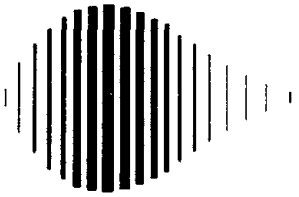

NATIONAL CENTER FOR EARTHQUAKE ENGINEERING RESEARCH

State University of New York at Buffalo

Issues in Earthquake Education

Edited by

Katharyn E. K. Ross

National Center for Earthquake Engineering Research
State University of New York at Buffalo
Red Jacket Quadrangle
Buffalo, New York 14261

Technical Report NCEER-92-0003

February 3, 1992

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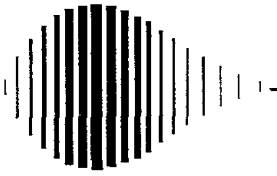

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1 Education Specialist, National Center for Earthquake Engineering Research

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Introduction

by Katharyn E.K. Ross
Education Specialist, National Center for Earthquake Engineering Research

Why devote an entire publication to issues in earthquake education? Are there really that many issues? Isn't the problem just a lack of awareness? Getting materials to teachers? The development of disaster plans?

Many educators will agree there is a need for an earthquake education program in their schools once they are aware of the seismic risk in their area. However, later follow-up reveals that there is frequently a lack of implementation. A belief in the importance of earthquake education and agreement with its goals does not guarantee its addition to the school curriculum because lack of awareness is not the only issue. There are other concerns which can impede implementation or, at the very least, make it a challenge.

"What is it you want me to incorporate?" asked frustrated school administrators at a recent workshop. Differing definitions or various interpretations of the scope of earthquake education can cause confusion for some school programs. Why should this be? Don't we all want the same thing?

Part of the strength of the earthquake education effort comes from its support by a diverse, multi-disciplinary community of individuals. However, this diversity can also create some difficulties. Individuals from different disciplines can convey varying priorities to schools, and as a result, differing definitions of earthquake education. An emergency preparedness specialist might stress that earthquake education is earthquake preparedness and safety instruction and/or the development of an emergency plan that includes procedures to follow in the event of an earthquake. A science specialist might define earthquake education as the science of tectonic processes. A comprehensive earthquake education program, recommended by the National Center for Earthquake Engineering Research, incorporates both science and its application to daily life, including preparedness, safety, and beginning concepts about seismic design (See Figure 1).

Even when one definition is provided to a school system, it may not convey enough information to facilitate its implementation. Generic definitions or generalized position statements may not provide enough site specificity. Such definitions may need to be elaborated in order to provide guidance to school systems on how to tailor an earthquake education program to meet the needs of their heterogeneous population. Because no program can meet the needs of all children everywhere, the individual school or district may also have to modify existing curriculum guides and develop specialized materials and safety procedures. **Meeting the Needs of the Diverse School Population** attempts to look at ways that programs can adapt their earthquake education programs for certain student groups.

Therefore, before addressing other issues, the individual district or school must agree on a concise, working definition of earthquake education. Is it a disaster plan that includes earthquakes? Is it the addition of preparedness and safety information to the existing science curriculum whenever earthquakes are discussed? Is it the incorporation of an additional earthquake curriculum at each grade level? Equally important, the school or district must decide whether this definition will remain the same for all groups of students. In addition to clarifying earthquake education, resolution of these questions will assist with the determination of definitions and implementation procedures for other natural hazard education programs.

There are additional concerns that can interfere with the implementation of earthquake education, some recently raised by an educational administrator in her response to a position paper on earthquake education:

"How does one convey the importance of such a program to a community, a government and a school system when the possibility of such a disaster is fairly remote? The importance of earthquake education wanes tremendously when considered along with the drug problems, the violence and the across-the-board poor performance of minority students in education in general and in science in particular."

"How can teachers be motivated to take on one more program when they are already overburdened with the social and educational problems associated with urban minority education?"

For some educators, the availability of earthquake education materials is not so much the problem as the place of these materials in an already filled school program. Where and how does earthquake education fit into the hierarchy of curricular needs? Tori Zobel provides one way in which earthquake education can be creatively accommodated in an already crowded curriculum -- the "Whole Language" approach in which earthquake education becomes a theme across subjects.

Does earthquake education only take place in school during the traditional academic day? When does the school day actually start? Suppose students are on school buses? Carole Martens, concerned about the possibility of school children being on buses during such an earthquake, provides a structure for preparing school bus drivers.

Does earthquake education occur only in the classroom? Suppose children are in other locations when an earthquake occurs. What would happen to them? Do school plans consider children in portable classrooms? In the school library? In the cafeteria? Changing classes? The issue of location in the school can become critical in the event of an earthquake and a comprehensive earthquake education program must provide a plan for each of these locations. Joyce Bagwell provides some guidance on developing a plan for school libraries.

Students attending institutions of higher learning may be especially vulnerable. Not only could they lack scientific knowledge about earthquakes but also knowledge about appropriate response during an earthquake. In addition, they may attend classes in facilities where the procedure in the event of a damaging earthquake is not practiced or even known. Larry Parsons provides some information to consider when planning for colleges and universities.

As is all education, earthquake education is complex. It touches scientific, preparedness, engineering, psychological, and sociological domains. Its implementation requires a careful review of the total school program and a balanced, sequential approach. In an effort to assist with this effort, this publication examines some of the issues involved, attempts to clarify what some of the difficulties are, and makes recommendations for the future.

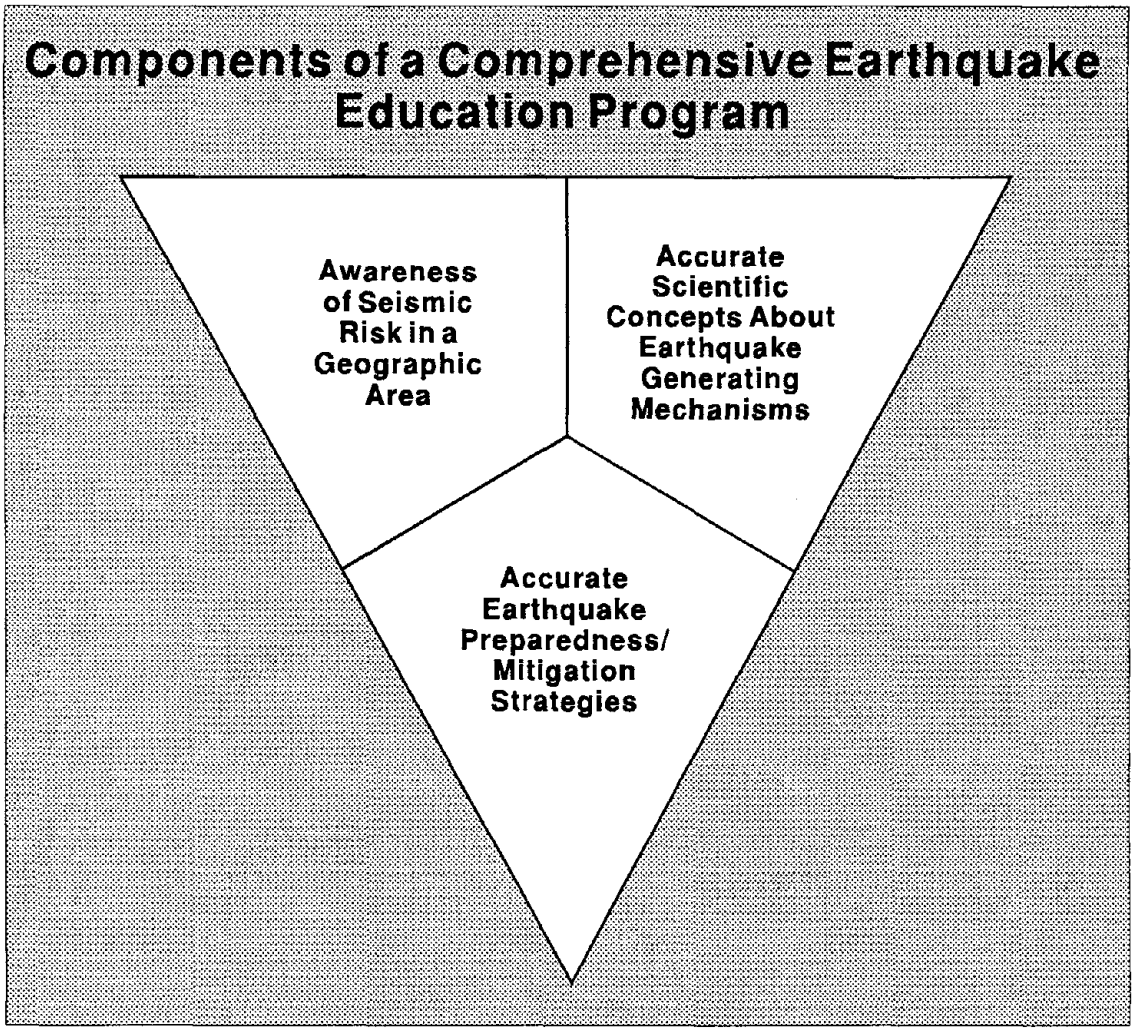

Figure 1: Components of Earthquake Education

Section 1

Meeting the Needs of the Diverse School Population

1. Cultural Diversity: Communities Have Many Faces
   by Frances E. Winslow, Director, Office of Emergency Services, San Jose, California

2. Adapting Earthquake Education to Meet the Needs of Our Culturally Diverse Population
   by Jacolyn L. Dudley, Instructor, UCLA Extension, Los Angeles, California

3. Managing Hazards in a Changing Multi-Cultural World
   by Fred Cooper, Former Director, Emergency Preparedness Canada - British Columbia and The Yukon and Laurie Laughy, Emergency Preparedness Canada, Victoria, British Columbia

4. Teaching Earthquake Awareness to Persons Labeled Mentally Retarded
   by Katharyn E.K. Ross, Education Specialist, National Center for Earthquake Engineering Research, University at Buffalo, Buffalo, New York

Students with varied cultural backgrounds, ability levels, and handicapping conditions can all be found in a school community. Even within what would be considered a fairly homogeneous group of children, there will be differences in background and family experiences that will impact on the students' interpretation of earthquake education activities in the school. This diversity is evident even in poems written by a group of third graders after a unit on earthquakes. Although the youngsters all received the same instruction, what they remembered and emphasized in their literary works was different:

> "Earthquake
> Rumbling, tumbling
> I don't like them
> Shaking buildings
> Destroy."

"Earthquake
Red Lava
I do not like earthquakes
Rumbling
Hot."

"Earthquake
See a crack in the earth
The earth rattling
Feel the earth vibrate
Vibration."

To meet the needs of a varied population, any earthquake education program must be adaptable to individual differences. It should not be designed as if there is only one group of students.

Cultural Diversity: Communities Have Many Faces

by Frances E. Winslow
Director, Office of Emergency Services

Years ago the United States was called a melting pot. People came to this country from all over the world, and tried to become "Americans." In this quest, they often forfeited the language and customs of the land of their birth. Today the United States is a salad bowl. People come here to participate in the culture and economic milieu, but they most often strive to maintain the language and traditions of their home country within the family group.

Previously, most immigrants to the United States were young men seeking their fortunes, or their young brides, joining them after some years of planning and saving. Adapting to the new land was possible because they were young, and highly motivated to become a part of this vibrant new country. Today many of the new residents of the United States are fleeing oppression in their home countries. Today's immigrant may be a child or a senior citizen, as well as an adult in the working years. For some of the older people, adapting to a new language and new customs is too difficult. They make a community among themselves for support, and may never develop a working knowledge of written English. They often possess only a limited spoken vocabulary.

Previously, most immigrants to the United States came from countries in Europe. These cultures of origin had many similarities to the "American culture" that was developing in the United States. Language groups generally shared Germanic, Slavic or Romance roots. Most all of the immigrants used the Roman alphabet, and were accustomed to phonetic written languages. Since English has many words from these European roots, and shared the phonetic alphabet approach to writing, immigrants could learn spoken English based on common words from their birth language, and could learn to read using a dictionary. Today people come from cultures with languages using entirely different alphabets, including symbolic representations. The result is that many immigrants today have a greater challenge learning to read and speak English because the alphabet and word roots are radically different.

Years ago most immigrants came from countries with religious practice based on the Judeo-Christian traditions. Cultural norms related to personal behavior and community interaction tended to be similar among the immigrant groups. The religious backgrounds of the immigrants of the 1980's and 1990's has included every religion and cultural tradition in the world. The cultural norms of their birth cultures may preclude the interaction of some members of the culture with strangers, in some cases leading to isolation. Behavior that is unremarkable to an American may be offensive or shocking to a new resident.

This is the cultural diversity in Orange County in the 1990's. This profile can be extended to the whole State of California, and to most of the rest of the United States. For those of us whose professional activities depend on communication with groups of people, recognition of the impact of language and cultural factors can be critical to the success of our programs.

In addition to the diversity of cultures in our state, there are also other "minority" groups for whom special planning may be needed. Older people have special needs. Physically limited people of all ages will have different considerations in lifestyle and access issues. Some Americans are illiterate, or have only limited reading ability, either through learning disabilities, or through lack of effective educational opportunities. A successful public outreach program must take into account the development of methods of reaching out to the whole constituency in order to effectively convey the earthquake education message.

Psychological trauma suffered at an earlier time will effect the ability of the individual to withstand a new trauma. Researchers have described an "echo effect"[1] which causes people to react to the current crisis by reverting to the experiences of an earlier trauma. For example, someone who has experienced an earthquake earlier will react more strongly to a subsequent earthquake, especially if the first experience carried with it severe consequences or personal loss. Someone who has lived through a war at an earlier time in life will react more strongly to any subsequent disaster.

Some groups of immigrants are in the United States today specifically because of some tragedy in their birth country. Many Americans who were born in Southeast Asia have personal memories of the wars in Laos, Cambodia, and Vietnam. Should they experience an earthquake, for example, the previous traumatic event will influence their psychological response to the new stimulus. Many people who have recently arrived from Central America have similar memories of wars in Nicaragua and El Salvador. The people from Nicaragua may also have experienced the earthquake there in the 1970's. People from Mexico may have experienced the Mexico City earthquake.[2] All of these people may have a much stronger psychological response to a new trauma than will their neighbors who have not suffered a previous traumatic event.

For example, a business in my community suffered a significant disruption of production because most of the workers refused to reenter the building following a minor quake on the Newport Inglewood Fault. These ladies did not speak much English, and as a result, there was a communication problem between the supervisor and the workers. When a bilingual employee was able to assist, it was discovered that many of the ladies had previously experienced an earthquake while in a Central American country. Because this country did not have strict building codes, they expected that the buildings they were currently working in would surely fall down in the first after shock. This type of issue could well be addressed in a new employee briefing so that employees could be reassured that California seismic codes make it unlikely that buildings will collapse. Recognizing such a potential problem in advance can prevent some of the psychological trauma to the workers after an earthquake, and can benefit the company by getting work started faster again.

An effective emergency management program requires a realistic evaluation of the community that the program will serve. Are there groups of non-English speaking citizens in the community? Are there people with physical disabilities, learning disabilities, lack of literacy, young children? Each of these groups needs to be considered in developing public education materials. The California State Department of Education Language Census Report can provide information on the number of languages spoken in the homes of the children in the local school districts. This is a good guide in selecting which languages, other than English, should be included in the public education program.

The Governor's Office of Emergency Services (OES) has provided basic earthquake preparedness information in the following languages commonly spoken in California homes: Spanish, Korean, Mandarin, Vietnamese, Lao, Cambodian and Hmong. Local ethnic associations may be willing to provide the translation of this set of fliers into other languages that are important in the community. For example, in Irvine, a group is translating a flier into Japanese, a language not currently available through OES. It is very important to have the translation undertaken by someone who speaks the desired language idiomatically. Some comical results have developed from translations by persons who speak a language only on a scholarly level, or through a phrase book.

In addition to providing preparedness information in several languages, the emergency plan should include a resource list of translators, preferably people who are birth speakers of the language other than English. These people will be a critical resource in the medical aid center, the Emergency Operations Center, and the Public Information Office staff. If a building must be posted as dangerous, and the occupants are unable to read English, it would be helpful to have a birth speaker of the other language accompany the building official, and leave a written

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[1] "Predicting the Range of Adjustment to Earthquake Trauma in Santa Cruz," by Francis R. Abueg, Ph.D., Terrence M. Keane, Ph.D., Jessica Wolfe, Ph.D., Rock Pfotenhauer, and Robert Agrella, Ph.D., a paper presented to the International Society for Traumatic Stress Studies, New Orleans, 1990.

[2] "The Mexico City Earthquake Disaster," by Corinne L. Dufka in School Casework: The Journal of Contemporary Social Work (March 1988) notes how previous loss, trauma and psychological difficulties contributed to the responses of individuals after this earthquake.

message in the occupants' language on the official posted notice. After the Loma Prieta quake, people entered unsafe buildings, and others refused to enter perfectly safe buildings because of their inability to understand the instructions posted on the building. In addition to relying on color-coding signs, major languages spoken in the community might be included on life safety signage.

Seniors, children, those with physical and learning disabilities, and those unable to read English must also be considered in developing a program. Seniors can be addressed through special publications that are distributed both at general public events, and at special senior events such as health fairs, and at senior centers and clubs. Children can be reached through comic books and puzzle books. The simple picture book approach can also be used on fliers for adults that include crucial life-safety issues. For example, Irvine commissioned a flier on gas meter safety issues that uses cartooning extensively. A flier on nonstructural hazard mitigation uses illustrations to show how to accomplish the necessary tasks. Adults with limited reading ability will appreciate the simple format of a comic book, like those created by Hanna Barbarra, featuring Yogi Bear. These books convey a serious message about earthquake preparedness through attractive graphics and few words. Earthquake preparedness materials for the disabled are available from the Federal Emergency Management Agency (FEMA) and from OES. There is an excellent film called "Silent Quake"[3] with captions that can be a resource for hearing and non-hearing audiences. Develop a volunteer group like the Guardian Angels for the Handicapped that will work with citizens with physical limitations both before and after a disaster.

