-tuning" of the plan and its programs. In addition, as priority programs mitigate the most critical hazards, the plan changes focus to address the second and third level of priority issues. This continuing planning process--problem identification, development of alternative strategies, evaluation and selection of strategies,

implementation, evaluation and feedback--ensures that the plan documents are continuously updated and are responding to the most current description of the environment, the hazards, the risks, and the needs and resources of the jurisdiction and its response capability before, during, and after the earthquakes occurrence.

#### CONCLUSIONS

While the planning process and the concepts of planning and "plan content" suggested above are not new to the field of urban and regional planning, they have not as yet been accepted universally in the field of disaster preparedness. This paper suggests only a skeleton of a process that should be expanded and adjusted to the needs and idiosyncrasies of individual communities to provide a more rational approach to earthquake preparedness.

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(The phases of a disaster are defined as follows: (1) the earthquake period, lasting from 10 to 60 seconds, during which severe ground shaking occurs; (2) the response period, lasting from 24 to 72 hours after the event, during which emergency services and the public react to the disaster; (3) the recovery period, during which a semblance of normal activity resumes; and, (4) the reconstruction period, during which the community returns to its pre-event status. There is, in addition, a fifth phase not identified above, and that is the pre-event planning period, a phase of unknown duration, during which the event is anticipated, and planning, mitigation, and response programs are implemented).