FORMULATING AND IMPLEMENTING POLICIES FOR SEISMIC SAFETY[1]

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Reducing earthquake hazards is basically an unresolved problem of politics and administration. Obviously scientific and engineering considerations must also figure in seismic safety, just as science and engineering play essential roles in most aspects of modern life. But fulfilling crucial and comparatively neglected requirements for seismic safety are fundamentally tasks of politics, administration, and implementation, i.e., getting policies formulated and adopted, and then making them work in practice.

Sources of Policy

Recurring earthquakes affecting significant populations anywhere in the world are by far the best source of information for the sophisticated and pragmatic understanding that must underlie effective seismic safety policies. A good deal of such learning from earthquakes involves seasoned professionals observing the results of earthquakes, and interpreting their observations to draw informed conclusions on what actually happened and why it happened, especially when there are anomalous or unexpected results.

One central goal, of course, is improved understanding of the kinds of ground behavior and forces at work in earthquakes, and of the responses of different kinds of structures and materials. Shaking-table experiments and computer simulations of earthquakes and structural responses can provide extremely helpful clues, but actual behavior in damaging earthquakes--which are highly chaotic events, often with significant unanticipated effects--is the most persuasive and reliable evidence on which to build policies. In any event, experimentation and research, plus observing the results of actual earthquakes, can lead to better understanding of sesismic phenomena and to improved "state-of-the-art" architectural and engineering designs. These in turn can form the basis for sound public policy.

Learning from earthquakes requires much more than simply photographing surface faulting and building damage, or recording data collected after an earthquake. Although such information is essential,

probably most important is the judgment of experienced professionals who can interpret the data and make comparisons and contrasts with other earthquakes, recognize significant patterns of damage, reach tentative conclusions on the principal causes, and suggest measures that might reduce or eliminate such results in the future.

In the process, scientific and engineering research is helpful, even essential, but is not sufficient by itself. Indeed, central to the formulation of workable safety strategies are other kinds of information and communication flowing between (1) the professionals trying to interpret learning-from-earthquake findings, and (2) individuals who are concerned with policy formulation and implementation.

Improved communication is essential, because the non-technical part of the policy mix is crucial, involving a host of political, institutional, governmental, and human factors that help determine how things get done in the practical world. It is indeed probably an oversimplification to suggest that policy has two distinct sides--technical vs. non-technical or policy oriented--for they are not so easily distinguishable. For example, the very choice of a technical or scientific policy component, e.g., an engineering criterion such as a force resistance requirement, is itself a strategy choice and thus a policy issue in its own right. In any event, the technical aspects and the many other aspects of earthquake policy need to be dealt with in an integrated manner, a goal not easy to achieve for a number of reasons.

For one thing, there are weaknesses in seismic policymaking. First, the process of learning from earthquakes is still haphazard, piecemeal, and lacking in thoroughness. Observers too often concentrate on substantial descriptions of what they have seen, and give only passing attention to interpreting the significance of their observations and drawing conclusions to guide policymakers.

Another weakness relates to communication on seismic safety issues between earthquake professionals and policymakers. Typically, such communication is difficult, usually being nonexistent, or at best spasmodic, especially with hazards that occur infrequently in any one region, e.g., earthquakes. Policymakers tend to be mindful of earthquake hazard for only a relatively short time after an earthquake has affected areas in their own immediate charge. Then their principal attention shifts back to other pressing matters. Consequently a major failing has been lack of depth and continuity in policy-level concern with seismic hazards and their mitigation.[2]

Formulating and Implementing Policies

Policy formulation is a complicated and rather messy process. When most successful it should produce measures that can be adopted, will actually deal with the problems addressed, and should not have undue "unforseen" consequences. Developing effective strategies to create such policies takes a judicious mix of expertise and judgment. There must be (1) expert understanding of the problems confronted, 2) a sensitivity to political and institutional forces that will influence policy acceptance, and (3) a realistic sense of "what will work" after a policy has been adopted, i.e., during implementation and administration.

Achieving the appropriate mix is difficult enough for almost any kind of complex problem, but is especially so for seismic safety. The very infrequency of earthquakes means that seismic safety receives only sporadic attention from policymakers--this is a major part of the problem. The top administrative personnel in most organizations--the people who have been aptly characterized as "the get-it-all-together" profession [Cleveland, 1979]--are only rarely involved. Instead, planning and preparation for many kinds of disasters (especially infrequent events) tend to be relegated to second- or third-string personnel in both government and industry. Disaster preparedness simply does not have a high place on the agendas of most top administrators.

Table 1

City/County Administrators' Time
Spent on Disaster Preparedness

Time spent per year	City Managers	County Administrative Officers
None	6%	2%
Less than 1 week	72	52
1 to 2 weeks	6	19
More than 2 weeks	11	10
Other	5	17
Total	100%	100%

Source: California Seismic Safety Commission, Public Official Attitudes Toward Disaster Preparedness in California (SSC 79-05, August 9, 1979), Appendices and background materials, pp. A-18, A-25.