Finally, it is important to be sensitive to economic issues within a community. Analyze the socio-economic balance in the community before launching any program that includes a significant amount of self-help or citizen financial participation. For example, in a community with lower income renters it may not be effective to hand out fliers on "how to strap your water heater." In such a community it would be more effective to contact the landlords regarding having the water heaters strapped with two belts of plumbers tape. The $5 cost of materials might mean a missed meal to a family on limited income, while it would be a small outlay in a more affluent community. Similarly, before launching a program of emergency supplies collections at the schools, consider whether the families can afford to donate several dollars worth of goods that may never be used. A family of limited means with several children may find that the financial burden of providing a backpack of food for each child is prohibitively expensive. It might be better to contact the major industries in the community and see if they would donate the basic necessities of water and first aid to the schools. Coca Cola Company donated the emergency supplies to the schools of South-gate, California.

The United Nations Office of Disaster Assistance in New York and the Pan American Health Organization in Washington, D.C. are sources of educational materials in languages other than English. The ethnic associations within the community may be able to provide translation services for fliers. Cartoon artists (including students from the junior colleges) are a good resource for interpreting life safety information into simple formats. These and other resources are available to assist the emergency management professional in reaching out to the entire community.

Orange County, California, the United States ... today we live in a salad bowl, not a melting pot. The spice and color of our multi-cultural nation adds excitement to our lives. We need to continue to be sensitive to the responsibility to provide community education services to everyone, to make emergency preparedness information accessible to all the citizens of our diverse communities.

[3] "Silent Quake: Preparedness for the Hearing-Impaired" is available from the American Red Cross, Los Angeles Chapter, Audio Visual Department, 2700 Wilshire Boulevard, Los Angeles, CA 90057 for $30.00, plus $5 shipping and handling.

Adapting Earthquake Education to Meet the Needs of Our Culturally Diverse Population

by Jacolyn L. Dudley
Instructor, UCLA Extension, School Earthquake Preparedness Program

If students are going to be prepared for a disaster of any kind, particularly an earthquake, we must acknowledge the relevance of cultural diversity and the influence which students' pre-existing, culturally-based attitudes and belief systems have on their ability to grasp earthquake education concepts.

The purpose of earthquake education is two-fold: to provide an exciting and often timely introduction to earth sciences curricula and to train children in effective earthquake preparedness and response actions.

It is axiomatic that successful teaching must begin at the point of the student's current level of understanding. When teaching earthquake science and safety, it is important to recognize the need to pre-test not only to assess the student's factual base, but also to understand his cultural perspective and personal experiences. A recently immigrated child who has been subjected to natural and/or man-made disasters will almost certainly understand the importance of preparedness far better than a child who has grown up in the relative safety of the United States; conversely, that child's painful memories may be a barrier to effective learning.

Educators who teach earthquake safety and survival to children from diverse cultural backgrounds are encouraged to consider the following points:

1. Lessons must be age- and culture-appropriate. Many children have an existing base of myths, experiences, and religious interpretations of earthquakes. The successful teacher needs to be sensitive to these belief systems when introducing basic scientific concepts.
2. Information must be simple and clearly explained, with lots of pictures to help those who may not have a good grasp of the language. For example, the command to "duck and cover" may confuse a child whose primary association for the word "duck" is a fluffy yellow bird.
3. Practice is an integral part of preparedness. The more familiar children are with exit routes and other emergency procedures, the less likely they will be to panic during the confusion.
4. Materials designed to reinforce preparedness in the home must not only be available in the family language, they must be written and delivered in a manner which reflects and honors culturally diverse attitudes. Families from a culture which considers their children a critical link to the new country will enthusiastically participate in a "home hazard hunt." A child from a different background who brings the same assignment home may be punished for his impertinence.
5. Since parents' post-quake responses will partially determine the success or failure of the school's disaster plan, it is essential that they are incorporated into the planning process. To encourage this interaction, the school should provide interpreters at planning meetings and arrange free child care so that more parents can attend.

In a large proportion of urban and suburban schools, the "minority" student population is actually a majority. If educators intend to give students a basic understanding of geological concepts and a greater chance of surviving a damaging quake, they must use every means at their disposal to insure that each child - and his family - is fully included in our science and safety program.

Managing Hazards in a Changing Multi-Cultural World

by Fred Cooper and Laurie Laughy
Emergency Preparedness Canada, British Columbia and Yukon

This paper is based on a presentation made by Fred Cooper and Laurie Laughy to the Emergency Preparedness National Symposium in September 1988.

Background

Very little attention has been paid in Canada to the multicultural effects in disaster management. The results of current research are primarily based on American research. This in itself should serve as a warning flag for Canadian emergency planners and should reinforce the need to take ethnic issues into consideration for planners in the United States and abroad.

The *1986 Statistics Canada Report* indicates that in 1986, the Canadian population was 25,309,330. Most Canadians, 62%, live in the provinces of Ontario and Quebec. The population is widely distributed and primarily concentrated in urban communities along the American border. Large expanses, such as the Northwest Territories, have very few residents.

Approximately 10% of the population is either under the age of five or over the age of eighty. This information alone adds to the complexity of emergency planning in Canada. But the ethnic makeup of Canada, with what we have learned from elsewhere, adds to the intricacy of planning.

Table I: Ethnic Breakdown for Canada

	% of Canadians	Speak Neither French nor English	% of Ethnic Origin who Speak Neither Language
British	39.13	11,995	0.09
French	25.69	5,465	0.06
British & French	3.90	1,900	0.15
Latin, Central & S. America	0.16	4,355	8.70
Caribbean	0.26	530	0.65
African American	0.82	1,100	0.42
Aboriginal	2.25	23,505	3.30
N. Europe	2.19	1,900	0.27
S. Europe	5.39	108,300	6.35
E. Europe	10.55	13,475	0.40
W. Europe	5.97	19,320	1.02
Western Asia	0.16	3,740	7.24
Southern Asia	0.99	18,105	5.76
Southeast Asia	2.18	87,125	12.65
Pacific Islands	0.03	330	3.18

* Figures extrapolated from *Statistics Canada 1986*

What do we know about Canada's ethnic population? We can see by examining the figures in Table 1, that over 300,000 persons in 1986 did not speak either national language. Since we know that, in many cases, new immigrants to our country tend to migrate to neighborhoods where the population is comprised of persons with similar ethnic backgrounds (e.g. "Chinatown," "Little India," "Little Italy"), we have large pockets of citizens who have difficulty relating in the common language.

This is compounded by the fact that *Statistics Canada* reports that an additional 680,524 immigrants have arrived in Canada since 1986. Given the number of English as a Second Language (ESL) students in our elementary schools, although no national figures are available, it would appear to be reasonable to assume that many of the new immigrants have difficulty communicating in French or in English.

In some ethnic cultures there is a much higher proportion than in others of those who speak neither official language. With 12.65% of those from Southeast Asia not speaking either national language, provinces such as British Columbia and Ontario, with a high concentration of Southeast Asians, have many ethnic issues to address. Many emergency planners would probably be surprised to hear that over 23,000 aboriginal people speak neither French nor English.

It is important to consider that *Statistics Canada* further breaks down ethnic categories by primary language spoken, and recognizes 61 separate languages. However, this can be misleading as it records Chinese as one language and fails to recognize the many dialects which can present additional problems.

Some of the breakdowns by language, of those who speak neither French nor English and may be of interest are:

Table II: Language Breakdown

German (0.43%)	Ontario	3,874	Chinese (16.46%)	Ontario	29,786
	Alberta	2,068		Alberta	9,342
	B.C.	1,768		B.C.	20,662
Italian (5.41%)	Ontario	34,047	Inuit (10.69%)	N.W.T.	1,962
	Quebec	10,739		Quebec	786
	B.C.	5,008			
Vietnamese (15.39%)	Quebec	2,681	Greek (6.4%)	Ontario	6,304
	Alberta	1,791		B.C.	760
	B.C.	1,091			
Cambodian (26.66%)	Quebec	1,539	Portuguese (12.94%)	Ontario	20,988
	Ontario	976		B.C.	2,686
	Alberta	315			

* Extrapolated from *Statistics Canada 1986*

Of additional interest are the percentages of the various ethnic populations who speak neither national language. For example, while the actual numbers of Germans and Vietnamese who speak only their language of origin in the province of Ontario are roughly the same, the percentages are quite different. With less than one percent of Germans speaking neither official language, the chances are that there will almost always be someone who can translate. However, with more than 15% of those from a Vietnamese background unable to speak either language, the odds of having a translator available decrease significantly.

Until they have obtained landed immigrant status, many refugees coming to Canada are legally unable to work. While in many cases family, friends and the community provide for refugees, in other cases, refugees find themselves in difficult financial circumstances. Often, until refugees obtain employment and become assimilated into the Canadian culture, they live at a lower socio-economic standard.

Canada is still a country of persons and families living in self-owned dwellings, although as housing costs rise in the larger cities, fewer and fewer renters are able to afford to buy a home. The 1986 *Statistics Canada* reports that of the 24,773,100 people living in private dwellings, 17,235,500 or 69.57% live in owned dwellings as opposed to living in rental accommodation.

For social and economic reasons, many minority ethnic groups choose to live in particular neighborhoods, such as the "Chinatown" area in Vancouver, B.C. In addition, many ethnic groups live in older, unreinforced masonry buildings. These buildings were built prior to the existence of the National Building Code, which was implemented across Canada in the early 1950's and as a result, are most susceptible to damage during an earthquake. The Canada Mortgage and Housing Report, following studies based on the Loma Prieta earthquake, predicted that following a major earthquake, 50-100% of the unreinforced masonry buildings in the Vancouver area will be uninhabitable. The extent of the problem, with the combination of large ethnic populations concentrated in pre-1950 buildings, is considerable.

Table III: Canadian Occupied Private Dwellings

Provinces	5 Story Apartment Building Built Prior to 1920	5 Story Apartment Building Built 1921-1945
British Columbia	1,740	1,250
Alberta	275	375
Saskatchewan	115	115
Manitoba	390	330
Ontario	2,650	6,175
Quebec	1,775	3,680
New Brunswick	80	145
Nova Scotia	130	170
Prince Edward Island	0	0
Newfoundland	5	0
Total	**7,160**	**12,240**

** Statistics Canada 1986*

Having given you some of the Canadian facts and figures regarding multiculturalism in Canada, as related to emergency planning, it is important to examine some of the problems and solutions identified in Canada and other international communities. While the ethnic mixes may be somewhat different, the message should be clear.

Hazard and Risk

Belonging to an ethnic minority is an added risk because disaster related deaths are historically higher among ethnic minorities. Damage levels are directly related to ethnicity because residential patterns are determined by ethnicity and different ethnic groups live in differing sorts of housing (Bolin & Bolton, 1986). For example, in the Coalinga earthquake in 1983, the Hispanics suffered the most because they lived in older unreinforced masonry buildings, many of which were poorly built. Ironically during Hurricane Iwa in 1982, it was the Caucasian minority living in expensive beachfront homes on Kauai who suffered greater amounts of property damage (Bolin & Bolton, 1986).

Therefore, it is important for planners to complete a hazard and risk analysis which includes a hazardous building analysis and targets the populations most likely at risk (Bolton, 1988). But it is also important for planners to realize that racial and ethnic minorities assess risk differently (Perry, 1987). For example, Perry noted that in sample studies in the United States, African Americans and Mexicans were often more fatalistic about earthquake danger and more skeptical about science. He found that African Americans viewed flooding as an uncontrollable natural event and were thus less confident in their ability to deal with such events.

Surveys have also indicated that ethnic groups hear or learn about hazards from different information sources. In one survey, Caucasians listed newspapers, mail, and radio as the preferred means of communication while Mexicans listed radio and neighborhood meetings (Perry, 1987). In the 1987 Whittier Narrows earthquake, it was found that residents in the Asian areas of Monterey Park were out of the information network and were not as aware of earthquake hazards as the Hispanics from earthquake areas (Bolton, 1988).

As part of the community hazards needs assessment, planners should attend to the social organizational issues and develop an ethnic profile of the community. By doing so, one becomes sensitive to the living patterns and customs of relevant ethnic minority groups (Perry, 1987).

One can also develop contacts who can provide information on emergency planning issues relevant to ethnic groups. It is, therefore, very important for the emergency planner to provide hazard information distribution networks geared to the way in which ethnic and cultural groups receive and assimilate information.

Mitigation

Very little work has been done in the area of mitigation, primarily because it is a new area of concentration for the emergency planning profession as a whole. What is suggested is that since ethnic groups have differing degrees of fatalism, some may fail to take protective actions, thus leading to higher death and injury rates. If a person believes a hazard is beyond the control of technology, he may then be reticent to take protective measures.

Therefore, any mitigative program that is geared towards the reduction or elimination of existing hazards or the reduction of the risk that these hazards present is going to have to take this factor into consideration.

Emergency Response

While implementing the planning process and in writing emergency response plans, planners have often ignored critical ethnic and cultural factors. From the warning stage through stages of recovery and reconstruction, minority groups have specific needs and concerns which need to be considered.

Warning

It goes without saying that to follow warnings or orders, one must understand the message. However, different ethnic groups have different concepts of what is a threat or the credibility of a warning (Perry, 1987). Clearly, non-English or non-French speaking persons are subject to more warning related difficulties as they may never be aware of the warning or may not understand it. In addition, they may have less confidence in the warning and therefore perceive themselves to be less at risk (Perry, 1987).

Different ethnic groups may learn about the warning in different ways and thus may perceive the warning quite differently. Native populations in Northern Canada, when dealing with the Royal Canadian Mounted Police (RCMP) respect and see the officers as being credible, despite local problems with them (Larkin, 1991). In fact, any person in uniform, such as a security guard, is often seen as someone in authority who should be listened to. While all groups

see civil authorities as reliable, the mass media can be seen as less reliable than other sources by certain minority groups. Similarly, in small towns, friends and relatives can be seen as more reliable when the threat is a familiar one (Perry, 1987).

The degree to which one has relatives and friends in a community is, therefore, a consideration on how a given community responds to certain warnings. For example, if certain ethnic groups have a large kinship network or if a specific cultural society has large extended families, how information is communicated in the warning phase will be very different than in a single's neighborhood in an isolated setting.

The size of one's family also has implications for evacuation. When there are elderly individuals as well in the household, this increases complications in complying with an evacuation order (Perry, 1987).

As previously mentioned, in many cases refugees awaiting immigration status and other ethnic minorities, experience a lower socio-economic status. Low socio-economic status has been shown to have an effect on interpretation of warnings (Perry, 1987). Although there is insufficient data to conclusively determine the relationship between socio-economic status and ethnicity, findings to date would suggest there exists a correlation.

Planners must therefore develop alert and warning plans which take into account language difficulties, risk perceptions, socio-economic disparities and cultural characteristics such as extended families and kin networks.

Rescue

During the rescue phase, ethnic minorities may have language difficulties which interfere with understanding the directions for rescuing others. Lack of understanding may result in volunteers putting themselves and others at risk during rescue operations.

What information does get communicated during the rescue phase is also subject to language constraints. For example, in Whittier although there was a Chinese radio channel, it did not meet the needs of those who spoke one of the thirty-two different dialects. Bilingualism was not widespread and so instructions were not communicated well. Most of the information was by word of mouth and much of this information was wrong (Bolton, 1988).

Studies following the Whittier earthquake indicated that there was a real need to develop better media packages to reduce the uncertainty after the earthquake as opposed to information on what to do during the quake, which is what most radio stations provide (Bolton, 1988).

Bolton (1988) mentioned that lack of consideration for ethnic diversity also led to problems with building inspectors following the Whittier earthquake. Whereas we generally think of police, fire and ambulance as being the primary first responders, after the quake the building inspectors were very much on the front line. The inspectors had to respond to a large number of damaged buildings, many of which were inhabited by ethnic minorities. They often ended up working day and night, assisting authorities to determine whether the building was safe to re-enter.

These building inspectors were not bilingual and unused to talking face-to-face with tenants, many of whom were Hispanic. They also were not trained to be "social workers" to those unable to return to their homes with no place to go, and not used to working with other first responders. Additionally, their lack of visible and credible identification compromised their authority with both rescue and ethnic groups.

Planners and the media must carefully plan for language differences in the rescue phase to ensure that instructions and information is readily accessible to those of different ethnic backgrounds. Identification of those in roles of authority must be clearly identifiable to those not speaking the common language.

Recovery and Reconstruction

Most of the research to date has been done during the recovery and reconstruction phases. This is a period of assessment and acceptance when people require shelter, food and other necessities until life begins to return to some degree of normalcy.

Studies indicate that minorities have greater difficulties after a disaster because they have more communication problems, lower incomes, less money, more unemployment and less insurance (Perry, 1987). After a disaster, the provision of temporary shelter and food are a priority, but how these services are accessed, perceived and accepted by ethnic groups differs considerably. It's been found that in several ethnic groups, people were unclear that there might even be assistance and so they didn't bother to ask. In other cases, services such as those provided by the Red Cross, were known but people didn't see them in the community and therefore did not access them (Bolton, 1988).

Communication regarding existing services in the recovery phase has been a real problem. For example, after the Whittier earthquake, Asian groups had a real problem accessing information. The police translation pool had thirty-seven different translators but could not always get them in normal circumstances, let alone after a disaster. The one Chinese newspaper produced old information and the Hispanic radio stations broadcast human interest stories rather than give the facts which were broadcast on the English speaking stations (Bolton, 1988).

