University of Delaware
Disaster Research Center

PRELIMINARY PAPER
#166

EARTHQUAKE HAZARD REDUCTION POLICY IN THE UNITED STATES: A PROBLEM FOR LOCAL GOVERNMENTS

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1990

This paper was prepared for the International Symposium on Building Technology and Earthquake Hazard Mitigation, March 25-29, 1991 in Kunming, Yunnan, People's Republic of China.

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In the United States, the National Earthquake Hazards Reduction Act is the heart of the federal government's program to improve seismic safety--to protect both the built and social environments from the destructive effects of earthquakes.

There are four federal agencies which have the major responsibility for developing and conducting activities under the National Earthquake Hazards Reduction Program (NEHRP)--the Federal Emergency Management Agency (FEMA), the designated lead agency; the National Science Foundation (NSF); the United States Geologic Survey (USGS); and the National Institute of Standards and Technology (NIST).

Since the Earthquake Hazards Reduction Act was passed by the United States Congress in 1977, substantial progress has been made toward expanding the knowledge base from which seismic safety practices can be improved. Although specific questions in the engineering and geophysical sciences continue to require research, substantial bodies of knowledge have already been accumulated to allow for the reduction of threat to life and injury, the lowering of potential property loss and business disruption, and the minimization of lifelines disruption in the United States (cf., Scholl, 1986). Much of this knowledge was developed under programs funded by the four federal NEHRP agencies.

While these four federal agencies have a mandate to enhance knowledge needed to reduce earthquake hazards and risks, none of the agencies have--as part of their institutional missions--the authority nor the organizational capabilities to bring about **direct** changes in seismic safety policies at the local level of government. In the United States, local governments--cities and counties--have the primary authority to enact policies that directly improve seismic safety; that is, only they have the authority to establish land use practices that take geophysical hazards into account, to adopt building codes with seismic provisions and to develop emergency preparedness and response planning efforts for destructive earthquakes.

We know, by looking across the thousands of local jurisdictions in the United States, that attention to earthquake hazard reduction considerations is extremely varied, even in the highest risk areas. In this paper, two primary explanations are proposed for this variability in seismic safety policy adoption, to explain why some "at risk" communities have enacted seismic hazard reduction policies and others have not.

VARIATIONS IN POLICY ENVIRONMENTS

One of the major difficulties in characterizing the policy process for any specific hazard reduction issue involves the extreme variability of "policy environments" that exist in communities across the nation. A policy environment refers to the many factors that could potentially affect a community's receptivity toward a policy concern or initiative (cf., Dror, 1983; Rein, 1983). Such factors would include: social, political, and economic forces in the community; cultural and historical ways of dealing with hazard concerns; and the relative importance of other current issues in the community (e.g., reducing crime, improving low-cost housing for the poor, and improving education).

It must be remembered that policy processes at any particular point in time are part of a larger social context within which a variety of organizational, institutional, and governmental processes are taking place. Therefore, the policy environment is not a uniform entity across communities in the United States--the dynamics within one community may be entirely different from those in another, affecting the way local governments respond to and process seismic concerns.

Two examples of this variability in policy environments provide illustrations of the complexity of this problem.

Regional Variation

One of the most obvious variations in policy environments is illustrated by comparing the attitude taken by California toward seismic safety to other states. Certainly, the aggressive seismic hazard reduction efforts that have been promoted by the State of California (especially through the legislative process) have created a very different environment within which communities consider how to reduce seismic risk. With respect to all three of the seismic policy areas--land use, building codes, and emergency preparedness and response planning--California has specified levels of community planning and actions to reduce earthquake threat. Clearly, there are reasons for this proactive seismic attitude in California--its history of earthquake disaster events; its moderately high level of on-going seismic activity; the scientific projections of future destructive-magnitude earthquakes; and the relatively short length of recurrence intervals between destructive magnitude quakes. Because of these features of the physical environment, the seismic policy environment within California differs from that found in other states.

However, state-level activities should not be categorically differentiated as "California" and "all other states." There is also wide variation among other states with regard to the policy environments that develop within their communities. Lambright (1982), for example, compared and contrasted the policy

environments in three states--California, South Carolina, and Nevada--as they relate to earthquake preparedness policy innovations. Lambright attributes much of the difference in amounts and types of earthquake-related activities in these states to differences in scientifically-based knowledge concerning the objective earthquake risk to which each state is exposed.