For example, a recent California study found that "three-fourths of the city managers and over half of the county administrators said they spent less than one week per year" on disaster preparedness, concluding that it is "a low-priority business for most government leaders" [Olson, 1980].

On the scientific and technical side of the personnel equation, expert attention and academic investigations are understandably focused heavily on matters that interest geologists, seismologists, and research-oriented engineers and architects. While such work has basic, long-term importance, it often has limited immediate application to the kinds of problems that practicing engineers, architects, builders, and policymakers need to address in dealing with earthquake hazards.[3] Further, many of the more scientifically and technically oriented researchers may not be well qualified to contribute effectively to the

unfamiliar process of policy formulation. To sum up, if disaster-planning personnel are typically removed from mainstream policymaking and administration, and if many scientific and technical personnel can make only limited contributions to policy development, where shall we find the human resources needed for seismic safety policy formulation?

A Small But Growing Contingent...

What has emerged in California and the United States is a rather small but growing contingent of dedicated people with a wide variety of backgrounds--a "self-selected elite"--who have taken a special professional interest in earthquakes and disaster preparedness. Many are engineers in the forefront of the state-of-the-art in structural design. Some are earth scientists, e.g., geologists and seismologists. There are representatives from a wide scattering of other disciplines, including a relatively small minority from policy fields (sometimes called "generalists").

Even in modest numbers, knowledgeable and determined individuals can be influential, especially if their ideas are well formulated enough to be effective during those limited periods when seismic hazard is temporarily the center of public attention, i.e., immediately after an earthquake, particularly one causing undue or surprising kinds of damage. Moreover the number of such individuals, as well as the general awareness of seismic issues, has been increasing in our area. Thus California observers have noted a reasonably clear progression of interest, especially since the Alaskan earthquake of 1964, which seems to have been an important contributor to the upward trend of awareness in the past two decades in California and the United States. Since then, each successive damaging earthquake has made its own contribution. While we have complained that seismic policy and disaster preparedness are still low among policymakers' priorities, we nevertheless must admit that awareness and public concern are notably higher now than they were ten or fifteen years ago.

In Southern California, at least, the level of public support for governmental action on seismic safety seems unmistakable. Recent studies in that region by Ralph H. Turner and others [1979], [1980] found strong approval of rather stringent seismic policy measures: nearly 90 percent favored posting warning signs or closing down buildings found unsafe, and 75 to 80 percent favored laws to require the strengthening or abandonment of hazardous apartments, workplaces, etc. Substantial support was also found for investing large sums of money in safety measures.[4]

Institutionalizing the Efforts

Partly in response to growing interest, there has been some institutionalizing of policy processes that in earlier times were almost entirely ad hoc. A classic ad hoc policy response came after the 1933 Long Beach earthquake, which demonstrated the extreme vulnerability of public school buildings as then designed and constructed. That same year a shocked California legislature immediately passed the "Field Act," aimed at enforcing seismic safety standards for all public schools. While such ad hoc approaches can occasionally be quite effective, as is

the California law on school safety, the result is limited-purpose response to individual earthquake events. This can mean progress on a few fronts, but also usually means comparative neglect on others.

In a recent move toward greater continuity and comprehensiveness, the State of California established the State Seismic Safety Commission in 1975. The commission is an advisory body on seismic policy, whose 17 members are chosen to represent a cross-section of appropriate backgrounds and interests.[5] Its principal role is to set realistic goals and priorities and to seek effective methods of implementing them. A crucial part of its task is to identify and recommend ways of filling major gaps in seismic safety programs. This means a continuing overview of all seismic safety efforts, keeping a watch for hazards that are not being dealt with adequately.

Other forms of institutionalization could be noted, but since a comprehensive survey is impossible here, attention will be focused on one significant example, the work of the Earthquake Engineering Research Institute. EERI is a non-profit corporation founded in California on a small scale in 1949. It has now matured into a major participant in the study of seismic safety. Beyond its principal activity of holding conferences and workshops, and publishing an informative bulletin, another important institute function is sponsoring investigations of destructive earthquakes in various parts of the world [EERI, 1979].

After roughly a decade of experience, EERI is restudying and trying to improve the methodology of its investigations. Preliminary findings suggest that while the basic task of collecting data has been handled reasonably well (often under quite adverse circumstances), still largely missing is the continuity and follow-up needed for deeper exploration of the policy significance of the investigations. In short, interpretation of the investigations' results needs considerable strengthening to give effective guidance in public policy formulation.