Ethnic and cultural perceptions have to be taken into account. For example, pride and the concept of self-reliance made it difficult and inappropriate for Asians to request services from local reception centres after the Whittier earthquake; it was not the Asian way. Fear of losing face needed to be overcome before those in need felt able to go to a centre. When they did go, they found staff who were unable to speak their language and saw Hispanics in attendance. As a result, they didn't think the services were for them and left (Bolton, 1988).

On the other hand, many Hispanics felt the centres only offered short-term assistance. They needed long-term solutions and so did not attend. Others, although financially burdened by the effects of the earthquake, did not see themselves as "poor" and also didn't go (Bolton, 1988).

An additional complication in the Whittier earthquake was that many illegal aliens had registered under the amnesty program and were unclear if their applications for assistance would make them ineligible. Authorities were equally unclear and this resulted in many people not availing themselves of benefits.

Many ethnic minorities live in similar neighborhoods of older, vulnerable buildings. The Whittier earthquake took out over 900 units of housing and the lower-income units that were damaged particularly hit the Hispanic community. Although Hispanics make up 27% of the Los Angeles populations, 90% of citizens requiring shelter were Hispanic and 90% of those spoke no English (Bolton, 1988).

Additionally, many Hispanics' had previous experiences with earthquakes which made them fear aftershocks. This was reinforced by a major aftershock which took place three days later. As a result, they were afraid to re-enter buildings showing any cracks or effects of the quake. Many wanted to stay close to their homes to prevent robbing and so congregated in parks and parking lots. Those staying outside did not have access to television and other news media and so their ability to get information on available services was curtailed (Bolton, 1988).

The fact that many of those displaced by the earthquake were renters and had difficulty speaking English created another problem. Legal Aid was unprepared for requests for information regarding rental payments on suites that were damaged by the earthquake. Although they had many bilingual staff, most of these persons were living in the hard-hit areas and didn't come to work (Bolton, 1988).

The reality is that the inability of minorities to get aid means that there is a longer period to economic recovery and thus it can mean a long-term decline in the quality of life and standard of living (Bolin & Bolton, 1986).

Since many of the ethnic families studied in the United States after a disaster tended to be large and poor, they had the most difficulty acquiring aid and recovery from a disaster. Often the ethnic groups with the highest levels of damage received the least economic recovery (Bolin & Bolton, 1986).

Insurance was often a factor. Bolin and Bolton (1986) found that fewer African Americans had earthquake insurance than Caucasians. While most earthquake insurance paid for temporary housing, even when African Americans had earthquake insurance, their policies did not provide for temporary accommodation. Thus, most survivors choosing to live in Federal Emergency Management Agency (FEMA) trailers were African American while Caucasians found other, more desirable accommodation. African Americans, then, experienced higher degrees of stress because of the inadequate housing (Bolin & Bolton, 1986).

While the large extended family relationships were highly supportive and promoted post-disaster recovery, if kin were killed in the disaster there were higher negative consequences. As a result, these different cultural groups often suffered the most losses following a disaster (Bolin & Bolton, 1986).

Many minority groups also were affected by their inability to obtain post-disaster loans. Bolin and Bolton (1986) found that in some cases Caucasians were twice as likely to get Small Business loans than African Americans. Planners, businesses and the community at large must plan for both emotional and economical recovery in order to mitigate social and cultural iniquities. The media needs to have information on what services are available, eligibility for services and access made convenient for all citizens regardless of ethnic origin.

Residents need to be made aware of disaster relief services and what they offer before the disaster occurs. Local reception centre staff need to be sensitive to ethnic concepts and perceptions and to be prepared to aggressively offer services in the community. Planners need to take stock of vulnerable buildings and ascertain which populations are most likely to be affected. Temporary housing plans need to take these factors into consideration.

Education

In examining education and training requirements for emergency preparedness, there are many ethnic considerations for emergency planners. First, different ethnic groups have different interests and cultural biases towards participating in the planning process. Secondly, communication can be a large problem.

In Canada, from experiences with some of the Inuit and other Native peoples, we know they have different cultural outlooks towards programs and training. Tyrone Larkin, the Regional Fire and Safety Officer for Public Works Canada, has spent many years involved in training Native people in the Yukon and northern British Columbia in fire prevention and safety. He has found that, based on their history, the Native people have often felt a loss of control over their own destinies and this has, in many cases, created a dependency on others to care for them. Because of these feelings, there is a strong sense of fatalism. In the past, if a house caught on fire, it burned to the ground and there was nothing the Native person could do since he had no skills, equipment or training for fire fighting. Training and education has been crucial in helping Native people regain their sense of control, and has given them the opportunity to take the necessary steps towards emergency preparedness.

Larkin found that the Native people responded very well to training sessions which included a short, theoretical presentation, immediately reinforced with practical sessions. Repetition of tasks, frequently conducted, until behavior became *base knowledge* was very effective in teaching fire fighting skills. Personalizing the training, relating current practice to injuries or incidents where the trainees had personal information of the situation, was very important. *You don't want to have what happened to Mary happen to you, do you?*

Larkin found that incentives that worked well for Caucasians or other ethnic groups did not work well for Native people. Performance or planning related to economic incentives was not effective. A history of infrequent paycheques, lowered socio-economic status and reliance on others, tended to make financial inducements not very attractive. However, Larkin found that Native peoples have very strong family ties and that their children and elders are very important to them. Emergency preparedness programs which focused on the ability of Native persons to meet their family commitments worked well.

For many Native people there was a need to see a practical application for the training and payoffs needed to be tangible and in the very near future. Programs with long term goals were not seen to be as valuable by Native persons as those with short term goals.

Larkin also found that Native people were very receptive to audio-visual training aids. He felt that one of the best ways of reinforcing the lines of authority and responsibility during an emergency was to post a large organization chart in a common area. Names and passport size pictures next to each name, indicating the lines of authority and delegation, were very effective in helping people remember who they reported to.

Although the previous information clearly makes some generalizations based on a very specific ethnic population, the issues it raises are important ones. It is important for planners to use both local knowledge and census data regarding living patterns. If ethnic minorities are clustered within a community, then language problems will exist. However, if ethnic groups are dispersed throughout the community, then one can probably assume that the language problems will not be as significant (Perry, 1987).

After the Whittier earthquake, the lack of bilingual staff in various agencies was a real problem. There was a need to develop a coordinated approach. Using people who were bilingual, but unfamiliar with disaster relief also presented problems (Bolton, 1988). There was a need to have a trained bilingual staff.

Access to non-English media is also critical and there is a need for signs and directions to be pre-printed in multiple languages. It is also important to ensure that translations are accurate. When translation is sloppily or hastily prepared, those who understand both languages become mistrustful and suspicious of the intentions of those in charge (Bolton, 1988).

Education and training in different ethnic neighborhoods is necessary prior to the disaster. For example, apartment managers of buildings housing different ethnic groups are often seen as a source of information, however, without training they are unable to answer the questions of the residents (Bolton, 1988). In addition, since many residents are extremely reluctant to leave their own neighborhoods to go to reception centres, it is important to have trained agency resource staff who can go into the neighborhood and provide help and answer questions rather than wait in their offices (Bolton, 1988).

Conclusion

Emergency preparedness is still, for many, a low priority and receives little public interest or funding. Even so, it is important that emergency planners reach the entire community, including the different ethnic groups. Our country is enriched by its multi-culturalism and it is, therefore, important for emergency planners to take these ethnic factors into consideration when planning for disasters.

While all citizens are affected by a disaster, and communities will and do recover, any emergency planning efforts which can be made to alleviate suffering and accelerate recovery will be to the benefit of all.

References

Bolin, R., & Bolton, P. (1986). Race, religion and ethnicity in disaster recovery, Program on Environment and Behavior, Monograph #42. Institute of Behavioral Science, University of Colorado.

Bolton, P. (1988, December). Preliminary project report: Notes from interviews. Ethnic Community Structure and the Use of Disaster Assistance Project, funded by the National Science Foundation.

Cooper, F., & Laughy, L. (1988, September). Managing Hazards in a Changing Multicultural World. Paper presented to the Emergency Preparedness Canada National Symposium.

Larkin, T. Regional Fire and Safety Officer, Public Works Canada. Whitehorse, Yukon. (Personal meeting)

Perry, R. (1987). Disaster preparedness and response among minority citizens. In R.R. Dynes, B. de Marchi, & C. Pelanda, (Eds.) Sociology of disasters: Contribution of sociology to disaster research. Milan, Italy: Franco Angeli.

Teaching Earthquake Awareness to Persons Labeled Mentally Retarded

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Introduction

Earthquakes have caused, and can cause in the future, enormous loss of life, injury, destruction of property, and economic and social disruption. Because no accurate method for predicting earthquakes has yet been developed, there is usually no immediate warning and the area cannot be evacuated prior to an event. Therefore, the safety of individuals is more difficult to deal with in an earthquake than with other natural hazards such as hurricanes or floods (FEMA 149, 1988). However, knowing what to expect, how to prepare, and how to respond to an earthquake is a proven method of mitigating the loss of life and property (Buckle, 1989).

A survey of state education departments revealed that only a few states required earthquake awareness and safety education as part of the state education guidelines (Ross, 1990). A survey of earthquake education materials in the United States disclosed that there were no specific curricula for individuals who are mentally retarded or learning disabled.

Children do not automatically know what to do in an earthquake. In a preliminary study (Ross & Shuell, 1989), 9% of those K-6 students interviewed gave clearly correct answers to questions about what to do in an earthquake. Students also showed confusion in differentiating earthquakes from other natural hazards and weather. It can be assumed that persons who are developmentally delayed might also be unfamiliar with self-protective action in an earthquake and might confuse earthquakes with other natural hazards. In addition, persons with mental disabilities may be limited in their ability to understand information, recognize danger, and self-protect.

Although a literature search revealed no article specifically related to teaching earthquake awareness and/or safety to persons classified as mentally retarded (there were guidelines for teaching earthquake preparedness to those with other disabilities, i.e., blindness, deafness), there were articles related to the ability of those individuals to learn fire safety and other designated survival skills such as calling for assistance in an emergency or crossing a street. This literature is particularly relevant to those deciding whether and how to develop an earthquake education program for this population because it contains information about the ability of some individuals to learn survival skills. In addition, fires and earthquakes can produce some of the same circumstances, such as blocked exits and the inability to use the elevator; moreover, fire can occur as a result of a major earthquake. This makes fire education literature a logical element to consider when developing an earthquake education program (Tierney, Petak, & Hahn, 1988).

However, an important distinction between fire and earthquakes should not be overlooked. Fires usually consume single buildings, while earthquakes can affect large geographic areas. Information learned from fire safety articles is useful for justifying earthquake education for persons who are mentally retarded and provides some considerations that would need to be addressed in planning for an earthquake. Nevertheless, such articles are incomplete guides for the development of earthquake education programs for this population and should be used only as resources.

There is an additional consideration when planning earthquake education programs, evacuation behavior. Sime (1984), as cited in Tierney, Petak, and Hahn (1988), discusses evacuation behavior in a fire in terms of "movement toward the familiar." Sime argues that in crises, people receive more sensory input and have more cognitive

ambiguity than can be comfortably handled. As a result, they seek settings and exits that are familiar, showing little inclination to find alternate exit and escape routes. Those who have physical disabilities may be even more limited in the number and types of exit routes they use (Tierney, Petak, & Hahn, 1988).

Background Research

Previous investigations have shown that persons diagnosed as mentally retarded have the ability to protect themselves (MacEachron & Janicki, 1983; MacEachron & Kraus, 1985). MacEachron and Janicki looked at Perske's concept of risk from the perspective of fire safety, and found that about two-thirds of the developmentally disabled population receiving services in New York were capable of self-preservation.

Different teaching methods have been used effectively to instruct individuals in safety and survival skills. Instruction has been directed toward both those with mental handicaps (Horner, Jones, & Williams, 1985; Rae & Roll, 1985; Risley & Cuvo, 1980) and those without mental handicaps (Jones, Kazdin, & Haney, 1981; Miltenberger & Thiesse-Duffy, 1988).

Matson (1980) reported on a training program to teach persons with developmental disabilities how to escape from fires. Modeling and active rehearsal were used to train individuals to evacuate their homes in case of fire. Rae and Roll (1985) used daily practice, graduated guidance, and social praise to reduce evacuation times and the amount of assistance needed during fire drills for ten clients considered profoundly mentally retarded.

Jones, Kazdin, and Haney (1981) used instruction, shaping, modeling, rehearsal, feedback, and external and internal reinforcement to teach third graders how to exit in several simulated fire emergency situations.

Tymchuk, Hamada, Andron, and Anderson (1989) trained three mothers diagnosed as mentally retarded how to respond to household emergencies, including what to do and what not to do in dealing with a grease fire. There were two facets of the training: participants had to verbalize correct information about what would be done in a particular emergency and then had to role play each action. Training occurred weekly in both a community facility as a group and individually in the mother's home. Steps for each emergency were listed on a poster, discussed and demonstrated. Dolls and child mannequins were used in some of the demonstrations.

Prior to training, participants had limited information about some of the designated emergencies. Several stated actions that would have placed them and their children in even more danger had they been followed. After training, it was found that each mother acquired some of the information and necessary skills. However, acquired responses varied and because actions were demonstrated in a role play situation, there was no way to see whether the taught actions would actually have been applied in a real emergency.

Horner, Jones, and Williams (1985) used general case instruction[4] to teach individuals with moderate and severe mental retardation to cross streets which had not been used during training sessions. Initial training involved daily practice with one-to-one instruction, physical assistance, feedback, prompts, praise, and tokens which were gradually faded.

Risley and Cuvo (1980) taught three workshop clients to call independently three different emergency parties in simulated situations. The researcher's teaching package consisted of modified telephone directories, disconnected table model telephones, pictorial representation of emergency situations, an 82 step task analysis, and response feedback.

Nochajski and Gordon (1987) adapted the game of Trivial Pursuit and used it with a group of adults, labeled as mentally retarded, to teach functional community skills. The questions used in the game, based partly on the

[4] The term "general case instruction" comes from Horner et al. (1982) who described specific procedures for selecting training examples that sample a range of relevant stimulus and response variations present in a student's environment.

McCarron-Dial Street Survival Skills Questionnaire (SSSQ) and its accompanying Curriculum Guide (Linkenhoker & McCarron, 1979), were grouped into six categories: functional signs, domestics/measurements, health and safety, time and money, social skills, and public services and occupations.

Miltenberger and Thiesse-Duffy (1988) worked with four-to-seven-year-old subjects to teach the prevention of abduction and sexual molestation. The researchers found that the use of behavioral skills training following parental instruction using a commercially available program produced criterion performance in all of the subjects for all assessment procedures.

The literature tells us that daily individualized instruction, shaping, modeling, rehearsal, and feedback can be used effectively to instruct persons classified as developmentally disabled to learn survival skills.

Generalization of safety and survival skills is a crucial issue (Horner, Jones, & Williams, 1985). Research on the generalization of some of these skills can provide relevant insights to those planning an earthquake awareness and safety program.

Research has shown that it is possible for students to generalize the safety and survival training they receive (Horner, Jones, & Williams, 1985; Miltenberger & Thiesse-Duffy, 1988; Neef, Iwata, & Page, 1978). Horner, Jones, and Williams investigated the generalization of street crossing after using general case instruction. One student correctly crossed 89% of the social validation probe streets after the initial general case instruction, while another student crossed 90% correctly.

Neef, Iwata, and Page (1978) examined a classroom training procedure used to teach independent bus riding skills to persons who were classified as mentally retarded. They found that the in-classroom procedure was equally effective when compared with a bus riding program using city buses. The students receiving in-class instruction were able to generalize the skill.

Planning Earthquake Education Programs for Those Labeled Mentally Retarded

In view of the above studies, it seems plausible that students diagnosed as mentally retarded can learn the correct safety response for an earthquake, and appropriately generalize that response to other settings. Techniques successfully used in other survival oriented programs should be incorporated into any such earthquake programs including individualized instruction, task analysis, shaping, modeling, rehearsal, and feedback. Nochajski and Gordon (1987) also demonstrated that the use of a game may be another way to work on safety and survival skills. Curriculum developers might want to consider the adaptation of some currently popular games. In addition, an instructional program that uses both visual and verbal materials might maximize learning.

A major consideration in the development of earthquake education programs for those labeled mentally retarded is the subject matter that should be taught. While it is advocated that earthquake education programs for students in regular school programs incorporate both the science of tectonic processes and the application of science to daily life, this may be too all encompassing for some of the individuals in this population. A better starting place might be with instruction in the correct response to an earthquake in a simulated situation (earthquake drill). Students could be taught a five part response in a daily, structured earthquake drill through the use of teacher modeling and verbalization of steps, individual physical assistance, verbal prompts, and reinforcement of appropriate behavior. The eventual use of an earthquake sound tape might give students a better idea of what to expect when there is an earthquake.[5]

One procedure for an earthquake drill can be found in Earthquakes/FEMA 159 (Callister, Coplestone, Consuegra, Stroud, & Yasso, 1988). The following guidelines are adapted from this curriculum:

[5] An earthquake sound cassette tape can be obtained from the Emergency Preparedness Committee, Utah State PTA, 1037 East South Temple, Salt Lake City, UT 84102 for $2.00.

The first part of the daily earthquake drill training involves teacher modeling and verbalization of the five part response. This is done by the teacher telling the student or students that when they hear the directive, "Earthquake! Take cover," they should do the following:

1. Get under the desk or table
2. Hold on to the legs of the desk/table
3. Keep the head down and protected
4. Remain quietly in this position until told it is safe
5. Get out from under the desk/table when told it is safe

The teacher would then model the appropriate procedure, verbalizing the necessary steps.