Even where the objective risk is known (for example, in California communities that straddle active surface faults) or where the same earthquake hazard could effect several states (for example, along the New Madrid Fault in the Central United States), variability has also been found. Mushkatel and Nigg (1987a; 1987b) found significant differences among local elected and appointed officials--both within and across states exposed to high levels of seismic risk with respect to their awareness of the hazard, perceptions about what could be done to reduce the risk, and attitudes toward the likelihood of taking policy actions. The policy environments in the various Central States adjacent to the New Madrid Fault are different, resulting in these differing attitudes toward reducing earthquake hazards deriving from the same physical agent.

Variation in Institutional Relationships

A second major influence on the policy environment derives from a community's institutional relationships; that is, from the interrelationships among the various local governmental agencies in carrying out their primary functions for the community. In most community agencies, hazard reduction issues do not generate a substantial amount of the concern among agency personnel. For example, building officials are much more concerned about the routine activities such as plan checking and construction inspection; community and regional planners frequently find themselves confronted with economic development issues, neighborhood rezoning requests, and urban center redevelopment concerns. Often, smaller communities do not even have the resources to support such departments.

Not only do these "routine" activities occupy a great deal of agency staff time, but there are often no viable mechanisms in existence that can incorporate representatives from these offices--who usually do not have any on-going contact--in hazard reduction planning efforts. Without such organizational mechanisms that provide bridging opportunities to bring these disparate agencies together to acknowledge a common problem, community decisionmakers will have difficulty deriving a set of acceptable hazard reduction strategies.

It is not only within communities, however, that problems of coordination and responsibility exist. Problems in coordinating hazard reduction efforts also exist between different levels of government. Mushkatel and Weschler (1985), in their discussion of national emergency management programs promoted by FEMA, maintain

that the tremendous transformation in the intergovernmental system since the 1960's has resulted in an "unstable" policy environment for local governments. While receiving greater responsibility for federally-encouraged or mandated programs, state and local governments are being limited in the extent to which they can raise and spend revenues. Mushkatel and Weschler go on to argue that this increasing responsibility at the lower levels of government is overburdening a system that already has problems of inadequate capacity; that is, with adequately fulfilling existing responsibilities.

These complexities in the intergovernmental system result in a policy environment that is fragmented both horizontally (i.e., among agencies within the local community) and vertically (i.e., across different levels of government). The process by which seismic hazard reduction gets onto the public agenda for consideration and gets transformed into policy options is, then, further complicated by the ways in which these intergovernmental relationships are structured in any particular locale.

SOCIALLY ACCEPTABLE COSTS OF COPING WITH EARTHQUAKE HAZARDS

The problem that faces local governmental leaders is not solely one of convincing the public that earthquake hazard reduction policies are needed and will work. Rather, the local policy maker has to make a good case that policies for stronger building codes, more effective land use controls, and more preparedness and response measures should be placed ahead of other social needs and issues. Not only does such a concern involve the comparison of seismic risks with those of other hazards (e.g., floods, typhoons, and water and air pollution) but also with other pressing social and economic needs (e.g., education, health care, and housing). More resources (money and personnel) devoted to earthquake hazard reduction must mean that fewer resources are available for other issues that are important to a community. This is a difficult task because it forces to the foreground the concept of an acceptable level of risk for earthquake hazards in any community.

The question of an acceptable level of risk was clearly raised by a task force for the Office of Science and Technology (1978):

> All social goals incorporate values that must be weighed against costs of achieving various objectives. Several factors must therefore be considered in defining "acceptable risks" or "residual risks" to life and property in relation to the costs and outlays required. There is no uniform level of acceptable risk. Acceptable safety levels vary with time, place and circumstances; they must be related to costs; and they are influenced by cultural and economic factors as well as the subjective feelings and emotional reactions of policy makers. [Emphasis in the original.]

In other words, the reduction of earthquake hazards per se is an insufficient basis for a policy to be enacted. Ostensibly, there can be too much mitigation and preparedness as well as too little. However, the notion that there can be an optimal level of seismic risk has not been sufficiently developed, even though the literature on optimal levels of air and water pollution control in the United States (involving similar reasoning) is extensive.

