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## PRIVATE SECTOR EARTHQUAKE PROGRAMS IN JAPAN AND THE UNITED STATES

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### SUMMARY

Private sector earthquake programs in Japan and the United States, along with their mutual transferability, were studied. Japanese companies are very well prepared in terms of engineering, but do lack inter-company communication and behavioral aspects of earthquake preparedness. U.S. companies stand to gain tremendously by adopting the technology the Japanese have developed. Companies in both countries would benefit from standardizing earthquake countermeasures. While Japanese companies seem to rely too much on a earthquake prediction, U.S. companies seem to have neglected earthquake-caused fire and hazardous materials problems. Long-term planning for earthquake hazard reduction is also necessary.

### INTRODUCTION

Japan and the United States have free market economies with the private sector forming the backbone of the national economy. Speedy recovery of companies after a natural disaster will be one of the key factors determining the rate of recovery. Both countries are highly industrialized and have areas of very high seismicity. Another point of similarity, particularly relevant to this study, is that both countries are also great centers of earthquake engineering.

There are also some key differences between the two countries, which must be carefully considered in any evaluation of the transferability of lessons learned from corporate earthquake programs in Japan to the United States, or vice versa. The major relevant differences between the two nations, pertaining to the topic of earthquake hazard reduction, are summarized in Table 1.

Table 1: Major Differences between the United States and Japan that Affect Transferability of Earthquake Programs

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1. National Scope and Significance of Earthquakes
  2. Seismicity and Risk
  3. History of Disasters
  4. Earthquake Prediction
  5. Government-Business Relations
  6. Cultural Factors
  7. Commercial Development
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In their study of private sector earthquake programs in Japan and in the U.S. the authors have found that companies in each of the countries have certain characteristic features. Though as a whole Japanese companies are better prepared than their U.S. counterparts, several U.S. companies are also quite well prepared. The ability to learn from each other would undoubtedly be mutually beneficial.

The intent of this paper is to point out the major features of corporate earthquake programs, with an emphasis on the strengths of Japanese practices that would be beneficial to U.S. companies, and vice versa. The authors recognize that technology transfer is often dependent upon sociological and cultural factors. This paper, however, is intended to address only the technological and organizational aspects.

#### CHARACTERISTICS OF JAPANESE CORPORATE PROGRAMS

This section outlines some of the strengths of Japanese earthquake programs that would benefit U.S. companies.

Long-term Policy Directed Corporate Programs Most Japanese corporate earthquake programs are balanced, well-proportioned. Some of the programs of Japanese firms are quite modest in budget, but they still generally aim at sorting out the various problems and allocating resources to the more important threats, attacking with more than one tactic - physical changes to improve safety as well as training to improve response. The long-term perspective of the typical large Japanese company is a distinct advantage in developing and maintaining an earthquake program. The growth or decline of the company may affect the size of the earthquake program, but it is recognized that, like fire insurance, one does not forego protection selectively in low-budget times and then acquire protection when funds are plentiful. One is not likely to find a company where a single-minded concern along "survivalist" lines has led to the stockpiling of food while obvious nonstructural hazards have been left untouched. Annual or more frequent earthquake drills or exercises are typical of Japanese firms that have active earthquake programs.

The short-term approach is to invest in the staff time to develop an earthquake plan and stop there; the long-term perspective is that if it warranted the cost to develop the plan in the first place, it is necessary to maintain it over future years in a routine manner. The short-term perspective is that earthquake risk reduction does not contribute to quarterly earnings per share, and in fact, the slight cost of the program is a negative factor. The long-term more typically Japanese view is that the earthquake program is one of those essential costs of doing business that will guarantee the corporation's future into the next century.

Staff Position in Management Hierarchy Japanese companies generally benefit more from the personal involvement of the chief executive officer in the management of earthquake programs. If the earthquake program is important, then it should be well managed and not just allowed to randomly and amorphously grow. The safety manager who carries out the details of the earthquake program is usually on a generalist's career track into management, with promotion opportunities beyond that available within the safety function on the organization chart. Good performance in managing an earthquake program can lead to placement in a position where good management of some other type of program is required, while in the United States, the safety or risk management function is more often separate from the general flow of management promotions. Because earthquakes, unlike hazardous materials, are not a major regulatory and liability concern, the typical California company isn't likely to devote much management attention to the subject.

Emphasize Practical Countermeasures California companies can learn from the way Japanese firms focus their earthquake programs on the countermeasures that can have the greatest practical effect on reducing the losses from future earthquakes. The image of the program is relatively unimportant, and the public relations angles are typically not calculated. Specific training objectives for various classes of employees are carefully set. Earthquake plans contain specific emergency response checklist items

Learn Quickly from Disasters While learning from earthquakes occurs in both Japan and the United States, the extent to which the Japanese learn a lesson from an earthquake and then quickly apply that lesson was a surprising finding in this research project. This learning process has pervaded both the private and public sectors. Using the example of petroleum refineries, after the 1964 Niigata and 1978 Miyagi-ken-oki earthquakes, the causes of damage were identified and practice rectified so the same causes will not result in damage in future earthquakes. The ignition source provided by floating oil tank lids with metal-to-metal seals was eliminated with the use of plastic seals throughout Japan, for example, after the Niigata earthquake.