The second part of the daily training involves an actual drill. This would be held at least fifteen minutes after the teacher's demonstration. The drill should start with the teacher repeating the directive, "Earthquake! Take cover." At this time, the student/students would be expected to demonstrate quickly the appropriate behavior. If a student did not respond within 15 seconds, the command would be repeated and the student would be physically assisted to get under the desk. Physical assistance and verbal prompts would then be used to help the student successfully accomplish each part of the five step response. Such assistance would be faded over time. Verbal praise would initially be given for accomplishing each step, either with or without assistance. Once a student correctly performed each of the five steps during an earthquake drill, he/she would be praised for his/her response during that drill rather than for each step. The times for training and drills would vary from day to day and care would be taken that training was done when students were at different locations in the classroom and engaged in different activities.

It is also suggested that at least one other time during the day a poem, song, or chant, such as the one provided in Earthquakes/FEMA 159 (Callister, Coplestone, Consuegra, Stroud, & Yasso, 1988) be repeated by the teacher (and eventually by the entire group) while a picture of the correct response during an earthquake is shown. The advantage of using the chant from FEMA 159 is that it includes what to do outside as well as inside. This is important information that should be included if teacher-composed poems or songs are used.

The initial phase of training would conclude when what is considered a socially valid criterion is reached. Because this is a survival skill, it is reasonable to expect students to accomplish 100% of the steps in an earthquake drill and execute them within five seconds of the directive at one drill/day in the classroom for ten days in a row without physical assistance or verbal prompts. After students reach criterion, follow-up training would take place in other locations in the school: cafeteria, gym, auditorium, playground.

It is important in the development of any new program to study objectively whether a particular intervention is effective with a certain group of learners. Research is needed. A program such as the one outlined here lends itself to a multiple baseline design across students.[6] In such a study, students could be selected from different classrooms. Prior to the training phase, baseline information could be collected utilizing multiple probes with a minimum of three probe trials. The percent of the five identified steps completed by the student could be recorded along with the latency time between when the verbal directive is given and the first step is initiated. It is recommended that intermittent probes be taken in place of a continuous baseline because it is unlikely that students will acquire the new skills without training. During training, information can be averaged for the week and graphed in a continuous baseline format. In addition, a separate graph could be used to show the number of trials to criterion. Once the criterion-level response is demonstrated by a subject, the training phase could be initiated with a new subject. After a student has reached criterion, probes of the latency time and the percentage of the five steps correctly accomplished could be taken in other designated locations in the school. With such objective information, program designers and teachers will be better able to determine whether this is an effective training program.

[6] For more information about this design, see Single Subject Research in Special Education by J.W. Tawney and D.L. Gass, 1984, Charles E. Merrill Publishing Corporation.

Conclusion

Persons with mental handicaps can learn appropriate safety actions if they are taught concise information in a structured, systematic manner that provides the repetition and consistency that is needed for them to acquire new skills. However, it should be remembered that the mentally retarded are not a homogeneous group taught by only one method. A review of previous research tells us that there is no curriculum or teaching model universally applicable to all students. Individual learning styles, strengths, and weaknesses need to be recognized and appropriate adaptations made to any earthquake education programs that are developed. In addition, those programs need to be systematically evaluated in order to objectively determine their effectiveness.

References

Buckle, 1. (1989, July). The need for earthquake education. In K. E. K. Ross, (Ed.), Proceedings from the Conference on Disaster Preparedness--The Place of Earthquake Education in Our Schools. Buffalo, NY: National Center for Earthquake Engineering Research.

Callister, J., Coplestone, L, Consuegra, G., Stroud, S., & Yasso, W. (1988). Earthquakes. Washington, DC: FEMA 159.

Horner, R. H., Jones, D. N., & Williams, J. A. (1985). A functional approach to teaching generalized street crossing. Journal of the Association for Persons with Severe Handicaps (JASH), 10(2), 71-78.

Horner, R. H., Sprague, J., & Wilcox, B. (1982). Constructing general case programs for community activities. In B. Wilcox & G. T. Bellamy, (Eds.) Design of high school programs for severely handicapped students (pp. 61-98). Baltimore: Paul H. Brookes.

Jones, R. T., Kazdin, A. E., & Haney, J. L. (1981). Social validation and training of emergency fire safety skills for potential injury prevention and life saving. Journal of Applied Behavior Analysis, 14, 249-260.

Linkenhoker, D., & McCarron, L. (1979). SSSQ adaptive behavior: Street survival skills questionnaire manual. Dallas: Common Market Press.

MacEachron, A., & Janicki, M. P. (1983). Self-preservation ability and residential fire emergencies. American Journal of Mental Deficiency, 88, 157-163.

MacEachron, A., & Kraus, M. W. (1985). Self-preservation ability and residential fire emergencies: Replication and criterion validity study. American Journal of Mental Deficiency, 90, 107-110.

Matson, J. L. (1980). Preventing home accidents: A training program for the retarded. Behaviour Modification, 4, 397-410.

Miltenberger, R., & Thiesse-Duffy, E. (1988). Evaluation of home-based programs for teaching personal safety skills. Journal of Applied Behavior Analysis, 21, 81-87.

Neef, N. A., Iwata, B. A., & Page, T. J. (1978). Public transportation training: In vivo versus classroom instruction. Journal of Applied Behavior Analysis, 11, 331-344.

Nochajski, S. B., & Gordon, C. Y. (1987). The use of trivial pursuit in teaching community living skills to adults with developmental disabilities. American Journal of Occupational Therapy, 41(1), 10-15.

Rae, R., & Roll, D. (1985). Fire safety training with adults who are profoundly mentally retarded. Mental Retardation, 23, 26-30.

Risley, T. R., & Cuvo, A. J. (1980). Training mentally retarded adults to make emergency telephone calls. Behavior Modification, 4, 513-525.

Ross, K. E. K. (1990). Implementation of earthquake education in the United States: An overview. Proceedings of Fourth U.S. National Conference on Earthquake Engineering (vol. 1). Palm Springs, CA: Earthquake Engineering Research Institute.

Ross, K. E. K., & Shuell, T. J. (1989, October). Children's beliefs about earthquakes. Paper presented at meeting of the Northeastern Educational Research Association, Ellenville, NY.

Seismic considerations: Elementary and secondary schools. (1988, April). Washington, DC: FEMA 149.

Sime, J. D. (1984). Movement towards the familiar: Person and place affiliations in a fire entrapment situation. Proceedings of the Fifteenth Conference of the Environmental Design Research Association. Washington, DC: Environmental Design Research Association.

Tierney, K. J., Petak, W. J., & Hahn, H. (1988). Disabled persons and earthquake hazards. Program on Environment and Behavior, Monograph #46. Institute of Behavior Science, University of Colorado, 1988.

Tymchuk, A. J., Hamada, D., Andron, L., & Anderson, S. (1989). Emergency training for mothers who are mentally retarded: A replication. The Mental Retardation and Learning Disability Bulletin, 17(2), 34-45.

Section 2

Curricular Issues

1. Public Perception of Seismic Risk: The Educational Implications
   by Herbert D. Thier, Associate Director, Lawrence Hall of Science, University of California at Berkeley, Berkeley, California

2. Integrating Earthquake Education Into the Elementary School Curriculum: A Whole Language Approach
   by Tori Zobel, Teacher, CleveHill Middle School, Buffalo, New York

3. Teaching About Earthquakes in an Elective Course
   by Steven Boyar, Teacher, Scarsdale Public Schools, Scarsdale, New York

There is a tendency to view earthquake education as a narrow, discrete topic; separate from the rest of the curriculum. When viewed in this manner, it is not surprising that some educators do not have time to add it to their already crowded schedule. A broader perspective provides more places for earthquake education to be integrated into the curriculum.

There are a number of global approaches for the incorporation of earthquake education into the curriculum:

- Earthquake education as a model for other hazard education programs.
- Earthquake education as a model for other Science, Technology and Society (STS) programs.
- Earthquakes as a cross-curricular theme.
- Earthquake education as a vehicle for encouraging critical thinking.
- Earthquake education as a catalyst for encouraging an interest in earth science and engineering.

Public Perception of Seismic Risk: The Educational Implications

by Herbert D. Thier
Associate Director, Lawrence Hall of Science, University of California/Berkeley

Introduction

Research (Thier and Gratton, 1986; Thier & Schnur, 1982) and extensive experience during the development and dissemination of the materials produced by the California Earthquake Education Program (CALEEP) has shown that it is quite easy to raise the public awareness of the threat of earthquakes and the need for preparedness. For example, state supported earthquake week and month activities in California over the years have brought to a focus public interest and actions regarding awareness, and to some extent preparedness. These activities have always been carried out in April, around the anniversary of the 1906 San Francisco Earthquake. You now see from time to time in the media questions or discussions about "earthquake weather." That is, people believe earthquakes take place at warm, somewhat humid, still times of the year (the weather in California in April). Perhaps the occurrence of the anniversary of the Loma Prieta Earthquake in October, when it tends to be cool and windy, will help to at least broaden the concept of "earthquake weather."

The great majority of the individuals surveyed during the research carried out in relationship to CALEEP expressed the **intentionality** to prepare for earthquakes, while only a small minority actually took **action** to prepare for an earthquake. This difference, which we found continuously between **intentionality** and **action**, is especially critical in schools. Teachers, for example, could reduce significantly the possibility of personal injury to students during earthquakes by taking action beforehand to provide effective earthquake education. This should include both planning and preparedness components, in addition to scientific information about earthquakes. An example of educational materials that meet these needs are those developed by CALEEP.

The California Earthquake Education Project (CALEEP) is a major activity of the Lawrence Hall of Science, University of California, Berkeley. CALEEP was a cooperative effort between the Lawrence Hall of Science and the California State Seismic Safety Commission. Curriculum development was funded by Chapter 785 of the 1981 Statutes of the State of California. Chapter 1558 of the 1984 Statutes of the State of California provided funds until December 31, 1987 for the implementation of these materials state-wide.

Independent evaluation, and direct user feedback, have proven these materials to be engaging and effective in school earthquake education and preparedness programs. In addition, CALEEP is a program that can be readily incorporated into the regular curriculum in science, math, language arts and social studies. The materials are specifically designed to help teachers meet their long term education goals in these areas, while teaching specifics about earthquakes and how to prepare for them.

No outside funds are currently available to support the work of CALEEP. Considering the need for earthquake education in California and the clear desire of teachers and schools to use CALEEP, the materials continue to be available on a cost recovery basis through the Lawrence Hall of Science.

CALEEP has developed extensive educational materials for school and community groups on earthquake science and earthquake preparedness. The goals of CALEEP are:

1. To motivate students and their families to take action to better prepare themselves to survive an earthquake with minimal injury, loss of property, and psychological upset.

2. To teach students about the science of earthquakes and related areas in the physical sciences.

3. To accomplish goals 1 and 2 in the context of a program that helps the teacher accomplish his or her goals for science and related educational experiences in the classroom.

Our evidence indicates that similar to the general public, many teachers intend to prepare and plan for earthquakes while far fewer take action to do so.

For example, after the September 1985 earthquake in Mexico City, a survey of 284 teachers carried out by the author and his associates clearly indicated this difference between intentionality and action on the part of teachers in schools directly impacted by the event.

The analysis of the data collected was carried out by using a test for significance and computing eta, a statistically determined index of practical importance, to determine the proportion of the variance associated with the differences between pairs of means. This provided extensive information regarding the differences between intentionality and action on the part of those leaders who experienced the Mexico City earthquake of September 19, 1985. This information is summarized in the Comparison of Selected Means from the study reprinted below.

Comparison of Selected Means

	Comparison	M1	M2	t	eta	Estimated eta magnitude
1	Adequacy of knowledge of the cause of the earthquake before/after	3.03 (1)	3.48 (12)	4.47*	03%	small
2	Adequacy of preparation for the earthquake before/after	2.77 (2)	3.14 (13)	3.70*	02%	small
3	Adequacy to act as a leader before/after	2.85 (4)	3.08 (10)	2.16	01%	small
4	Adequacy of knowledge of the cause before/desire to increase the adequacy of knowledge after	3.03 (1)	4.52 (6)	16.5*	33%	large
5	Adequacy of knowledge of preparation before/desire to prepare after	2.77	4.58	21.1*	45%	large
6	Desire after to know more/perception of information availability	4.52 (6)	3.24 (8)	14.8*	28%	large
7	Desire after to know how to prepare/ perception of information availability	4.58 (7)	2.96 (11)	18.2*	38%	large
8	Knowledge before/action after	3.03 (1)	3.91 (9)	9.25*	13%	moderate
9	Knowledge of preparation before/ action regarding preparation after	2.77	3.08	2.98	1.6%	small
10	Desire to know more after/actions to inform self	4.52 (6)	3.91 (9)	8.75*	12%	moderate
11	Desire to know how to prepare after/ actions to learn how to prepare after	4.58 (7)	3.08 (4)	17.19	34%	large

*significant at .01, t Dunn

The first two comparisons in the Table look at individuals' perception of the adequacy of their knowledge before and after the earthquake, of what causes earthquakes, and how to prepare for them. This is essentially a measure of what respondents think they have learned since the earthquake. Though the t ratio is significant, the value of eta is quite small and the actual mean difference is also quite small. This contrasts with comparisons 4 and 5, which compare individuals' perceptions of the same issues before the event with their desire for knowledge about earthquake causation and preparation after the event. This is essentially a measure of their desire or intentionality to learn since the earthquake. Note that the eta squared values are quite large and the actual differences in the means are quite large. Since one has to do something to learn something (items 1 & 2), these four comparisons clearly indicate the difference between intentionality (comparison 4 & 5) and action (comparisons 1 & 2) regarding knowledge of what causes earthquakes and preparation for earthquakes. Comparisons 3 and 9, which investigate individuals' perception of their capacity to be a leader afterwards compared with their perception of their knowledge of preparation or ability to act as a leader beforehand, are the only two comparisons with non-significant t's. This, combined with the previous comparisons, clearly indicates that even after a major earthquake, intentionality alone is not enough to develop in these respondents the confidence to act as leaders in a future disaster.

A partial explanation of the results may be that these respondents perceived a lack of satisfaction with the amount of information available to them after the earthquake. The means were close to neutral (3.24 for causes and 2.96 for preparedness) indicating a lack of strong agreement that sufficient information was provided. However, availability of information is closely related to the effort one makes to obtain it, particularly in major urban areas. Hence, we can assume that the intentionality of these respondents exceeded their efforts. Note that any bias resulting from sampling technique would be in opposition to this result. Teachers who came to meetings and participated in the survey would be expected to have more initiative than those who did not. These findings regarding the discrepancy between intent and action reinforce the information on these same issues obtained during the early survey research efforts related to CALEEP. In this research, 75% of over 600 representative Bay Area residents indicted that they expected a large earthquake would strike in their lifetime, that they would be affected by it, and that they did not anticipate receiving emergency services quickly. Nevertheless, less than a quarter of respondents had done anything to prepare for the event of an earthquake (Thier & Schnur, 1983).

Recently, especially at the community level, a number of efforts have been focusing on motivating people and neighborhood groups to organize themselves to respond effectively at the time of an earthquake. Many of these efforts also attempt to provide their public with the information they need to better prepare themselves beforehand for the eventuality of an earthquake.

Traditionally, earthquake preparedness and education programs have concentrated on making the public aware of earthquakes and the need to prepare for them. Fliers, brochures, slide shows, etc. have been produced which tell people about earthquakes, their causes, and appropriate preparedness measures. The distribution of the flier or brochure and the viewing of the slide show has too often been considered a measure of the success of the endeavor.

Frequently, the evaluation of the success of such efforts is based on the number of pieces of information distributed and/or the number of people who attended the events. Both of these are absolutely necessary, since, if the public you want to effect does not hear your message, your chances of bringing about change are zero. On the other hand, experience clearly shows that simply providing the public with information does not bring about action on the part of a significant percentage of the public. The provision of information by "public earthquake information" efforts increases awareness but is not enough to motivate action. Such long term concern and action can only be motivated by the kind of educational effort that involves the individual actively in the issue, so that they see earthquake preparedness as necessary to make possible the way they want to live their life. That is, earthquake preparedness concerns need to become an integral part of the individual's life.

Role of Risk Perception in Motivating Public Action

As stated above, needed beyond awareness is the motivation of the public to take action. The question is, "What prevents the public from taking action when they express the intentionality to do so?"

Rational policy making by society and action-based decisions by individuals regarding seismic events and preparing for them requires an understanding of the relative risks involved and how to control them. Prior and concurrent work by the author and his colleagues at the Lawrence Hall of Science and the University of California has identified the importance of considering the public perception of risk in fields as diverse as smoking prevention (RAY:S) and the use of chemicals in society (CEPUP). Major current efforts on the need for public understanding of risk is highlighted in the following statement. "They (the students) should be able to make informed choices regarding their own health and lifestyles based on evidence and reasonable personal preferences, after taking into consideration short- and long-term risks and benefits of different decisions." This was stated as a major goal for reform in science education by the National Science Board of the National Science Foundation in 1983. This expansion of the concept of "scientific literacy" to further emphasize both personal decision making about health and lifestyles and the consideration that risk plays in such decision making is part of the increased emphasis on the need for public perception and understanding of risk in our society generally.

As stated by Koshland (1985), in an editorial in *Science* magazine, the fundamental concepts and methods of risk assessment are outside the understanding of the vast majority of the public. According to Koshland, improved scientific literacy is required to bridge the "concept gap" between scientists and the public. Part of the problem lies in how the public comprehends concepts of risk. The public has a hard time comprehending unfamiliar mathematical concepts, and making analytical decisions based on information. Koshland further stresses the need to introduce concepts of risk assessment into the school system. "These concepts are directly transferable into public policy and should be taught to students at the elementary, high school, and college levels."

One of the means of bridging the "concept gap" is by developing adequate language to convey the conclusions of a complex and uncertain science. Dr. Frank Press, President of the National Academy of Sciences, claims that scientists must do a better job of communicating risk to the public. He supports identifying and evaluating alternative approaches to improving public understanding of risk. Furthermore, Fischhoff (1987) claims that a public-centered perspective by risk communicators is necessary. Risk communicators need to identify three aspects about the public: What the public wants and needs to know; what the public currently believes; and messages which are sensitive to how lay people process information (Fischoff, 1987).

