MANAGEMENT OF EARTHQUAKE SAFETY PROGRAMS BY STATE AND LOCAL GOVERNMENTS

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This paper deals with fundamental concepts for management of earthquake hazards and associated earthquake safety programs at state and local levels of government. The focus of the paper is upon recognizing and narrowing a gap which the author believes to exist between earthquake hazards information (essentially research data) and applications of the information (public policies for implementation of hazards reduction methodologies).

BACKGROUND

That natural hazards can be managed for the overall benefit of our society is a notion accepted by most of us. We believe--correctly, I think--that life loss, injuries, and property losses can be reduced through prudent pre-event practices and effective deployment of resources when disasters occur. Emergency management is an institution of government that has evolved over the past two or three decades whose primary purpose is to articulate and carry out a broad array of activities directed to loss prevention and/or loss reduction due to extreme events--both natural and man-made.

Emergency management practices traditionally have separated into several phases, due no doubt to the time-related character of the activities. For this discussion, we refer to four such phrases--preparedness, mitigation, response, and recovery. Other divisions have been used, but the variations have no significance to our purposes here.

Beyond these time-related characteristics that are common to nearly all emergency management activities, the similarities among the risk reduction activities appear to end for the various hazards. Each type of natural hazard-- earthquakes, tornadoes, hurricanes, and floods--derives from a different sort of natural phenomenon, has different physical characteristics that create risks to life safety and property, and, consequently, requires different methods for effective control (management) of the risks.

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If the reader accepts that there are physical distinctions between the several types of natural hazard named above, then it is useful to examine briefly the implications of these distinctions with respect to the time-related emergency management activities of preparedness, mitigation, response, and recovery. Although management concepts for the hazards may be similar in some cases, the specific risk-reduction activities are quite different for each type of hazard. Moreover, the importance (priority) of the types of action with respect to the end goal of risk reduction seems to be different for each type of hazard.

For example, for a variety of reasons control of losses due to a hurricane requires different emphasis upon preparedness and recovery actions than does control of losses due to an earthquake. In the case of hurricanes, preparedness actions based upon pre-event warning are possible; mitigation is largely a matter of siting considerations; and response activities can be coordinated to occur even during the event. On the assumption that life safety is the paramount objective, preparedness based upon pre-event warning is emphasized.

Riverine flooding, too, requires a different emphasis for effective loss control. Once again, preparedness actions can be based upon pre-event warning, but effective loss control requires that emphasis be placed upon mitigation actions.

Earthquake events, in contrast, say, to hurricanes happen without warning and are of very short duration--a few minutes at most and hardly enough time to do anything more than duck. Current technology does not allow short-term prediction of the events, although regions of greater earthquake potential and even long-term (several years to several decades) speculations about impending events are within current technical state-of-the-art capabilities. Moreover, we presently do not know how to control (eliminate or soften the occurrences) of the earthquake events. Accordingly, emergency management methods presently are limited to (1) reducing the effects of the earthquake upon buildings and people--mitigation--and/or (2) providing recovery services--picking up the pieces, so to speak--after the events.

Either of the above types of emergency management actions will help to reduce earthquake losses to some extent, but mitigation assuredly can be the most effective of the two types of actions. Mitigation can eliminate losses in some cases and certainly can reduce losses in most cases whereas recovery actions can only attempt to contain the extent of losses and restore essential lost facilities and services.

These differences among the hazards lead to differences in management methods that must be acknowledged and met. This entails, first, recognizing the characteristics of each type of hazard and their consequent effects upon us. The appropriate kinds of management activities and the relative effectiveness of each activity then can be tailored to the type of hazard. We now take the specific case of earthquake safety for elaboration upon this point.

The argument developed above aims essentially at making a strong case for mitigation as the most effective means available to us today to reduce earthquake losses. If this argument is accepted, than we are left with the task of defining mitigation for earthquake safety and, consequently, with describing the implication that a mitigation approach has with respect to emergency management methods.

Mitigation of earthquake risk is accomplished almost entirely through control of the "built environment." Earthquakes themselves rarely if ever kill or injure people directly. Rather, they displace buildings, building components and other elements of the build environment such as highway structures, dams, water and electric systems, etc., which in turn may jeopordize life safety and cause great social and economic inconvenience. By controlling the quality of the things we build and by selecting construction sites less likely to feel hazardous earthquake effects, it is possible to achieve reduced life loss, reduced injuries, and reduced property losses. None of the other emergency management phases accomplish this to any degree even though the phases are necessary parts of a comprehensive comprehensive emergency operation.

Construction of the built environment is controlled by construction regulations, codes, zoning ordinances, siting evaluations, and good design practices. Most of these controls already are a part of every community's governance mechanisms. It is through actions that impact upon these processes of control that earthquake mitigation must be accomplished.

