Proceedings of Ninth World Conference on Earthquake Engineering
August 2-9, 1988, Tokyo-Kyoto, JAPAN (Vol.VII)

13-1-6

DETERMINANTS OF LOCAL MITIGATION RESPONSE TO EARTHQUAKE HAZARDS

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SUMMARY

Little is known about factors that affect community mitigation response to earthquake hazards. This study examines how planning process activities and community context characteristics influence local efforts to mitigate risks posed by earthquakes. Multiple regression analysis was employed using data from a national survey of communities at risk to earthquakes. Planning process activities had an important influence on local efforts to adopt mitigation measures. In contrast, community context characteristics did not play an important explanatory role. These results imply that efforts by planners and other decision makers can substantially advance earthquake mitigation planning programs.

INTRODUCTION

In recognition of the significant and rising risks to populations and property posed by earthquakes, the U.S. Congress in 1977 enacted the Earthquake Hazards Reduction Act. The act specifies, among other things, that risks be reduced through improvements of building design and construction methods, local controls on land use and development, and public education programs.

This paper reports findings from a continuing investigation of local planning efforts for earthquake hazard mitigation. Utilizing data from a national survey, we analyze the role planning process and context factors play in influencing local mitigation response to earthquake hazards. Recommendations for facilitating and establishing local earthquake mitigation planning programs are then derived from the analysis.

DATA AND METHODS

Data for the study was obtained from a national survey of communities in the 22 states that contain earthquake prone areas. Earthquake prone areas are located in seismic zones three and four as illustrated in Fig. 1. To be certain that communities were capable of establishing at least a minimal program, communities with populations less than 10,000 in 1980 were excluded, since many of them lack the resources to initiate a minimal planning effort.

A random sample of communities in California was used. A sample size of 104 communities was selected from the 256 communities in the state. Because of the small number of communities in each of the remaining 21 states all 156 communities were surveyed. Data from communities in the 22 states were obtained using a mail survey administered during the fall of 1986. (The response rate for California was 82.5 percent, 78.2 percent for other states, and 79.9 percent for the total sample.) Mail survey data was supplemented with information from the U.S. Geological Survey and the U.S. Census.

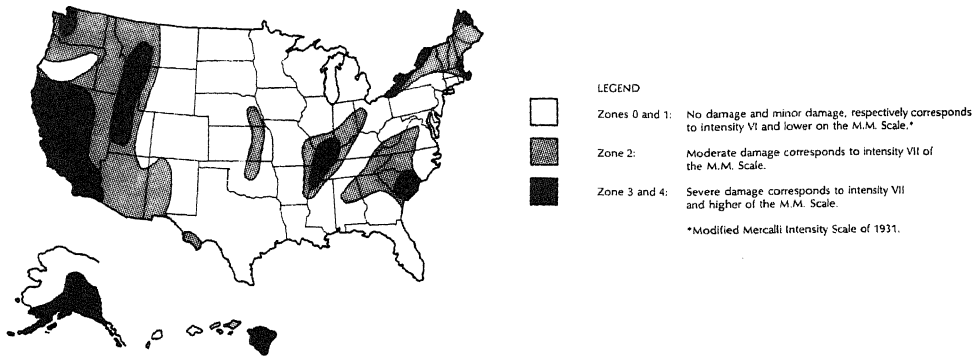

Figure 1. Seismic Zone Map of the U.S.--Uniform Building Code

Throughout the analysis of survey data, local earthquake mitigation planning programs of California and of all other states are examined separately. While communities throughout the country occupy different points in the program evolution process, development of programs in California is far ahead of the rest of the nation (Ref. 1). Given this difference in development, separate analyses of both groups of survey communities allows us to more carefully examine factors associated with local response to the seismic threat than examination of pooled data of communities in all states.

A series of regression analyses were used to examine survey data. The dependent variable (community response) is measured as the number of earthquake mitigation measures adopted by a community that are not required by state legislative mandates. The independent variables in the regression analysis were grouped into the four categories of factors that influence community response, including three sets of planning process factors (interorganizational relations, program operations and program support) and one set of context factors. Data analysis strategies and measures of both dependent and independent variables are discussed in detail in Berke and Wilhite (Ref. 2).