Speaking a language that communicates risk effectively requires an understanding of the public perception of risk. Conversely, effective learning by the public requires them to identify their own perceptions of risk. The public perception of risk varies drastically from the scientific community's perception (CMA, 1986). Public perception is based upon a number of factors. These include: whether the risk is controllable or non-controllable; voluntary or involuntary; familiar or unfamiliar; catastrophic or, spread out over space and time; presented pessimistically or optimistically (CMA, 1986; McKean, 1985; Ruckelshaus, 1984). On the other hand, scientific determination of risk is numerically and experimentally based. Risk assessment by the public is more than a numbers game. According to Paul Slovic, "the risk assessments that experts give out when they evaluate risks often don't match the perceptions that the people have because they are really speaking two different languages" (CMA, 1986).

Public attitudes towards risk, which are subjective and based heavily on personal experience, need to be tempered by public information on the current scientific methods of risk analysis and assessment (AIHC, 1986; CMA, 1986). "The ultimate goal is to get the American people to understand the difference between a safe world and a zero-risk world" (Ruckelshaus, 1984).

Unique Nature of the Seismic Risk

The lack of public understanding of, and therefore informed reaction to, risk benefit analysis and risk management generally, is a major factor preventing the motivation of the public to take action regarding seismic risk. Another major factor affecting public reaction to seismic risk is the nature of the risk itself. All of the research described above indicates that the public reacts in a more positive, rational manner when it perceives the risk to be controllable, voluntary, familiar, and not catastrophic, but spread out over time. This is exactly the opposite of the public's perception of seismic risk which they think is uncontrollable, involuntary, unfamiliar, and catastrophic. Unfortunately, these perceptions by the public are largely accurate, and therefore, motivating the public to really take action to mitigate the seismic risk, is very difficult. The nature of the risk, the relatively low frequency of occurrence of major seismic events, and the catastrophic devastation that can be caused by a major earthquake all tend to cause the public to adjust by psychologically rejecting the possibility that it will happen to them, and, therefore, they don't make any real effort to prepare for it. They do this because to a large extent, they do not believe that anything they do can really make a difference. Our task as educators is to find ways to truly educate the public about the nature of earthquakes and the proven value of preparedness actions beforehand in reducing loss of life and economic devastation. An integral part of such education has to be an understanding of seismic risk assessment and seismic risk management, so that the public believes that their actions will increase their chances for survival when the major earthquake comes, even though we cannot tell them when that will be.

References

American Industrial Health Control. (1986, December). *Risk Assessment: The Evolving Process.* Proceedings; Annual Meeting. pp. 1-2.

CALEEP - California Earthquake Education Project, headquartered at the Lawrence Hall of Science, University of California - Berkeley, is funded through a contract with the California Seismic Safety Commission. Copyright 1983 by The Regents of the University of California.

CEPUP. (1989). Risk Comparisons (CEPUP module). Addison Wesley (for the Lawrence Hall of Science, University of California at Berkeley, Berkeley, California).

Risk Perception versus Risk Assessment. (1986, July). Chemecology, p. 2.

Fischhoff, B. (1987, January). *Public Perceptions of Risk.*

Koshland, D. E. (1985). *Scientific Literacy.* Science, 230, 1.

McKean, K. (1985, June). *Decisions,* Discover. pp. 22-31.

National Science Board. (1983). *Educating Americans for the 21st Century.* National Science Foundation, Washington, DC. p. 45.

Risk and Youth: Smoking. (1986). Lawrence Hall of Science, University of California at Berkeley, Berkeley, California.

Ruckelshaus, W. D. (1984, April). *Risk in a Free Society,* Environmental Protection Agency Journal, pp. 12-15.

Thier, H. D. (1985). Perceptions of Californians Regarding Chemicals and Risk.

Thier, H. D. (1988, May). Educating the public about chemicals and risk. A background paper for Only One Earth Forum on Managing Hazardous Materials, organized by The Rene Dubos Center.

Thier, H. D. (1990, September). Building links between the education sector and industry and commerce. An invited keynote presentation at Our Common Future: Pathways For Environmental Education, International Conference sponsored by the Australian Association for Environmental Education, Adelaide, South Australia.

Thier, H. D., & Gratton, V. G. (1986). Intentionality and action: A survey of Mexico City schoolteachers' perceptions and expectations following the September 1985 earthquake.

Thier, H. D., & Pavlova, M. (1990, September). Barriers to the effective implementation of environmental health risk education in the schools. A report written for the Workshop on Environmental Health Risk Education for Youth held in Arlington, Virginia.

Thier, H. D., & Schnur, A. E. (1982). People - CALEEP and earthquakes: A project and study in progress.

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Public perception determines public acceptance of risk

Factors influencing perception are:

voluntary	vs	involuntary
controllable	vs	uncontrollable
beneficial	vs	not beneficial

All related to the *individual.*

Integrating Earthquake Education Into the Elementary School Curriculum: A Whole Language Approach

by Tori Zobel
Teacher, CleveHill Middle School

During the 1989-90 school year, I expanded the fourth grade Earth Science Unit to incorporate earthquake education and awareness. After mentally reviewing various instructional methods and then carefully selecting materials, I decided to teach the unit using a Whole Language approach. Using Earthquake Education as the theme, this approach necessitated webbing the other subject areas into this central topic.

The ideas for webbing earthquake education are endless and many content areas will, and should, overlap. For 3-4 weeks the classroom takes on the earthquake atmosphere. The theme can be envisioned as an umbrella, with different subject areas falling under it. It is a subtle way of integrating a topic into the curriculum (see Figure 1). The advantage of this approach is that if a particular day goes by and you haven't gotten to "science," it's all covered because of the central science theme.

While using the Whole Language approach,[7] lessons can be incorporated into learning centers, hands-on-activities, readings, writings, and extra-curricular activities that reflect the theme of earthquakes. After selecting a time frame for the unit, it is often necessary to consider introductory lessons, developmental lessons, and culminating activities.

Teachers who use Whole Language can present language learning in highly meaningful ways. Rather than focusing on separate skills, the development of a thematic approach exposes children to an integrated curriculum. By focusing on earthquake awareness, teachers can then prepare lessons that surround this theme (see Figure 2). During a language arts period, students can review words associated with earthquake awareness. A vocabulary booklet is a helpful tool for children to construct and consult. Using these words, the theme can be further integrated into the language arts program by writing folk tales or legends, composing newspaper stories that relate to precautions and/or hazards, creating safety booklets for parents, or discussing the cause and effect of earthquakes. In the realm of written and oral language, the possibilities for integration are endless.

During our weeks of study, the children discussed the safety and survival techniques needed in the event of an earthquake. While in small groups, students listed what they would do should an earthquake occur. From those suggestions, each child wrote and illustrated his or her own survival manual. Afterwards, the students read their books to and discussed the information with a first grade class. While the teachers provided supervision and direction, the children learned from each other. The use of this peer tutoring approach was beneficial for both classrooms.

Social studies is another area that teachers must address. By displaying maps that depict earthquake epicenters, children can become more familiar with the different countries and continents. Comparison of earthquake activity in two different areas can be expanded to include an investigation of a particular area. For example, Charleston, South Carolina and San Francisco, California could be compared because both cities have experienced earthquakes. Students could work together in small groups and gather information about the designated regions. All of these activities enhance language skills, integrate the curriculum, and allow for dynamic interaction among students while the earthquake theme remains constant.

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[7] "Whole Language is not a methodology but a philosophy, the major premise of which is that language should not be separated into its component parts but is best learned through use in authentic situations that have meaning to the learner." English and Reading Education News, Bureau of English and Reading Education, New York State Education Department, Spring, 1989.

Charts, bulletin boards, mobiles, and projects reflecting the theme can surround the students. Pictographs, bar graphs and line graphs can be displayed and studied, thus combining the math curriculum with the study of earthquakes. Reading, in and of itself, can be difficult for teachers to incorporate in the thematic approach. In the primary grades, reading groups often consume a large portion of the day. The Whole Language philosophy emphasizes that children learn to read by regularly reading and through exposure to integrated subject matter. With this in mind, there are many books that educators can display in the classroom and read to the children on a daily basis. For example, Scholastic, Inc. has published a soft-cover edition of *...If You Lived at the Time of the Great San Francisco Earthquake*, written by Ellen Levine and illustrated by Richard Williams. It is a perfect book to use in grades three through five. Intermediate grades can utilize some of these books for book reports, poems, drama, or pleasure reading.

The purpose of Whole Language is to expose children to reading and writing through an integrated curriculum; in this case, when they are learning science. Why make science a separate entity and isolate it from the other subject areas and real life experiences? Taking the time to plan, to explore ways of integrating a theme, and to provide enrichment activities allows children to experience and learn new scientific concepts in a natural and non-threatening environment. In addition, because this type of atmosphere allows for plenty of interaction, students can learn from their peers.

Earthquake education and awareness can provide a perfect classroom focus. Children become excited and want to explore as well as discover on their own. By creating a total atmosphere across the curriculum, teachers can create a more stimulating environment. A Whole Language approach facilitates this.

References

Brand, S. (1989). Learning through meaning. Academic Therapy, 24, 305-314.

Edelsky, C., Atwerger, B., & Flores, B. (1991). Whole language: What's the difference? Portsmouth, NH: Heinemann Educational Books.

Goodman, (1986). What's Whole in Whole Language? Portsmouth, NH: Heinemann Educational Books.

Goodman, K., Smith, E. B., Meredith, R., & Goodman, Y. (1987). Language and thinking in school: A whole language curriculum (3rd edition). New York: Richard C. Owen.

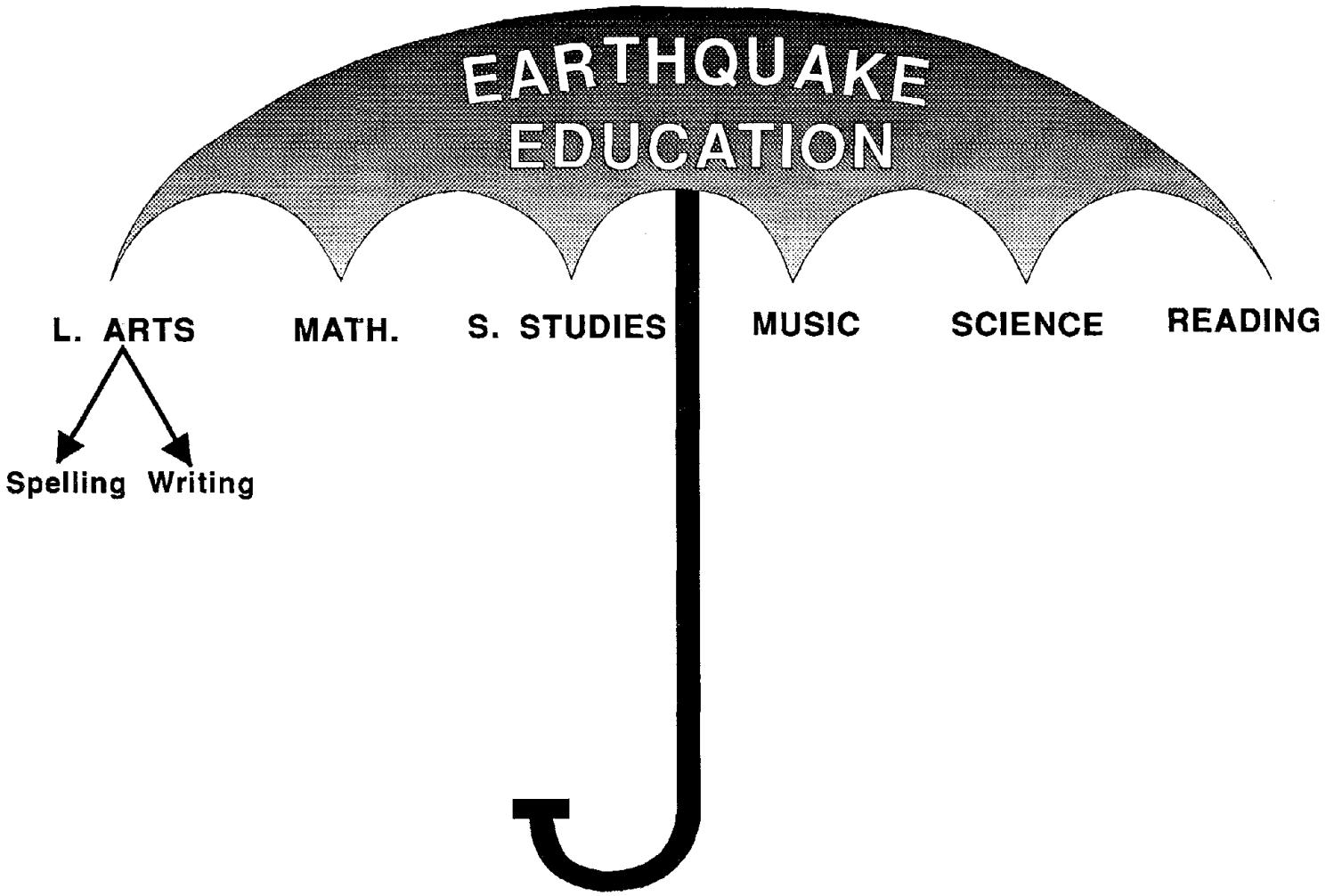
Harp, B. (Ed.) (1991). Assessment and evaluation in whole language programs. Norwood, MA: Christopher-Gordon Publishers.

Manning, G., & Manning, M. (Eds.) (1989). Whole language: Beliefs and practices, K-8. Washington, DC: National Education Association.

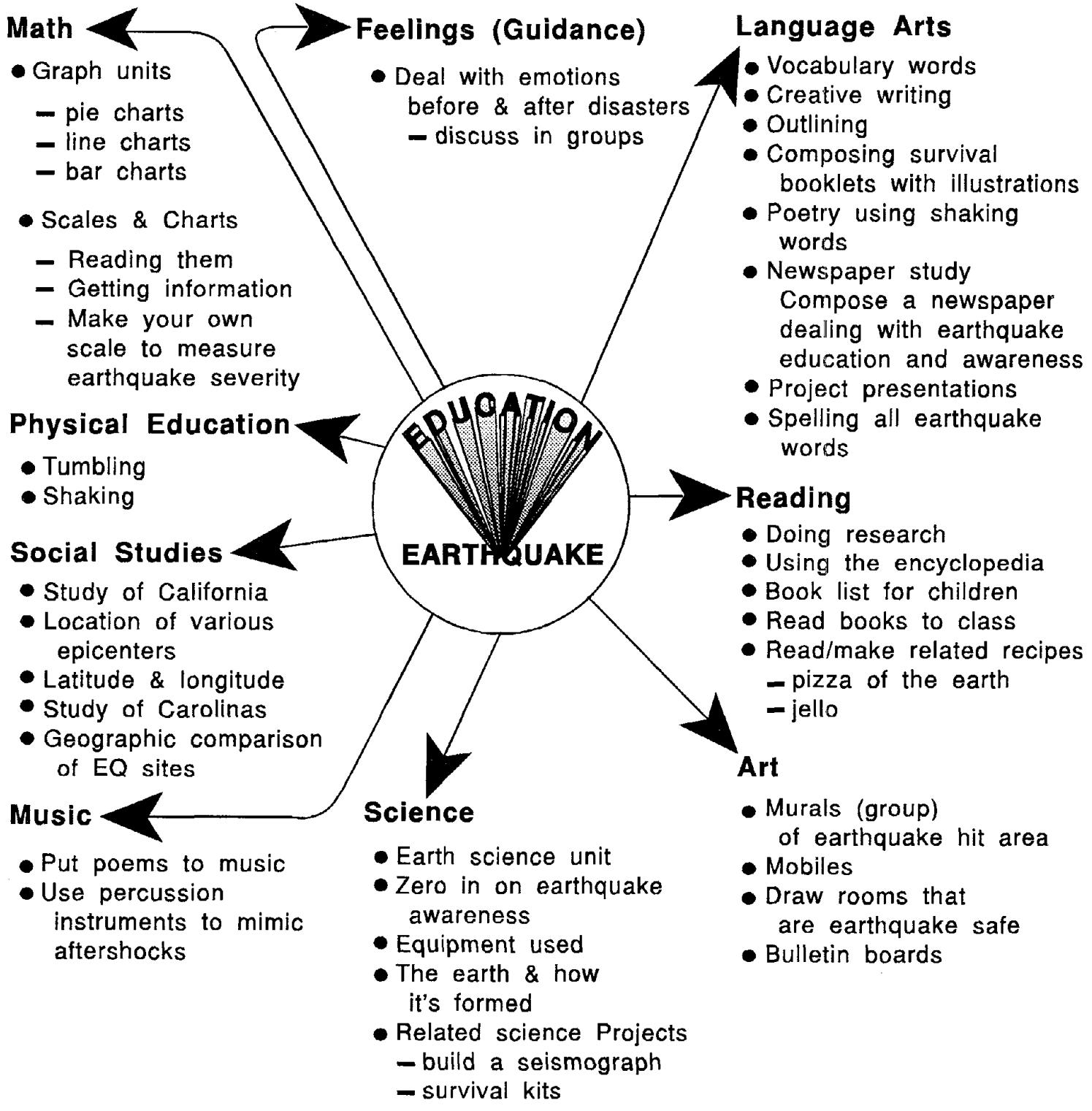
Mills, H., & Clyde, J. A. (Eds.) (1990). Portraits of whole language classrooms: Learning for all ages. Portsmouth, NH: Heinemann Educational Books.

Newman, J. (1985). Whole language: Theory in use. Portsmouth, NH: Heinemann Educational Books.