The control procedures indicated in the paragraph above are implemented through organizations which have not been dealt with to any great extent by traditional emergency management agencies in the past. Even when emergency management agencies have worked with these existing infrastructures, such as land-use regulatory agencies for flood mitigation efforts, the physical and technical difference between earthquakes and the other hazards allow very little carry-over of learning experiences. It seems clear to this author that effective earthquake hazards mitigation actions will require new liaisons to be forged between emergency management personnel and organizations that control or regulate construction of the built environment.

These new liaisons likely will be somewhat different than the liaison formed in traditional emergency management activities of the past, most notably the civil defense program of the past that dealt with problems not faced by many existing agencies of government. In the case of earthquake mitigation, we find that existing agencies already are in place which have responsibility for controlling the quality of the built environment. It is most likely that these agencies will insist upon preserving their regulatory jurisdictions when earthquake hazards mitigation processes are introduced. Under these circumstances, it is even questionable whether or not the traditional emergency management agency has a role with regard to earthquake hazards mitigation.

Severe flood threat in the State of Utah during the past two years illustrates this point. Having experienced excessive springtime run-off in 1983, with consequent flooding of stream beds and mudslides, Utah coun-

ties and cities undertook hurried public works improvements to mitigate similar future problems. Without exception, these prejects were managed by existing full-time public works administrators and flood control personnel. These personnel are not part of the state's emergency services agencies and work independently of those agencies. Although coordination between the public works agencies and the emergency services agencies occurred, this was primarily with respect to preparedness and recovery actions. Mitigation actions were carried on by the public works agencies.

Mitigation for earthquake safety seems to have silmilar restraints in the sense that there are existing governmental agencies responsible for control of the quality of the built environment. Once public policy has been set for earthquake hazards mitigation, as was the case for mitigation of flooding, the existing agencies having jurisdiction will proceed to carry out the policy mandates, I believe.

One implication of the above observation is that the problem of achieving effective earthquake safety is not so much one of management, but rather is one of persuading a reticent public sector of the need for a sound public policy for earthquake safety. If the public commitment is clear in this regard, the machinery is available in government to carry out the mandate.

THE GAP BETWEEN TECHNOLOGY (RESEARCH) AND APPLICATIONS

Knowledge about the behavior of earthquakes, although far from adequate for the scientific community, is quite adequate today for applying earthquake risk mitigation techniques to the built environment. The literature on earthquake physical characteristics and on techniques for construction of earthquake-resistant facilities--buildings, transportation systems, dams, utilities systems, etc.--is extensive. Sufficient technical information can be assembled to allow preparation of earthquake risk evaluations which, in turn, allow estimates of possible earthquake losses to be prepared. One also can ascertain the types of likely construction failures associated with the losses.

With such information, one can suggest modifications in siting practices and construction methods that are most effective for saving lives and most cost-effective for the community. Indeed, these kinds of data have been assembled in a variety of forms and for a variety earthquake conditions. As well, some of the data are even assembled for different regional earthquake conditions.

Despite this wealth of information, there has not been widespread application of earthquake risk reduction measures in the private or public sectors of this nation. Except in California, public apathy about earthquake risk prevails, and local governments resist adopting public policies that would encourage application of risk reduction. There is a large gap between the available technical information and application of earthquake mitigation measure.

Credit is due to the federal government which has been actively promoting improved earthquake safety practices and encouraging development of emergency management tools to deal with the hazard. However, these efforts have aimed largely at making the federal government a helpful partner with state and local government in such matters. In general, mandated federal requirements for earthquake safety do not exist.

Given this present working arrangement, it should come as no surprise that the federal efforts can be no more effective than the efforts of the other half of the partnership--state and local government. It is at these state and local government levels that earthquake safety has failed to receive the attention that I believe is warranted--the exception again being California. Other states and local governments occasionally give verbal support (motherhood statements) to earthquake safety. Rarely have they set forth public policies to bring about the needed changes.

Yet, control and regulation of construction of the built environment lies almost entirely within the domain of state and local government in this nation. The federal government has not usurped this prerogative. State and local governments zone the land; they adopt building codes; and their personnel design many of the public facilities, such as transportation systems, water supply systems, waste systems, and even some utilities systems. Mitigation of earthquake risk, therefore, apparently must be accomplished through these existing institutions and processes of state and local governments. For them to do so, however, the policymaker must be convinced that the public interests are well served. At this time, they do not appear to be convinced.

Some forward motion in improved earthquake safety practices has occurred through the private sector in ways that generally are independent of government. Recognition of this motion is pertinent to our discussion of the gap between technology and applications because it provides further insight into the reasons why the gap occurs.

Construction practices are influenced, sometimes even controlled, by groups besides governmental regulatory agencies. Two such groups are the design professionals and developers of construction codes and standards. The design professional--the architect or engineer--always has the option of specifying construction of a quality that exceeds the minimum requirements of adopted codes and standards. To some extent this has occurred, although randomly, throughout the nation with respect to earthquake-resistant construction. However, without a clear statutory mandate, designer attentiveness to earthquake hazards mitigation will continue to be random and susceptible to client pressure that the facilities meet only minimum standards of performance.