While U.S. engineers and earth scientists have also learned from earthquakes in other countries, it is difficult to find examples where changes in practice have occurred to the extent found in Japan. At many agencies and companies in Japan it was stated that the 1971 San Fernando earthquake helped crystalize a consensus that earthquake programs should be a standard of practice among Japanese companies. By the time the 1978 Miyagi-ken-oki earthquake occurred, some companies had already begun their programs and government agencies were working quite hard on the topic.

This rapid response to past disasters in improving protection from future ones is less a matter of research to discover the lessons and much more a matter of applying the lessons in practical ways.

Fire and Hazardous Materials Risks There is great concern over earthquake-caused fires and hazardous materials incidents in Japan. Most of the various techniques available to deal with the problem, such as anchorage of appliances, equipment and piping that could cause fires, automatic shutoff devices, fire resistant construction of fire breaks on an urban scale, etc., have been implemented in Japan. Probably due to the implementation of these countermeasures, the past several earthquakes in Japan have caused far fewer fires than had been expected.

The lower level of major earthquake-caused fires in the United States, partly due to lower densities of development, does not mean that this is not a serious problem. In any review of the potential problems that could arise at a company's facility, fire and hazardous materials should be carefully considered.

Commercialize and Apply Technology Japanese companies have been successfully developing earthquake hazard reduction equipment for at least 10 years, including (a) electrical and gas controls that respond to earthquakes, (b) base isolation devices for individual statues or pieces of equipment, and (c) earthquake-isolated raised computer floors.

Especially in the case of the high-technology items, it was found that the R & D was undertaken at a corporate facility, generally at its own expense, and in cooperation with manufacturers and users. For example, an earthquake-isolated raised computer floor system was developed jointly by a major automobile shock absorber manufacturer and an architecture-engineering firm that found the need for such floors.

In contrast, the hazard reduction devices that have been commercially developed in the U.S. tend to be undertaken by individual entrepreneurs who see a profit potential. The sophistication in the products, with some exceptions, is lacking, when compared with corresponding items in Japan.

Make Government a Leader by Example Japan's successful business earthquake programs owe some of their success to the examples provided by many Japanese agencies. Present government programs in the United States at the federal, state, and local levels usually attempt to increase private sector earthquake efforts by putting the government in roles such as a provider of information, a sponsor of conferences, a funding source for research, a provider of disaster aid, and as a public relations effort. It may be that without the additional role of government leading by example, these other roles are much less effective. For example, in the U.S. only a few national agencies have adopted earthquake code regulations governing their own buildings. A 1986 State of California law requiring local governments to inventory unreinforced masonry buildings exempted state-owned structures. In most local or regional government offices in California visited by the authors, emergency power systems, tall shelving, and other nonstructural features have not been restrained to resist earthquakes.

Tie Educational Efforts and Budgets to Specific Risk Reduction Goals Earthquake-caused fires are such a major threat in Japan that most public education earthquake efforts have included this problem within their scope. How to operate a fire extinguisher, how to reduce hazards associated with gas-fired appliances, which routes to take to open space refuge areas if large urban fires result - all these specific and practical pieces of information are then devised and convincingly presented. The lower-than-normal occurrence of these fires in the past few earthquakes has led to the conclusion that such efforts and training programs have been very successful.

In the United States, most awareness or educational efforts are much more diffuse. They are well-intentioned, but there is no clear strategy on how the good intentions will lead to good works. They are not tied to the specific behaviors they presumably intend to change. They may convince people there is a problem, but they usually stop short of telling them how to solve the problem.

#### STRENGTHS OF U.S. CORPORATE PROGRAMS

There are several practices in the U.S. that would be beneficial to Japanese companies.

Promote Inter-Company Communication In general, it was found that employees of Japanese firms are somewhat isolated one from another in terms of informal contacts by employees. A California facility or safety engineer would be more likely to attend an earthquake conference and meet counterparts in other companies. Japan also has fewer counterparts to the many volunteer or non-profit organizations in the United States, e.g. The Red Cross. There is a wealth of information that companies could share if increased inter-company communication about earthquake programs could be encouraged.

Standardize Countermeasures Some of the larger California firms have employed engineering consultants to develop standardized solutions, based on sound engineering principles, such that all four-drawer filing cabinets are restrained with identical braces, wherever they are located within the facility. The implementation of standardization would not only decrease the cost of such measures, but can also be expected to increase the reliability of the installed braces. With rare exception, individual work units or departments do not need to devise their own solutions.

Avoid Dependence on Predictions While the major Tokai prediction effort in Japan has done much to advance the state of the art of earthquake preparedness in Japan, in some cases there is an excessive reliance on the possibility that the Tokai earthquake will be accurately forecast.

Consider Behavioral Aspects Japanese emergency plans generally assume that employees, or the general population, will respond as they have been told to do in an earthquake disaster by going to certain locations, taking certain protective actions, following various instructions, and so on. More consideration of the behavioral aspect of earthquake response could be given to ensure that plans are flexible enough to adapt to different ways in which people may behave.

Prepare Smaller and Larger Companies This point is not really a lesson that Japanese firms can learn from California any more than it is a lesson California can learn from Japan, since in both places there is a large divergence in the degree of earthquake protection activity of the big versus the small firm. Small companies are a significant factor in both economies, employing numerous people, and are much less likely to have earthquake protection programs.

#### CONCLUSION

Characteristic differences in corporate earthquake programs in Japan and the U.S. are such that learning from each other will be definitely mutually advantageous. This paper has pointed out these characteristics of Japanese and U.S. corporate earthquake programs, and discussed the manner in which a transfer of this technology will benefit the recipient.

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