Vail, P. L. (1991). Watch out for the hole in whole language. The Education Digest, 56, (8), 23-29.



For 3 - 4 weeks the classroom takes on the earthquake atmosphere. When you integrate a theme into the curriculum, that theme is like an umbrella.



Typical Webbing of Curriculum for a 4th and 5th Grade Class

Teaching About Earthquakes in an Elective Course

by Steven Boyar
Teacher, Scarsdale Public Schools

Another alternative to the perennial issue of where to fit new content into an already crowded curriculum is in an elective course. At Scarsdale High School we offer an elective course on "Earthquakes and Volcanoes."

The course is aimed at Juniors and Seniors who did not take Earth Science or who may have taken Earth Science and had a special interest in these topics. Although the greater part is spent on earthquakes, there are many opportunities to study them together because of the obvious parallel themes.

Below is a list of topics in the order they are studied for the earthquake component. Following is some additional information that may be helpful.

- Formation of the solar system and development of the earth's internal layering.
- Using seismic waves to understand the interior of the earth.
- Continental Drift and Plate Tectonic theory.
- Stress and Energy within the earth.
- Types of deformation.
- Types of faulting.
- Basics of earthquake occurrence.
- Worldwide distribution of earthquakes.
- Earthquakes and plate boundaries.
- Richter and Mercalli scales.
- Determining magnitude from a single seismogram.
- Types of seismographs and how they record earthquake waves.
- Location of epicenters from seismograms.
- Determining the origin time for an earthquake.
- Interpreting first motion from seismograms.
- Liquefaction.
- Case studies of historic earthquakes.
- Tsunamis.
- Predicting earthquakes: a) precursors; b) instruments; c) short vs. long term prediction.
- Damage caused by earthquakes.
- Minimizing damage.
- Safety measures.
- Potential seismic risk to New York State.

Instructional Materials

- Laboratory Materials - lots of lab work from many different sources.
- Slide sets and films.
- Magazine articles - have students regularly review articles.
- Computer program: Students manipulate a large data base from the USGS which includes a mapping program that allows students to research earthquakes and relate their distribution to plate boundaries. This was developed at Scarsdale.

Project:
Students are responsible for a research study of a specific geographic area (i.e., Japan, Indonesia, Iceland). They combine cultural-historical information with a computer-based study of seismicity and its relationship to plate boundaries. They also produce a detailed study of volcanic activity and relate it to seismicity.

Section 3

Disaster Preparedness

1. How and Why To Prepare Our Schools for an Earthquake Disaster
   by Karl E. Naugle, Jr., Computer Coordinator, Dorchester School District, Summerville, South Carolina
2. Earthquake Disaster Preparedness Planning: What is It All About? Who is Responsible?
   by Bret Breton, Safety Coordinator, Ventura County Schools, Ventura, California
3. Earthquake! This is Only a Test! How to Conduct a School Earthquake Exercise
   by Pat Jocius, Administrative Specialist for the City of Cupertino, Cupertino, California
4. Urban Search and Rescue in Schools: A Disaster Affecting the Future of the Nation
   by Jan Smith, President, Urban Search and Rescue, and Administrative Director for CMC Rescue, Inc., Santa Barbara, California.
5. School Preparedness Supplies and Student Emergency Comfort Kits
   by Frances E. Winslow, Director, Office of Emergency Services, City of San Jose, California
6. Financing School Preparedness Supplies: The Pennies for Safety Project
   by Terry Gabrielson, "Pennies for Safety" Project Chairperson, Blytheville, Arkansas
7. Unacceptable Risk: Earthquake Hazard Reduction in One California School District
   by Arrietta Chakos, Facilities Grants Liaison, Berkeley Unified School District, and Sarah K. Nathe, Resource Coordinator, Bay Area Regional Earthquake Preparedness Projects, Oakland, California

Earthquakes have damaged schools. August 31, 1886, damage occurred at Charleston College in an earthquake that killed 60 residents of Charleston, South Carolina. March 10, 1933, in Long Beach, California, the John Muir School on Pacific Avenue and the wall of the dance hall building in Compton High School collapsed. October 31, 1935, the west wing of the new Helena High School collapsed in an earthquake in Helena, Montana; the collapsed part of the school had reinforced concrete frame, floors, and roof, and tile floors faced with brick. August 18, 1959, in Hebgen Lake, Montana, the decorative stone entryway was shaken down at the West Yellowstone Elementary School. Government Hill Elementary School was split in two during the Good Friday earthquake (March 27, 1964) in Anchorage, Alaska.

At 4:42 p.m. on Monday, May 2, 1983, a 6.5 magnitude earthquake struck Coalinga, California. Seconds later there was an aftershock of 5.0 on the Richter Scale. A report prepared after this earthquake by E. Robert Bulman for Charles S. Terrell, Jr., Superintendent of Schools for San Bernardino County, California, noted extensive nonstructural damage to the schools. About 1,000 fluorescent light bulbs fell from the fixtures and broke. Improperly installed T-bar ceilings and glued ceiling tiles fell. Water pipes in the basement broke, flooding the basement and stopping the electrical supply because all the switching mechanisms were damaged by water. In a second floor chemistry lab in the high school, bottles of sulfuric acid and other stored chemicals fell and broke. Acid burned through to the first floor. Because there was no electrical power to drive the ventilating system, poisonous fumes filled the building. Superintendent Terrell feels that death and serious injury would have resulted had school been in session. This damage could have been minimized had school personnel reviewed and remedied some of the potential hazards prior to this earthquake.

Children spend a significant portion of their day in schools. The school community needs to be well-prepared to meet school earthquake emergencies in order to protect the welfare of students and staff both during and after the ground shaking. Therefore, the development of an effective earthquake education program requires not only an understanding of the natural processes involved but also the type of dangers they pose to the school community. Students of all ages and ability levels must be able to take self-protective actions during an earthquake. Schools must have an emergency plan that includes earthquakes. Earthquake preparedness must be the responsibility of the entire school community, for it is the total school community which is at risk.

How and Why To Prepare Our Schools for an Earthquake Disaster

by Karl E. Naugle Jr.
Computer Coordinator, Dorchester School District

Major earthquakes and disasters have occurred around the world, from Armenia to California. This underscores the importance of making your students, co-workers and friends earthquake aware - earthquake prepared - and in general, disaster aware.

After watching students carrying gas masks in Israel, the terrible effects of Hugo just a short year ago, and the results of Loma Prieta, I have come to believe that preparation is the key to survival. I have stood before groups many times and pointed out that preparation usually lasts only about two days past the end of the last disaster. Yet, preparation combats panic and indecision. I still believe that unless you begin to prepare now, the momentum will wane. You will put it off until tomorrow and that may be too late.

Eight years ago when I was the Assistant Principal at Newington, Joyce Bagwell asked Mike Burrell if the school could be used as one of the pilot test sites in the United States for an earthquake preparation curriculum. No one ever dreamed how far we would come in these few years. I want to give you a brief retrospective look and relate that to current events to show you my perspective on this issue.

The program officially began with in-service training for the faculty that helped make earthquake safety part of the curriculum. Some teachers incorporated earthquake safety into science, other teachers included it in social studies, and still other teachers taught it as a single unit. We started with an all-out building safety search by faculty, students, parent liaison groups and maintenance staff. At that time, we found many areas in need of improvement, such as:

- Cabinets were not secured to walls.
- Cubby shelves were loosely hanging over students.
- Water shut-off valves were inaccessible and worn to the point of no use.
- Electrical wiring problems that could lead to wires falling on students or complete outages.
- Bathrooms with no emergency lights where young children could be trapped.
- No first aid equipment, except in the office.
- Major air-conditioning units poised on the roof where they could fall on students.
- Hot water heaters were in the ceilings over classrooms.
- As many as 10 to 60 classrooms could be totally cut off from outside access.
- Outside, after-disaster meeting areas were located over major power lines that might cause problems if they were pushed up out of the ground.

Today, all of the areas that could be corrected have been corrected. We have taken the home search/preparedness plans to the children's parents. We have taught the families the basics: what to store in the house for emergencies, how to talk to children about emergencies, and what to do. We learned from our teacher committees that the children would be more worried about what has happened to their parents than what is happening to them. This had to be considered in our planning. We also envisioned the parents of our 2,500 students trying to get to the one lane road that leads to Newington as they plow through the rubble that could be the City of Charleston. (Hugo proved that fear to be a realistic nightmare for many, many days.)

When I sat on the FEMA five-year curriculum planning committee, I emphasized that we needed better architectural plans for school buildings, and we needed to make sure that these plans did not make the buildings so expensive that we could not afford them. They were already focusing on older housing and shopping malls, but had put off schools. Had the quake in California been an hour or so earlier, where would the students have been? Maybe no one would have been hurt, but I am not willing to risk my three children. How about you?

In addition, I also stated that instead of each state making a documentary film, efforts should be combined and one generic film produced. It could then be shown on a major TV network. The purpose of the documentary would be to inform, not scare, the public.

I am pleased to note that today, much of what Joyce Bagwell, Katharyn Ross, and so many others have struggled for these many years, has been accomplished. In my district, our building plans have shifted to include the new earthquake standards. These new standards are recent off-shoots of that five-year curriculum plan. Even the rebuilding we did after Hugo included upgrading older structures with the new standards and features. Each school has in its emergency guides a plan for earthquake preparation. Summerville now has an emergency disaster plan and an emergency disaster director. I was surprised just this past Sunday to see a show on the South Carolina ETV called "Surviving the Big One." It was exactly the documentary we had planned five years ago. If any of you want a copy for your districts or groups, they gave this toll-free number: 1-800-228-KCET. It is the generic video tape that we should all be showing. It covers prevention and preparation, and I would call it "30 Minutes to Earthquake Preparedness."

However, we still have more work to do. One year ago, we had a first-hand view of what a major disaster can do to the low country, and, in fact, this entire state. "Hugo" is a word we would like to put in the past, but it still affects our children, ourselves, and even our state budget. There are lessons to be learned from it. Preparation saved many lives and many material things. Our preparations also saved many a fragile child from fearful nights. After the disaster, guidance counselors, teachers, and administrators worked to console and give comfort to the returning students. I had never even considered this part of the disaster preparation prior to Hugo. Psychological support is important, plays a major role in recovery, and should be included in all of our future disaster plans.

I would like to share with you some facts about my 25-family neighborhood. If we had been less prepared for a disaster, we wouldn't be where we are today. I learned that week that we are doing many of the right things. I also learned that these things would apply for an earthquake as well. The children in my house were less afraid during the storm because they had their own flashlights, security toys, and clothes by the bed. They were aware of a family plan that said if we stick together, we'd be ok. They were scared during the storm, but did not *panic*. They moved to the "safe area" and fell asleep. By contrast, I didn't. In the morning, they went outside to view the destruction, and were scared just long enough to start a small football game.

Although I heard on the radio that it might be a week or two before we had power or water, it was hard to believe. I think we've all come to expect such things as "givens" in our lives. We lived for a week on a few supplies, one community generator for a freezer, candle power, cleaning our plates each meal, no TV, dirty clothes, no air-conditioning, no Nintendo, no toilets, and a good sense of "We're ok just like the plan said." We grew together. After a week of struggle, helping neighbors dig out, we finally realized that it might be two weeks until power was restored. I sent my family to a cousin's house in Columbia to get a break from the destruction. They called and told me what the news shows were saying about the disaster and how widespread it had been. Another aspect to this story is that "Hugo" cut us off from the outside world in more ways than we ever had imagined. What if there had been no phone lines? Was there outside help on the way? Outlying areas continued to dig out and use rescue shelters. They still had no power, no phone, and low morale.

This experience emphasized to me that we needed a better plan. We had the advantage of intact phone lines. In an earthquake, we will probably lose those phones. What especially helped during this disaster was that the phone

company had a plan to route all calls so that they only went out and few came in. This plan made you think about who to call and enabled the phone company to pass messages along to out-of-state relatives. This plan kept phone lines from being tied up, which meant they were available for the important business of getting help to those who needed it the most.

The best activities came from necessity and creative invention. We now have a better idea of how our community will have to work together and how the various agencies will have to organize in a disaster. Although we did all right, we could have done much better. We could have had a more synchronized work plan. At times there was great confusion as to who was in charge, or who could do what and when. I was particularly impressed with the way the police and National Guard organized the custodial care for the cities. They prevented us from creating more problems for ourselves by taking greed out of our actions. They assisted in the clean-up and getting supplies into the remote areas. They kept the profiteers out of the cities so that we wouldn't be ripped off in our grief. Radio stations from as far away as Florida also played a major part in our recovery. In all, it was an amazing effort that parallels what it would be like if an earthquake hit.

However, although we did all right after "Hugo," don't be fooled. An earthquake of magnitude 6 or 7 will be much worse. It won't last all night, but it won't be cleaned up in one short year. Preparedness was the key for "Hugo" and continues to be the key for earthquakes. I gave a speech a few years ago and told the story of my two year old daughter Katie who woke up one night, and started singing, "Jesus Loves Me." I woke up and I went in and asked her what was wrong. She told me she was scared and that her Sunday school teacher had taught her that this song would keep her safe. Well, at about 1 am the night that Hugo hit, that two year old, who was now six, was singing this song to my three year old daughter, and telling her what the Sunday school teacher had said. That's when they fell asleep.

Preparedness is the key. Don't let the next 24 hours go by without starting to look at what you can do to be better prepared for the next disaster. Then let us pray it never needs to be used.

Earthquake Disaster Preparedness Planning: What is it All About? Who is Responsible?

by Bret Breton
Safety Coordinator, Ventura County Schools

What is it All About?

Earthquake disaster preparedness planning is about the survival of our school children, staff members, members of our communities, and the protection of our school properties. It is about protecting our homes and being in control of our lives when the earthquake strikes our area. It is about being smart and exercising common sense.

Who is Responsible?

Responsibility for earthquake disaster preparedness in schools belongs to the State Department of Education, District Board of Trustees, and school district administrators. It is also reasonable to expect every citizen in the state of California to be responsible for preparing their own earthquake survival plan and to be ready for the "big one." Do not expect that any individual or organization is going to develop your plan for you. Every citizen should also be prepared to assist their school and community (see enclosure AB 697).

So much has been said and written about earthquake disaster preparedness and planning that it's difficult to select the most reasonable and effective way to proceed. It is most important to encourage people to prepare their family and homes properly for the expected seismic event of M8.3. It is even more important to prepare our school sites and protect our children and staff from becoming injured. Proper action today can significantly reduce personal injury and damage to property.

The probability of developing a proper and effective disaster plan for a school site is greatly increased when PTA groups are involved and can assist school administrators with long-range planning. When the day comes that people are convinced earthquake preparation is essential, will most likely reduce damage to their properties, and save their lives and the lives of their children, perhaps action will follow thoughts about earthquake disaster preparedness. Developing such plans should be an integral part of everyday family and school business.

It would be ideal if earth science and geologic curriculum included disaster preparedness and was taught in all K through 12 classrooms. In a few years, a large percentage of people in California would be well-informed and have their survival plan in place. Disaster preparedness programs would be continuous and complete. Think of the pain and suffering and millions of dollars this program would save.

Based on the information already published about disaster preparedness, you would think that every adult in California would have earthquake survival planning as a high priority. It is interesting to note that after each earthquake event, no matter where in the world it was, in Mexico, Armenia or Northern California, people become motivated and start making telephone calls for earthquake preparedness assistance. Interest to prepare suddenly becomes important. It's as if somebody pushed a "start button" somewhere and the race begins. Within a few weeks, the interest falters and everyone goes back to the same, complacent attitude. Oh sure, there usually is some progress in program development each time there is an event, but that's not getting the job done. Successful plans are the direct result of commitment and involvement of administrators with dedication to provide whatever is necessary to

succeed. When the plan is completed, staff training and upgrading of supplies must be continuous to assure proper action when the need occurs.

Please understand that it takes a lot of work and time to develop an earthquake disaster plan. Don't become discouraged because it seems to take forever. It is not possible to complete a disaster plan all at once or overnight from one or two brainstorming sessions. You will find it takes several months of work, meetings, training sessions, re-writes, fund raisers, budget planning meetings, and commitment to purchase supplies and equipment to complete a disaster plan. Just when you think your plan is complete, something else will come up that you had not anticipated. For instance, more information on disaster recovery or the possibility of reimbursement for disaster preparedness expenditures and it's back to the planning stages again. Also, if purchases are not properly investigated and you take the easy way out because it is more convenient, you will be replacing expired items much sooner than you had expected.

It must be emphasized that there can be some measure of comfort before, during and after an earthquake. This comfort can come from knowledge of what caused the earthquake, what damage was possible as a result of the earth shaking and what supplies you should have on hand to survive. It can also come from taking proper action and preparing a survival plan. First you prepared your home as well as possible. Non-structural hazards were found and mitigated. The most affordable structural hazards were identified and corrected. You prepared an adequate disaster survival plan following recommendations you were given relating to earthquake disaster preparedness. Supplies were selected, purchased, and disaster kits were assembled. Plenty of fresh water was put into containers and maintained in a safe storage area with your food and other emergency supplies. You informed members of your family about what they should expect in an earthquake and what they should do to protect themselves. Every member of your family has the name and telephone number of your "out of state contact" person with instructions when they should call and what messages they should give. You are able to understand the emergency radio broadcast messages because you know what kind of damage to expect. You are confident that everything is being done that can be done by the officials in charge. Because you are prepared and understand the problems that can occur from earthquake disasters, you are able to wait patiently for assistance and not panic by letting your imagination get the best of you. Because you were prepared, you feel quite proud of yourself and are somewhat comfortable.