FACTORS RELATED TO COMMUNITY RESPONSE

Interorganizational Relations This group of factors focuses on the relationship between local planning programs and their political environment. Local planning programs are embedded in a larger political context and, therefore, must acquire political support for earthquake mitigation to be effective. Two factors are examined here.

Table 1. Factors Related to Local Mitigation Planning Response to Earthquake Hazards

Factor	Standardized Beta Weights (Standard Error)	
	California	All Other States
Interorganizational Relations		
Extent of Contact With Organizations	.17 (.14)	-.07 (.08)
Responsiveness of Other Organizations to Local Program Needs	.36[b] (.14)	.30[a] (.11)
Program Support		
Staff Hours Allocated to Seismic Safety	.42[c] (.23)	.77[a] (.27)
Adequacy of Maps That Delineate Seismic Hazards	- -	.07 (.10)
Program Operations		
Presence of an Advocate	- -	.64[c] (.35)
Integration of Seismic Issues with Conventional Comprehensive Planning Activities	- -	.98[b] (.49)
Linkage of Seismic Issues to Other Local Issues	.92[c] (.56)	.15 (.15)
Community Context		
Past Experience	.13 (.23)	.13 (.35)
R^2 for Equation	.313	.385
F-ratios	6.751[d]	6.405[d]

[a]t-value significant at the .01 level.
[b]t-value significant at the .05 level.
[c]t-value significant at the .1 level.
[d]F-value significant at the .001 level.

The first is the frequency of contact between local program staff, and federal, state and local organizations. Previous research indicates that interorganizational contact in a policymaking arena has a positive impact on community response to earthquake hazards (Ref. 3). Our findings, however, do not uphold previous research. As indicated on Table 1, the extent of contact has an insignificant impact on local adoption of earthquake mitigation measures.

In contrast, the second factor, perceived responsiveness of federal, state and other local organizations to local program mitigation efforts, has a much more important impact on local response for both survey groups. This finding supports Drabek et al. (Ref. 4) interpretation of interorganizational relations. That is, the frequency of contact suggests nothing about the content

or perceived usefulness of such contact. For example, highly technical reports from higher levels of government may not foster local understanding of the nature of seismic risk in a particular community.

Program Support These factors refer to the extent of resources available for initiation and adoption of local earthquake mitigation programs. The forms of support discussed here, include amount of planning staff time devoted to earthquake hazards and adequacy of maps that delineate earthquake hazards.

The results for staff time were consistent with our expectations. That is, staff time has a positive impact on local response, because more time allows staff to devote greater attention to activities required for initiating and adopting seismic mitigation measures. Table 1 indicates that this factor promotes an increased likelihood of response in communities both from California and other states.

Our hypothesis concerning the perceived adequacy of maps that delineate seismic hazards was not supported. We anticipated that the availability of such maps would enhance the capacity of public officials to better understand the causes of earthquake risk, and clarify the impacts of various mitigation policies. Mushkatel and Nigg (Ref. 5), for example, found that the presence of seismic zonation maps contributed to raising public officials awareness about the risk, and drew attention to the need for action. Our finding, however, probably reflects that while accurate maps raise awareness about the risk, this awareness has not been translated into significant action.

Program Operation This group of factors refers to the procedural aspects of a planning program. Factors discussed here include the role of seismic safety advocates, and linkage of earthquake hazards to comprehensive planning programs and other local concerns.

The presence of advocates that promote earthquake hazard mitigation was hypothesized to have a positive affect on local adoption of mitigation measures. Advocates are those participants in the planning process willing to invest their resources--time, energy and money--to assure that a particular issue is raised on governmental agendas. Advocates have been found to be a strong moving force in hazards mitigation planning (Ref. 6).

The results only partially supported the hypothesized importance of advocates. While this factor significantly influenced adoption of mitigation measures in communities outside California, it had little impact on communities in California. This difference is probably attributed to the fact that advocates have been found to play a strong role in localities where mitigation planning is a new and an emergent function (Ref. 7). In contrast, in communities with more established programs, adoption of additional mitigation measures is more likely to occur with relatively less change in the status-quo. Consequently, compared to communities in other states there is less need for advocates in California.