Several recommendations for improvement can be touched on here. First, investigation teams can be prepared beforehand with special briefing on the need for interpretation and policy guidance. Second, they could participate in debriefings as soon as possible on their return, and could contribute to workshops exploring the significance of the findings, especially with respect to the adequacy of current seismic safety policy and practices. Third, policy oriented observers should be included in the debriefings and, if possible, on the teams themselves. Fourth, there could be regular (perhaps annual) follow-up reviews of the investigations and other recent evidence on earthquake safety, posing such questions as these: What have we learned in the last two or three years? How well have we taken advantage of this new knowledge? What further investigations are needed? Are policy changes called for? Who would be responsible? Finally, the results could be disseminated to a series of audiences, including practitioners and professionals directly concerned with seismic safety, and other personnel whose activities could significantly affect seismic safety and hazard reduction.

What More is Needed?

If the investigative roles of bodies like EERI are greatly strengthened, they could provide extremely useful guidance for policy bodies like the California Seismic Safety Commission, developing new evidence from recurring earthquakes to help assess safety levels and policies and recommend new ones. The investigative and policy activities ought to be closely interrelated and coordinated: they should fit like a hand in a glove.

Other important contributors should not be neglected. For example, in the United States, the National Science Foundation funds important research efforts in the interest of improved seismic safety, and the U.S. Geological Survey has its own extensive research program. The Federal Emergency Management Agency is the key national overview agency concerned with earthquakes and other disasters. A full list would include a number of others who contribute. Furthermore, in the final analysis it is imperative to keep in mind the essential roles of the "regular" departments of national, regional, and local government, and the managers and workers in private-sector enterprises. They are the ones who will actually direct and carry out the programs that make things safer in the future--or fail to do so.

Whatever the institutions involved, a continuing, integrated dynamic process is needed to ensure that safety inadequacies are regularly reviewed and improvements formulated and implemented. The process should monitor and evaluate existing seismic safety policies, and recommend needed changes. Moreover it is unrealistic and unwise simply to pass a law, revise a code, or adopt an administrative regulation and assume that the problem addressed will thus be solved. Some remedial measures may fall short, while others may overshoot the mark, proving unduly stringent or difficult to administer, or causing unanticipated effects that may be counter-productive. An effective process of seismic safety policy formulation and implementation must be able to identify such failings and correct them.

This discussion suggests only the barest outline of some performance standards or goals for policymaking and implementation. How they can best be achieved, and through what institutional framework, will depend on many variables that are likely to differ significantly among regions and among nations. But it seems clear that a comprehensive policy process calls for permanent national or regional mechanisms having several responsibilities, including the following:

1. They should bring together the expertise needed to evaluate scientific and technical information on earthquake damage and seismic safety, and to interpret the significance of new findings about seismicity and seismic hazards.

2. They should draw on main-stream expertise in policy, administration, and management to help devise strategies and programs that will be realistic and workable, and that will be given a higher priority among policymakers than has previously been typical.

3. In implementing seismic safety policies, they should work through several appropriate kinds of vehicles, e.g., new legislation; administrative action by national, regional, or local government;

programs undertaken by public- or private-sector industries and commercial enterprises; professional education and training programs; and action by citizens' organizations and volunteer groups.

4. Tney should monitor and review the results of these efforts, identifying old measures that do not work well in practice, and devising new strategies when needed.

FOOTNOTES

1. This paper is based primarily on experience in the United States, especially California. With appropriate adaptation, several of the conclusions are probably also applicable to earthquake policy formulation and implementation elsewhere. On the other hand, it is acknowledged that such policy processes and their outcomes are greatly influenced by the physical circumstances (e.g., seismicity and earthquake history), institutional patterns, prevailing practices (e.g., engineering and construction), and political systems in the various countries.

2. Alan J. Wyner [1981], University of California, Santa Barbara, found a notable lack of concern among local elected officials in California, most of whom seem content to live with the status quo. Their philosophy is, in effect, "our current policies are producing a physical environment that we accept as safe enough, given the benefits, cost and risks." Wyner points out that in time such decisions, made "by default," have a greater likelikhood of producing unanticipated and unwanted consequences."

3. Winifred O. Carter, Professor of Civil Engineering, Utah State University, commented recently on engineering research: "I see a closed loop in the research community...the proposals are submitted, they are funded, the research is carried out, the report is generated, and it goes on a shelf. There is very little transfer of that research knowledge to the practicing engineering profession. It is also my perception that it is very difficult to glean useful information from most research reports." [Ward, 1981]

4. Turner cautions, however, that strong support "in principal" for such expenditures does not mean that earthquake safety equals other pressing needs, like public education, police protection, public hospitals and health care, all of which out-ranked seismic safety in the opinion sampled.

5. "...the individuals appointed to the commission are intended to represent the professions of architecture, planning, fire protection, public utilities, electrical engineering, mechanical engineering, structural engineering, soils engineering, geology, seismology, local government, insurance, social services, emergency services, and the State Legislature..." [California Government Code, sec., 8892.] Fifteen of the 17 members are appointed by the Governor, and one is appointed by each of the State Legislature's two houses, from its own membership.

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