The national model building code organizations and similar other groups who develop construction codes and standards also have great influence over construction quality. This occurs because the common practice is that state and local governments often adopt these codes as their standards or regulations. Yet, these codes and standards essentially are developed outside of government by mixes of design professionals, building officials acting independently of their agencies, product repre-

sentatives, and trade organizations. Hence, it is possible to achieve improved earthquake safety practices by including appropriate standards in the codes which eventually get adopted by most, but not all, states and local governments. The process for introducing new concepts into codes and standards is long and tedious, but the avenue is available to us.

Although forward motion in earthquake safety practices has occurred through the two types of groups described above, the efforts have been constrained by inadequate knowledge in application. It is one thing to gain appropriate language in the codes and standards; it is quite another thing to interpret and apply the recommendations in actual construction conditions. Broader and better focused training is essential if the design professionals and the standards are to be a primary means for achieving improved earthquake mitigation practices.

CAN EDUCATION NARROW THE GAP?

In this paper, the existence of a gap between our level of technical knowledge about earthquake hazards and a public willingness to apply the available knowledge to loss reduction practices has been emphasized.

In the author's experience with earthquake safety, this lack of public willingness to utilize available knowledge is the major reason for the lack of public policies that are needed to promulgate effective earthquake loss reduction actions. Public apathy toward the problem is manifested by the absence of political commitment by state and local governments to deal with the situation in any significant way.

Although the public generally seems to have knowledge about earthquake hazards and associated risks to life and property, albeit sometimes incomplete and inaccurate, this author's view is that there is adequate knowledge and information for the public to take risk reduction actions if only the will to do so were present.

Several conclusions can be drawn from this observation. One can only speculate as to which, if any, of the conclusions are accurate, and, of course, none of the conclusions may be valid if the underlying premise lacks validity--namely, that a public commitment is missing. Five possible conclusions are listed below and then discussed briefly:

1. The risks posed by earthquakes are not believed to be sufficiently great to warrant doing any more than presently is being done to control losses.

2. Earthquake risks are perceived to be too narrowly limited to just a few population centers (earthquake regions) to justify any public policies aimed at abating the problems.

3. In an economic, cost-benefit sense, earthquake risks are perceived (or actually are) lower than the costs of risk reduction.

4. Potential victims of loss believe that governments (federal, state, and local) will provide the resources to recover any losses. (This conclusion fails to be responsive to the possibility of life loss and injury.)

5. The public simply does not know enough about earthquake risk to give the problem much attention and so does not care.

If Conclusion 1 is accurate, then efforts to broaden the public concern for earthquake safety may be the equivalent of "beating a dead horse." If Conclusion 2 is accurate, then the case can be made for strengthening public information and education programs. If Conclusion 3 is accurate, then some research efforts ought to be shifted to economic analyses to confirm or reject the perceptions. If Conclusion 4 is accurate, then either some changes in governmental assistance policies ought to be made so that individuals and local governments are held accountable for their failure to act prudently or governments should redirect their emergency management functions to preparedness, response, and recovery and abandon mitigation efforts for which the cost is borne by others. If Conclusion 5 is accurate, then intensified efforts in public education seem to be warranted.

This author is not aware of any studies that aim at verifying or rejecting the conclusions suggested above. Until that is done, we can only speculate about which among them may be the more accurate. We therefore cannot direct educational resources to deal with a situation which is inadequately identified.

That the public is not ready at the present time to make policy commitments to earthquake safety is the best that can be said. While those of us who seek improvements in earthquake safety can point to a number of individuals and organizations around the nation who feel the same as we do, it is a sad fact that the numbers of us have not grown significantly in recent years nor have we achieved much in the way of public policy changes.

Enough has been said in the negative. The remaining questions are whether or not education and training can help to change this situation and, if so, what might be the form and focus of this education and training. This author's view is that educational efforts in earthquake safety must continue regardless of public receptivity. To do otherwise would reduce, in effect, the level of present knowledge about earthquake hazards and risk reduction for we would fail even to provide an opportunity for follow-up generations to inform themselves. Old timers eventually are replaced by new faces. It is the natural way of things. We would do a disservice to the younger generations by failing to provide for the transfer of our knowledge.

What kind of education, then, and for whom? Sidestepping for a moment the lack of public commitment to earthquake risk reduction, need for at least three types of education and training can be identified in the comments made in prior portions of this paper: training of emergency management personnel that aims at clarifying the new types of liaisons needed for earthquake risk reduction through mitigation; training for

design professionals and governmental regulatory agency personnel that aims at improving their skills in applying mitigation concepts that may be recommended or mandated in standards and codes; and general public education that aims at advancing the understanding of earthquake risks by the public and their political representatives.

Concurrent with these education and training efforts, it would be helpful to have results from studies of public apathy with respect to earthquake risk--their perceptions, misperceptions, and views--in order to determine whether or not public education is even warranted and, if so, the form it should take to be most effective.