Clearly, seismic hazard reduction must be placed in a context of balancing the enhancement of public safety and property protection against the costs of achieving them across a wide range of specific social and economic concerns. This is an especially thorny problem when the seismic risk is potentially catastrophic but the probability of the occurrence of a high intensity event is low or uncertain.

In addition to concerns about the level of hazard mitigation that a community finds desirable, public policy should also be concerned with an appropriate mix of policies whereby given levels of hazard reduction effectiveness could be achieved. Traditionally, economic analysis of the effectiveness of hazard reduction policies has concentrated on singular techniques (for example, land use controls or enhanced building codes). However, the losses averted because of land use controls will also be affected by the building codes that are enacted. Hazard reduction efforts within communities should focus on combinations of the available options instead of pursuing each policy option in a single-minded fashion.

Four problems are associated with the development of the notion of an optimal or efficient mix of policy options. First, the choice of mixing policy options must be made with respect to existing institutional arrangements. Cost and benefit considerations will not be independent of the institutional arrangements that exist for implementing the desired goals or achieving a socially acceptable level of risk.

Second, the policy mix and levels of hazard reduction desired should be based on information pertaining to specific types of expected damage (e.g., surface rupture, land slides, ground motion, liquefaction) that can be averted in any specific location. While the level of specificity of anticipated damage usually is a major gap in the scientific knowledge of any community, some methodologies do exist that enable decisionmakers to approximate the level of damage that could be sustained under various conditions.

Third, the measures of benefits and costs must be broadened to include information on their distribution. Of specific import is the question: Who will benefit and who will pay? Both coercive and voluntary measures rely on participation by public and private sector actors who individually will take into account the costs of

action, costs of compliance, costs of avoiding detection, and liability for failure to comply. In turn, individuals and public officials will compare these perceived costs with perceived benefits. Obviously, the distributed costs and benefits will vary greatly across the mix of policy alternatives.

Fourth, benefits and costs vary over time and their distributional effects may change. The usual practice in cost-benefit analyses is to discount future costs and benefits to a single time period, usually the present. However, such a calculation involves both technical and ethical considerations. Technically, one must determine a "social rate of discount" and decide how to account for risk and uncertainty. Ethically, one must be concerned with the well-being of both the current and future generations. In other works, does the present generation have the right to compromise the welfare of future generations by failing to undertake long-range hazard reduction activities?

One additional problem that cuts across each of the above issues is the insufficiency of information regarding the elements that could be included in a mix of policy options. Because of a lack interdisciplinary attention to this possibility, it is unclear which hazard reduction elements are best suited for any particular set of physical and social circumstances to reduce earthquake hazards in a cost-effective manner.

With respect to the preceding discussion, it should not be forgotten that actual risk reduction due to the enactment and enforcement of enhanced building or land use practices may be limited in scope. The costs of implementing such efforts in an existing built environment through redevelopment or retrofitting may be very large and, therefore, unacceptable to a local community. The same concern can be raised about land use practices which can be employed only at great costs when land is already fully developed. Obviously these two strategies result in lower economic costs when new construction and development are being considered. Local decisionmakers may not perceive that these two risk reduction strategies have a direct utility (or payoff) in existing, developed, and highly-built areas. The anticipated costs of implementing these hazard mitigation efforts may exceed the probable economic losses averted.

Where seismically relevant land use regulation and building code enforcement are not believed to be appropriate given local definitions of acceptable risk, decisionmakers are much more likely to rely on emergency response, disaster relief, earthquake forewarnings, and insurance. Basically, such measures involve the acceptance of a perceived level of risk and finding ways to bear and share that risk. However, it should not be assumed that local decisions about seismic risk reduction are always based on careful research, analysis of objective levels of risk, or analysis of the available policy options. Timing, the level of public concern,

interest group activities, and the individual concerns of local officials all play roles in how these decisions are actually made.

Because of the variability in policy environments and decisions about ways of achieving acceptable levels of risk, communities in the United States have developed a variety of strategies to deal with their earthquake hazard problems. Unfortunately, it is sometimes difficult to determine how effective these strategies are until a destructive magnitude earthquake occurs.

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