Researchers have found that a key determinant of local mitigation response, is when seismic issues that are traditionally of low political salience, are integrated with politically acceptable comprehensive planning activities (Ref. 3). Our expectation of the positive impact of such integration to

local response was only partially supported. This factor had no significant influence in California, but it played an important role in communities of other states.

This difference may be due to California's requirement that communities develop and amend a seismic safety element to their comprehensive plans. Since integration is required, it may deemphasize local involvement and commitment. Other states, however, have no such requirements. If communities in these states integrated seismic concerns into comprehensive planning activities, it probably originated at the local level. Planners, therefore, were likely to perceive such efforts as important.

We hypothesized that linkage of seismic safety issues to one or a combination of other local issues, e.g., environmental protection, economic development or recreation, would have a positive impact on adoption of mitigation measures. As one of a group of issues or in some cases, as a tool to be used for very different goals, e.g., stopping new development for purposes of environmental protection or encouraging renovation and reinforcement of buildings in declining downtowns, the earthquake issue can be raised on political agendas (Ref. 4). Table 1 shows that our hypothesis is only partially supported. In communities outside of California this factor was insignificant in influencing adoption, but it had a significant affect in California.

This finding suggests that raising seismic issues thru linkage is not influential enough for local action in communities where seismic planning programs are in the early states of development. Previous research supports this interpretation by indicating that, mitigation activities are more sustained and long-lasting in communities where seismic mitigation activities are a relatively established function of local government. Lambright (Ref. 7), for instance, found that if mitigation issues were to be raised on a local agenda, follow-up activities were more likely to occur in California, as opposed to the periodic and short-term attention drawn to seismic safety in other parts of the country. Thus, linkage of seismic safety to other local issues may have a more important impact on local response in California then in other states.

Community Context Context refers to the characteristics of communities in earthquake prone areas. Of the original six context factors (median home value, population size, past experience, presence of a visible ground rupture, conservation attitudes and legal constraints) only past experience with earthquakes was found to be significant on initial regression analyses. Furthermore, findings indicated on Table 1 do not uphold previous research that generally maintains a positive relationship exists between previous disaster experience and adoption of mitigation measures (c.f. Ref. 3). This suggests that while a disastrous event may provide a window of opportunity for adoption of mitigation measures, the window can close quickly during the immediate disaster aftermath with no ensuing follow-up activities. Some research findings reinforce this interpretation. Alesch and Petak (Ref. 6), for example, argue that the City of Los Angeles did not adopt a structural retrofit ordinance after a series of major earthquake events over a 50-year period, because local officials did not have a readily available solution that was both technically feasible and politically acceptable to various interest groups. Thus, at least for these data, past experience probably contributes little to influencing local response.

SUMMARY AND POLICY IMPLICATIONS

Planning process factors, or those activities that planners and other decision makers can use to advance planning programs, had an important influence on local efforts to adopt earthquake mitigation measures for communities in California and other states. In contrast, community context factors did not play an important explanatory role.

There were several differences in the causes of local response between both survey groups. Presence of advocates and integration of seismic issues with traditional comprehensive planning activities were more important causes of adoption for communities outside of California. Linkage of seismic issues to other local issues was important in predicting adoption for California communities, but not for other communities.

These results imply that efforts to advance local earthquake mitigation planning programs through enhancement of planning process activities have relatively substantial potential for success. Four recommendations can be derived from these results. First, an intergovernmental environment should be created that is supportive and responsive to local program needs and requirements. Second, because the most important form of program support is staff time devoted to seismic safety, provision of resources to foster mitigation should emphasize staffing the program adequately. Third, advocates should be identified and supported in their efforts to promote seismic safety, particularly in communities in the early stages of program development. Finally, opportunities to link earthquake issues with traditional planning program activities and with other local issues should be explored.

ACKNOWLEDGMENTS

This research was supported by a grant from the National Science Foundation (ECE-8421106). Any opinions, findings, conclusions or recommendations are those of the authors and do not reflect the views of the Foundation.

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