Did you know there are people who never prepare for an earthquake disaster because of fear? Every person I have spoken with, who had a great fear of earthquakes, is not interested in discussing their problem. They feel helpless and are convinced there is nothing they can do to protect themselves. They won't even try. Some of them believe that the earth is going to open and everything will fall into a big hole and close. They refuse to listen to a radio station broadcast, read a newspaper or watch television news when an earthquake has occurred to find out how much damage resulted or how many people were affected. If only someone could reach out and communicate with these people, their anxieties would be greatly reduced. Why not try, somehow, to gently introduce the facts to those people? Introduce preparedness as a school project and ask for their opinions. If you could change their thinking enough to reduce their fears, they may be motivated to prepare their own disaster survival plan.

How often have you read in a newspaper, viewed on television, or listened to speakers at conferences on earthquake preparedness say that when the M8.3 earthquake strikes, "You're going to be on your own, don't expect any help from the fire departments or emergency services people for several hours or perhaps days." Or maybe you've heard the statement, "You may not have water, electricity or natural gas for many days, and without electrical power all the markets, banks, gasoline stations and any other business relying on computers or electricity will be closed until power can be restored." Can you tell me why, with all this information, most people are still not motivated to properly prepare for that inevitable day when the earth will literally shake us off our foundations? You don't suppose they think about it as "It's not my problem," do you? When you hear documented facts from speakers at conferences and read reports from the Red Cross and professionals who are knowledgeable about earthquake disaster preparedness, you should believe what they tell you. The problem is yours. No one will prepare a plan for you. You will be

on your own for quite a while after the quake. Without a proper earthquake survival plan, you and your loved ones may suffer needlessly.

You should develop your own earthquake disaster preparedness plan and encourage all your family and co-workers to prepare as well. Doing this will increase your confidence that you and your family will be okay. Your home may be severely damaged and you may be living in your camper or tent, but you will have the necessities to survive. You will have food, water, extra clothing and shelter. With your "out of state contact person," you will be able to locate all your family members and not worry about their welfare. You may be a little concerned and in jeopardy because you will know many people in your community who are not prepared and have no plans to do so. You may be forced to help others and although you probably won't mind sharing, you will mind going without if you have to give away too many supplies.

There are going to be serious problems in many of the communities until shelters can be opened by the Red Cross, Salvation Army and local government agencies. Somebody must take care of the immediate problem of sheltering the community residents made homeless by the earthquake. That could take a few days to a few weeks. The Red Cross is a volunteer organization. Will there be enough volunteers for every community in California that may be affected by the earthquake? Volunteers may not be able to get to shelters if the roadways are blocked. How large is the Salvation Army in your area? How long do you think it will take for local government agencies to set up a disaster shelter? Where do you think the shelter is going to be located? How much space will be needed to shelter the people made homeless? Think about it before the earthquake!

The shelter location will most likely be at school sites. Are staff members at your school site prepared to accommodate and care for all the people who are likely to show up for assistance? They will need shelter, food, water, sleeping space, first aid, and perhaps even a psychologist to talk with and calm them down. This will be in addition to the student population, should the earthquake strike during school hours.

Residents in every community are aware that in a disaster situation such as fire, flood, or earthquake, when they are asked to leave or evacuate their homes, they should go to the nearest school site for shelter and assistance. It has been common practice and well publicized that the local school site is the disaster shelter location. People unable to remain in their homes are considered homeless. And when you think about homeless people, think also about homeless people already living in our community. The disaster shelters in Northern California were filled with homeless victims the very night the shelters opened. Shelter managers must be prepared to accommodate all persons entering the shelter for assistance. No one should be turned away for any reason.

Hundreds of disaster plans have been written and implemented into our school systems. The authors of these plans are convinced that each is adequate and meets the intent of the Katz Assembly Bill #2786. This Bill resulted in the following:

> Article 10.5- Earthquake Emergency Procedures in the Education Code, #35295, Section (b), in order to minimize loss of life and disruption, it is necessary for all public or private elementary schools and high schools to develop school disaster plans and specifically an earthquake emergency procedure system so that students and staff will act instinctively and correctly when an earthquake disaster strikes.

Article 10.5 means a lot more than "duck, cover and hold." It intended that all school districts will develop complete disaster preparedness plans that will protect staff, students, and property. It requires each school site to be prepared to serve as a shelter for homeless victims resulting from the earthquake.

It is sad to say that many earthquake disaster plans fall alarmingly short of what is necessary to survive. Because development of a plan has usually been the responsibility of an individual rather than a committee, it has been

difficult for that person, who has many other duties which take priority, to develop a proper disaster plan. Lack of revenue, and failure of top management and high level school administrators to directly involve and commit themselves to the project, has made it very difficult to be successful. Without support it is difficult to be motivated to action.

In the past few years there has been a great deal of progress with earthquake preparedness in several school districts. These districts have plans that include all of their employees and volunteers. Because of the need to be current and ready, they have purchased good supplies and continue to update the inventory. Training for all disaster teams is a continuous process. They have encouraged and assisted employees to have home disaster plans as well. They have followed the guidelines for disaster preparedness and will be ready to act when the time arrives.

Disaster plans can vary drastically, depending on the location of the school site in the community, size of the school site, geology of the area, student population, and staff requirements. What will work for one school site will not necessarily work for all. If you have handicapped and special children at your school site, they require special planning. In some cases you may need enough adults to work one on one with each child. Every plan must be tailored to the needs of the individual school.

For instance, liquefaction can have a drastic effect on buildings and their contents. Because of the increased shaking from the unstable, jelly-like soil, non-structural hazards being tossed around the room can cause a great deal of damage. A site can be crippled to the point of being totally useless as a shelter. The intense shaking can also cause serious injuries to students and staff. If your location is down stream from a man-made lake, you could have flooding. How about utility transfer pipelines for petroleum products and for natural gas that run underground in your area? Don't forget about overhead high voltage electrical wires that run next to your school and could fall on the cyclone metal fences and become an electrocution hazard to your students. Almost all communities have underground sewer systems. They all have large, high volume pumping stations. When electrical power fails, pumps stop. If the sewer line should be broken, sewer water will go where resistance is the least. Will that be in the area of your school property? What type of industrial complexes do you have in your area? Are any of them manufacturing products that have hazardous or toxic chemicals? Could a failure at their location impact your school site in any way? Are there any major freeways, highways or railroads that are close to your school site? These are only a few of the questions that must be answered. Planning contingencies for any bad situation you can think of is the only way to plan.

How would you handle the following scenario?

> It's one o'clock in the afternoon. It's raining for the third day in a row and the wind is blowing. The temperature has dropped to 55° F and no change in the weather is predicted for at least three more days. All of a sudden there is an M8.3 earthquake. The ground begins shaking violently. The noise is loud. Children are screaming, while staff are yelling for the them to "duck, cover, and hold." File cabinets are falling over, traveling across the rooms pushing children, desks and anything else in their path. Bookcases are falling over and their contents are scattering. Light fixtures fall onto the desks and floor. The exploding lights are scaring the children and teachers. Computers and printers are falling and tables are tipping over. The room heating/air conditioning unit that was in the rafters above the suspended ceiling has fallen down. Pieces of ceiling tile are falling and causing a tremendous amount of dust. The instructional aids and audio/visual equipment are also being tossed around the room. Window glass is shattering, and rain is blowing into the classroom. Glass is now everywhere and some of the children have been cut and injured. Finally, the shaking and the noise stop. Children and teachers climb out of the building through the broken windows and mill around, crying and calling for help. The staff is confused and totally unprepared for what has happened. It's cold and wet. You have to do something and do it fast because it will be dark in about four hours. The problems will then become more complicated because without electric power, you won't have lights to see.

NOTE: Broken pipelines, downed electrical high-voltage power lines and a fallen gasoline tanker truck from the nearby freeway overpass with burning gasoline running down the street in front of your school site could be added to complicate this scenario.

After close inspection, you discover you have lost the use of what was to be your shelter and most of your disaster supplies. Your mind is whirling with confusion. Flash-back sketches of the meetings when purchasing velcro was discussed to save computers and other office equipment come to you. Discussions about non-structural hazard mitigation ring clear in your mind. You try, but can't remember, why none of the projects were completed. They were scheduled, but you can't remember when. You must do something. The kits the PTA developed, with all the students names and emergency cards that worked so well during your disaster drills, can't be found. You look for remaining supplies and discover they are covered with debris scattered in the rooms. You have additional supplies in the closets, but the doors are jammed and you have no tools to get them out. Medical kits and supplies are needed for the injured, but can't be found. Gas and water is leaking. The valve wrenches to shut them off are in the building with the rest of your disaster kits. Electrical power failed soon after the shaking started, so windowless rooms are very dark. The flashlights are in the kits and you wish you had put one in your car. The big commercial gas stove in the cafeteria broke away from the two-inch gas line. Natural gas is filling the cafeteria. Food supplies are damaged and scattered all over the kitchen and storage area. The piano that was by the stage in the cafeteria traveled throughout the room, destroying tables, chairs and everything in its path. Where is the kitchen crew and the custodian? They were working when the earthquake struck. Now you realize the disaster has become an impossible situation, totally out of your control. What would you do to regain control and start getting your people sheltered from the storm? Where would you go for help?

Can you imagine how difficult this situation would be? It really could be that bad if you fail to develop and implement a proper earthquake disaster preparedness plan for your school site. You have to be ready for an earthquake. Include non-structural hazard identification and mitigation in your disaster plan scenario, get the commitment and cooperation of top school administrators, and organize your PTA to survey local people in the community to participate in your disaster preparedness planning. This can make the difference between a good plan and one that might fail. Personal trauma from the knowledge that you should have, but did not prepare a disaster plan could be the most devastating aftermath from the earthquake. It could take years to overcome. Make certain no one you know will be a victim of not being prepared!

You know that a M8.3 earthquake is many times greater than a M7.3. This will result in heavy-duty ground shaking, so you had better be prepared. Duration of the earthquake will also make a difference. The longer the ground continues to shake, the more damage to buildings and contents can be expected. If for any reason you fail to properly prepare for the disastrous event, you certainly will suffer the consequences of that failure.

There could be litigation resulting from inadequate earthquake plans which caused students to be injured. How much litigation cannot be estimated. Litigation can be reduced with properly documented disaster preparedness meetings and preparedness plans. So as you prepare, document your activities to protect yourself. Documentation is necessary for recovery as well, so preservation of records is essential to your recovery program.

When you are working on your disaster plan, remember that a great deal of information has been assembled and is available for your use. Try not to re-invent programs already developed. We are very fortunate to have organizations such as the Office of Emergency Services, the American Red Cross, and many others working on developing factual information about earthquakes and how to survive them. Use those resources and listen to what has been learned firsthand from people who have been at disaster locations and helped solve many of the problems.

Many people are needed to develop a disaster plan, so local community residents can be a tremendous resource. The surrounding community needs to be surveyed for hazards that could adversely impact your school site. Simultaneously, a survey of available resources should also be done. Every community has retired people from many professional occupations who could be a great asset to your planning (retired engineers, doctors, nurses, teachers, construction workers, planners, law enforcement, and the like). Although these people are retired, many of them are looking for something to do. In addition, their involvement will encourage and teach them how to prepare a plan of their own. Do you know how many people in your community own camping equipment, campers, portable generators, tents, motorhomes, and other useful equipment? A trained and aware community resident assisting at your school site shelter will be a big asset as well as the additional equipment.

Listed below is a sample of disaster teams that should be considered in your disaster preparedness plan.

1. Administration/ Command and Control	2. Media	3. Communication
4. Shelter Management	5. Medical	6. Search and Rescue
7. Food Preparation	8. Security	9. Damage Assessment
10. Student Release	11. Transportation Coordinator	12. Crisis Counseling/Management
13. Community Volunteer Coordinator	14. Morgue	15. Morgue Liaison
16. Family Liaison	17. Recovery	

The number of people on each team depends on the size of your school site and whatever special requirements your particular site may have.

You should also have alternates for each position to ensure proper coverage. Cross-train staff so they can help one another during the emergency. With all the jobs and activities that will arise from an earthquake, it is apparent that it would be difficult for a school administrator to prepare a disaster plan without the assistance of the PTA and the surrounding community. In addition, maintenance and custodial personnel must be assigned to disaster teams, trained in the disaster plan, and used to the best advantage. Because most of the staff will be required to stay at the school site for the duration, they should be encouraged to have a home plan which would allow them to remain at their job until released. Public employees become disaster workers during a severe earthquake or any emergency. They are expected to remain at their places of employment until released by the supervisor in charge. A copy of the State Code on Disaster Service Worker is as follows:

Disaster Service Worker

California Government Code 3100 states:

> It is hereby declared that the protection of the health and safety and preservation of the lives and property of the people of the State from the effects of natural, manmade, or war-caused emergencies which result in conditions of disaster or in extreme peril to life, property, and resources is of paramount State importance requiring the responsible efforts of public and private agencies and individual citizens and resources, all public employees are hereby declared to be disaster service workers subject to such disaster service activities as may be assigned to them be their superiors or by law.
>
> Workers will be notified of assignments by their supervisors who shall receive information from the County Department Heads staffing the Sheriff's Emergency Operations Center. Responsibilities for Primary Response roles and Secondary Support roles for departments are identified in the County Emergency Operations Plan.

> Compensation shall be furnished by the State Compensation Insurance Fund to a disaster service worker for any injury suffered either within or without the State arising out of and occurring in the course of his/her activities as a disaster service worker when he/she is performing services as a disaster service worker and is acting within his/her assigned duties. (Section 4351 Government Code)

Students in grades 7 through 12 could be difficult to control after an earthquake unless they have been included in the planning process and trained to assist. Students react well to responsibility and the feeling of being needed. They thrive when they see accomplishments directly resulting from their personal participation. Consider the possibility of controlling older and younger students with pre-planned programs and activities to occupy them during early post-earthquake time.

Middle and high school students can be trained to work with younger children. All children will need comforting and someone other than classmates and well meaning adults to talk with soon after the earthquake. Planning to combine the older children with younger children will help them cope with the event until their excitement settles down and you are organized. Provide games, activities, and music children can manage. Teach older children to include younger children in their activities. These pre-planned activities could help relieve stress.

Some critical supplies you should consider for your disaster plan are: water supply, food supplies, and first aid supplies. Each of these topics is described in greater detail below.

Water Supply

What about water in a crisis? What if there is no running water? The records show the water has been in storage for 18 months. In your excitement, you over-dosed or under-dosed available water with chemicals. Too much bleach, Iodine or Halazone was added to the water supply. Then you forgot about dwell time and made it available for drinking too soon. Have you ever had the experience of tasting and trying to drink treated water? Dwell time or not it tastes so bad that you can't tell if the chemicals were added to poison you or the bacteria. Because you made the water available too soon, people will become ill from the chemicals or from the bacteria. Now you have what you don't need in a disaster situation, a group of sick people. They can be of little use to the disaster team, themselves or the community. They quickly become victims needing medical care. Also, if water doesn't taste good, kids won't drink it. We can't expect them to be aware that serious physical problems can result from dehydration.

Drinking water may be the most scarce and precious commodity in a survival situation. This makes it doubly important to place it as a high priority. The safest and most economical method to store water, at any facility with more than 100 occupants, is in a water tank. Consider specially designed water tanks for earthquake disaster programs which are available in all sizes. After the initial expense for installation, you will only have the maintenance. There are no problems with expiration dates and costly replacements.

Contamination of water must be prevented. Maintaining this as a priority will help prevent serious illnesses, such as dehydration, liver damage, kidney failure, and severe stress. When developing your survival plan, think in terms of the shelter as the facility you are going to depend on for your own survival. Don't allow yourself to become caught up in the trap of settling for a system that someone else decides is good enough for you. Be truly convinced that it is.

There has been a great deal of discussion about water filters being used with emergency drinking water. These filters have no place in a disaster preparedness program. They will remove chemical taste and odor, but they will not remove harmful bacteria and pesticides. You should consider purchasing a WATER PURIFIER FILTER SYSTEM, not just a water filter. The outward appearance of the two units are similar so be aware and purchase the correct appliance. A water purifier system can remove all chemicals, particles and bacteria larger than .4 micron absolute, 100% of the time. A purifier will effectively remove all pathogenic bacteria, cholera, shigella, salmonella typhi,

eschirichia coli, chlorine and synthetic chemicals, such as: herbicides, pesticides, chlorophenols, dissolved or suspended organic matter, bad tastes, colors, organic odors, plus traces of detergents, oils, gasoline, fertilizers and some sulfur and dissolved iron and lead. It also removes large chlorine resistant protozoa such as, Giardia Lamblia and Cryptosporidium. This makes water purifier systems superior to ordinary filters such as, carbon block, charcoal, ceramic, GAC, ultraviolet and reverse osmosis.

If you have a swimming pool, and it survives the earthquake, you can drink the water through your purifier as well. Do you know how much water is in your pool? To calculate the amount, multiply the pool's length by its width by its height. Multiply that figure by 7.5 and you have the number of gallons in your pool when full.

Food Supplies

An adequate storage area for an emergency food supply is a common problem at every school site. Adequate storage rooms seem to always be sacrificed for class room space.

Many school sites have overcome this problem by purchasing used cargo shipping containers. These containers come in all sizes and are usually available from surplus companies. Other school sites build a storage area next to the existing building. Storage is a problem that must be resolved in a way that is best for your school. The resolution of this difficulty makes an excellent committee project.

If possible, avoid purchasing pre-packaged food. Some if it may not be palatable to children and contain a lot of sodium and preservatives. In addition, pre-packaged food can be expensive. One way to provide enough food for children is for them to supply their own. Give the children a list of sample items they should bring to school. Ask the parents to cooperate in your efforts. Should you decide to do this, have each child bring a backpack to school. It can be inexpensive and should have the child's name written on it with large block letters in permanent ink. The packs can be used to hold the food supplies for each child.

Suggest that each parent provide food their child will eat in an emergency. Items like canned meats, canned soups that do not require water, canned juices, canned fruits, canned vegetables, canned beans, canned tuna, canned hard candies, small packages of cereal that can be eaten dry, powdered milk (you may have enough water) and sealed packages of low or salt free crackers are good. Make parents aware of the emergency disaster plan so they will provide these supplies. Individual supplies should have each child's name on each item and be rotated occasionally into the family pantry. Children from poorer families, who are unable to support this program, should be assisted by the local PTA groups through fund raising projects. Each child should have enough supplies to last a minimum of three days or longer, depending upon your location. Don't forget the staff at the school site. The same program can work for them as well. Also, don't forget to add eating utensils, small plastic trash bags, and a reliable mechanical can opener.

Food for public disaster shelters should be pre-arranged with the local Red Cross, the Salvation Army and the local Office of Emergency Services. Pre-plan with local food markets in your area to purchase needed supplies from their stockroom during the disaster. Arrange for debts incurred to be settled after the disaster. Most markets will agree to this arrangement if you can show them a documented disaster plan with this inclusion. Develop forms for inventory and costs. These will help convince the market managers of your sincerity. The Red Cross should be involved with all shelter planning because they may be running your shelter.

Inventory and tag all food supplies already in stock and maintain an up-to-date inventory so you are aware of the supplies available immediately after the earthquake. Supplement your inventory regularly to prevent depletion of your supply. Use perishable food first, refrigerated food second, frozen food third and canned or dry packaged

food last. Food should only be prepared after a Shelter Manager has been notified. Try to avoid snacks and treats during the disaster period. Have scheduled feeding times and post the schedule in plain view.

First-Aid Supplies

Each classroom should have a container with the following items.

1. Flannelette or space blanket
2. "Wipe-Its"
3. Flashlight, batteries
4. Box of large plastic bags
5. Box of medium plastic bags
6. Pad, pencil and ballpoint pen
7. Bathroom tissue
8. Paper towels
9. Student roster
10. Student identification tags
11. Delineator with classroom sign
12. Sport type whistle
13. First-Aid kit

One gallon of water should be stored in the classroom. This water should be reserved for washing wounds and other medical purposes. Water should be kept fresh, and dated when replenished or purchased. Change the water every six months to insure freshness.

The First-Aid kit should be one that has been specifically designed for treating trauma cases and treating major injuries resulting from disaster situations such as earthquakes. The kit should be sealed and used only in an emergency, not as a daily use first aid kit. On evacuation, the kit should be taken to the field First-Aid Station and given to the person in charge.

Conclusion

This paper has included a number of considerations when planning for a disaster. It is not intended to offend or discourage persons from working on disaster plans. It is intended to encourage you to continue your efforts. Procrastination and disaster planning are cousins and tend to get into each others way. Examine your efforts. Commitment, active efforts and determination will get you the assistance you need. Be vocal enough to be heard and you will accomplish things.

Some Earthquake Preparedness Resources for Schools

American Red Cross (check your local chapter)

Bay Area Regional Earthquake Preparedness Program
Metrocenter
101 8th Street, Suite 152
Oakland, CA 94607
(415) 540-2713

CALEEP
Lawrence Hall of Science
University of California
Berkeley, CA 94720
(415) 642-8718

County Office of Emergency Service (check your local directory)

Federal Emergency Management Agency - Earthquake Program
500 C Street, SW
Washington, DC 20472
(202) 646-2812

National Center for Earthquake Engineering Research
State University of New York at Buffalo
Red Jacket Quadrangle
Buffalo, NY 14261
(716) 636-3391

Southern California Earthquake Preparedness Project
1110 East Green Street, Suite 300
Pasadena, CA 91106
(818) 795-9055

Quakesafe
700 State Drive
Los Angeles, CA 90037
(213) 744-2008

Assembly Bill No. 697

CHAPTER 643

An act relating to earthquake safety.

[Approved by Governor September 21, 1989. Filed with Secretary of State September 22, 1989.]

LEGISLATIVE COUNSEL'S DIGEST

AB 697, Roybal-Allard. Earthquake safety: public schools.

Existing law directs the State Department of Education to prepare a report containing recommendations for compliance with specified methods for earthquake preparedness of the public schools, which report is to be submitted to the Legislature no later than June 30, 1989.

This bill would make the Department of Education in consultation with, but not limited to, the Seismic Safety Commission, the State Architect, and the Office of Emergency Services, the lead agency designated to develop plans and procedures to coordinate earthquake awareness, disaster planning, and preparedness and hazard reduction programs for public schools. The bill would require the department to develop certain training programs in this connection.

The people of the State of California do enact as follows:

SECTION 1. The State Department of Education shall be the lead agency designated to develop plans and procedures, in consultation with, but not limited to, the Seismic Safety Commission, the State Architect, and the Office of Emergency Services, to coordinate earthquake awareness, disaster planning, and preparedness and hazard reduction programs for public schools. The Department of Education shall develop inservice training programs to mitigate the effects of a major earthquake, and shall provide a series of training seminars for school administrators and district board of trustee members. It is the intent of the Legislature that funds to support the activities in this section be made available through the state budget process.

O

Date:_____

To: Primary Contact Person_____

Address_____ Phone #_____

To: Alternate if no answer on primary_____

Address_____ Phone #_____

Alternate: If you are called, please telephone Primary Contact Person to relay messages. Thank you for helping us.

After a major earthquake in the state of California, telephone lines should not be used except for disaster service emergencies. It has been suggested that out of state contacts be established to serve the needs of relatives. Contact should be made by using pay telephones. Pay telephones are on an independent system and the chances of getting a call through is greatly increased.

Our family has designated you for their out-of-state contact person. Please be prepared to accept collect calls.

This is what we would like you to do as our contact person.

1. Person(s) will call you to let you know their status.
2. Any information they want passed on to other relatives will be given to you. Please write the messages down. As you receive calls, you will be able to relay the messages for us.

Following is a list of people who have your name and phone number.

NAME	ADDRESS	PHONE NUMBER

Please place this document in a retrievable location. When you hear about the earthquake in our area, you should place it near your phone along with the attached message sheet for your convenience. You will be the only lifeline for our family for information. Thank you in advance for your help with our disaster plan. It may take days for family members to re-establish communication within our area. Your assistance will help us know our family is well.

CONTACT TELEPHONE MESSAGE SHEET

Date:_____ Time:_____ Caller:_____

Message:_____

_____

Date:_____ Time:_____ Caller:_____

Message:_____

_____

Date:_____ Time:_____ Caller:_____

Message:_____

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Date:_____ Time:_____ Caller:_____

Message:_____

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Date:_____ Time:_____ Caller:_____

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Message:_____

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Date:_____ Time:_____ Caller:_____

Message:_____

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Earthquake! This Is Only a Test!
How To Conduct a School Earthquake Exercise

by Pat Jocius
Administrative Specialist for the City of Cupertino

The Scenario

"Attention, a simulated earthquake has just occurred! This is a test! Please react as if it were real. Teachers may now open your envelopes, while in a drop and cover position."

After 20 seconds...

"The simulated earthquake has stopped. Teachers read appropriate envelope contents to students and react accordingly. There will be no more PA communications until the exercise is over."

When students and staff hear the above announcements over their public address system, they know another school earthquake drill has just begun. The weeks of pre-planning and emergency training are about to be tested. With an emergency plan in place and emergency jobs assigned, the exercise continues as each teacher reads the contents of their envelopes to their students:

"At 9:45 a.m., April 27th, an earthquake of 6.5 magnitude hit the Bay Area. Your school has experienced damage to the corridors from falling debris. The public address system has been disrupted. Phones are not working. The electricity in the school is not working. There have been numerous injuries. The city is overloaded with emergency service requests, and will not be able to respond quickly. You are on your own!"

The Objectives

The staff, simulators, and observer/evaluators know the objectives of the exercise. They include:

- Practice drop and cover procedures
- Evacuate buildings in a variety of conditions
- Account for and report condition of all staff and students
- Assess emergency response and handling of injured
- Exercise emergency custodial duties
- Evaluate policy on student release

The Injuries

In every classroom, four to five students have received a 3x5 card on a string describing their assigned injury. These were in the envelopes the teachers opened in the classroom and are placed around the student's neck. The child is encouraged to "act" as if they had a real injury. The rest of the class and teacher begin to assess the injuries and any other room damage. Some doors are "blocked" (simulated) and in one classroom, the teacher has been designated "unconscious." Injuries range from broken arms and legs to glass in eyes and head injuries.

The Orientation Assembly

An orientation assembly was held earlier in the week. All the students and staff heard a speaker from the city describe the effects of earthquakes in the world and what will probably happen in their Bay Area. Preparedness tips were shared. "Creative first aid" was demonstrated on stage by selecting students to "bandage" and "splint" other students using items they would normally find in a classroom (e.g., rulers, jackets, masking tape, and towels). Evacuation routes were reviewed and the principal gave detailed instructions on how the exercise would be conducted.

Response Teams

Pre-assigned and trained response teams have begun their tasks. The principal and administrative secretary have set up the command center near the main office. The search and rescue team has assembled after their classes were evacuated and turned over to another teacher out on the playing field. In teams of two, they systematically sweep the corridors and bathrooms looking for trapped or injured people. They find several "hidden" students. They carry a walkie talkie and wear protective hard hats, gloves, and flashlights that were stored in exterior metal bins. Those staff members trained in first aid have set up a first aid station away from school buildings. A barrel of first aid equipment is being unloaded when the first injured student arrives on an old civil defense stretcher. The custodian has gone to shut off the water and gas valves and has found a sheet that says, "Remove this sign and the gas/water will be considered turned off."

Evaluators

Evaluators from other schools, the city, and the school district are watching closely for areas of success and improvements. They will share their observations at the debriefing immediately following the exercise during the regularly scheduled recess. A communication connection has been made with the district office through the district radio system. A student amateur radio operator has turned on the school's ham radio set and called for help through the ham network.

Frantic Parents

PTA volunteers are simulating frantic parents running around the school looking for their own children and generally causing chaos. They have been told that unless they are redirected by someone in authority to help, they should just cause trouble. Some parents have been told to "capture" children, and walk off campus without checking them out. Several "get away." The city staff are barraging the school with telephone calls simulating parents and the media. With all the challenges, the principal and staff are performing their duties with cool confidence.

Information Collecting

As student runners report damage and injuries back to the command center, fire engine sirens are heard in the distance coming towards the school site. The wail of the sirens echo through the corridors adding a heart-stopping realism. A "real" reporter from a local newspaper is recording the scene in words, while his fellow photographer is snapping pictures. A map of the school has been taped on a board and an assistant principal is marking off with a colored felt pen the classrooms searched, the damage assessed, and the injured still needing to be transported to the first aid station. Uninjured students are out on the playing field sitting on the grass entertaining themselves with the teachers that did not have pre-assigned jobs.

The Debriefing

After almost forty minutes after the initial announcement, the school has been completely evacuated. All injured students have been moved to the first aid station. The unconscious teacher was gently carried by eight of her students to the casualty collection area. They never leave her side. She later was heard to say that she never had felt so pampered and cared for in her entire life. All of the adult participants gather in the teacher's room to evaluate the exercise.

The principal leads the discussion getting reactions from teams, volunteers, and evaluators. A recorder captures all the comments for an after-action report to be distributed to all the participants. The exercise reminded the staff that they may not be in their usual room when a disaster strikes, so they must adapt to the situation. There was a lively discussion on whether a teacher should stay with an injured student, or evacuate the class to the field, report the injury, and go back to the student. Concerns about corridor overhangs, blocked doors, and broken glass lead to a re-evaluation of some of the evacuation routes. More stretchers were definitely needed! Everyone is asked to fill out the one page evaluation checklist and hand it in before leaving the room. The participants leave on a high, exhilarated by the drama and excitement of the event. Many plan on using classroom time tomorrow to review the lessons learned by the students. This will become the basis for the exercise next year.

Schools Exercised

The first school that used this model exercise plan was Columbia Community School in Sunnyvale. It is an elementary school with 1,200 students in kindergarten through sixth grade. Red Cross shelter supplies are stored on the campus in an ARK (a semi-truck-trailer container). The principal took it upon himself to open the ARK during the exercise and use the supplies. This gave the city a chance to review the proper procedures for using Red Cross supplies!

This event was followed by another elementary school exercise at Hollenbeck School in Sunnyvale. Ham radio operators were vital to this exercise, especially since the principal was an amateur radio operator himself. A substitute custodian was on duty that day. It became obvious that emergency position checklists with site maps in zip lock bags were necessary to give all staff members and were especially helpful to substitutes.

Cupertino Junior High presented a different challenge with older students. Of all the exercises conducted, these students showed the most creativity. Students were splinted with flutes in the music room, flag poles in classrooms, and carried out on tables to the field. This is the school where the teacher was so tenderly cared for by her students. A bullhorn out on the field was a must in controlling the mass of students. The orientation assemblies really prepared the students in "creative first aid" at this school.

Kennedy Junior High in Cupertino focused on the search and rescue teams and first aid station. The principal learned it was more important to stay in one place instead of wandering around the school where nobody could find him. Excellent computer print-outs on the student's locations during the day helped track missing or absent students. Overhanging roofs were a concern to the staff and evacuation routes were changed.

Homestead High School in Cupertino was a full-scale exercise complete with the press, fire engines, ham radio operators, and bloody injuries painted on by the drama department. This exercise was initially scheduled for the week of October 16, 1989. Inservice meetings had been held the week before with the staff. Every classroom held discussions and handouts had been given to the students to take home.

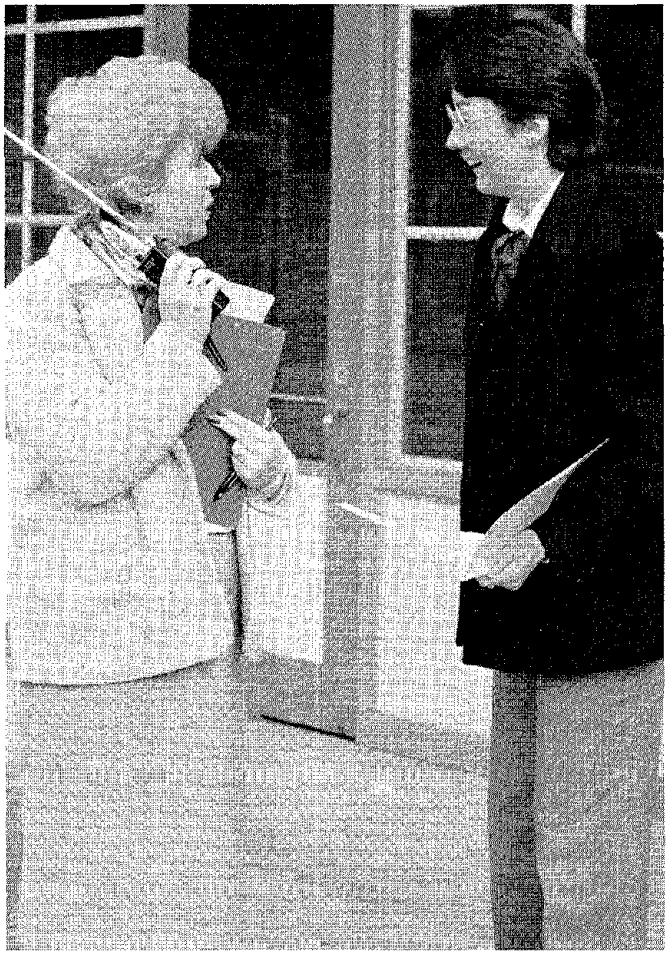
This exercise was postponed due to the *real thing* on October 17, 1989! Many of the staff and the principal felt the preparation for the earthquake drill planned for that week had prevented extensive damage and had prepared them

mentally for the shock of the real disaster. There was some discussion as to whether it was necessary to have an exercise after the Loma Prieta earthquake, but the principal felt "what better motivation to continue with the exercise!" So it was held in November with a seriousness born of real-life experience.

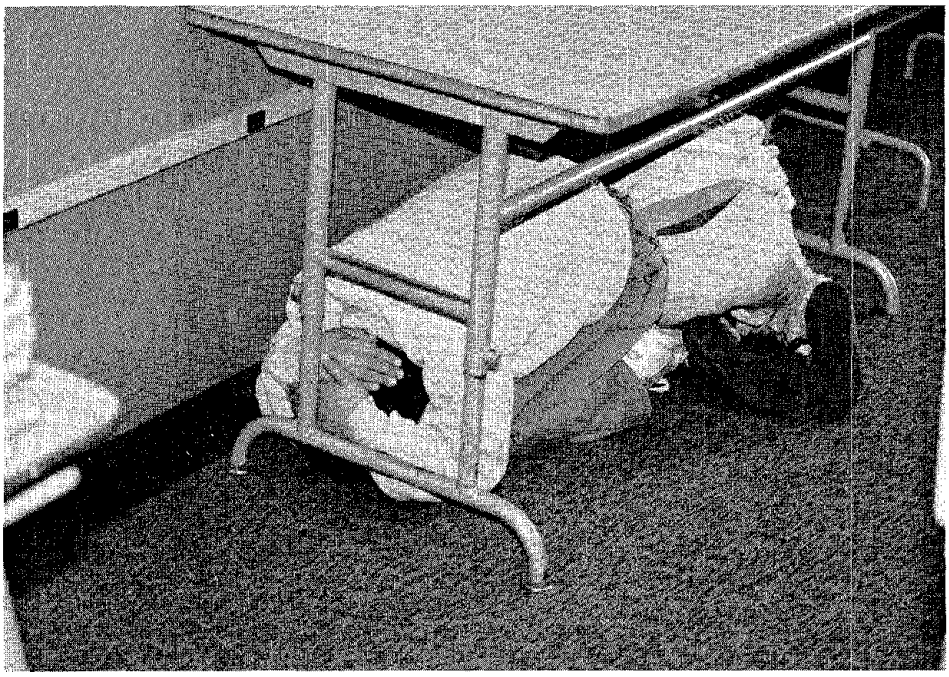
Community Support

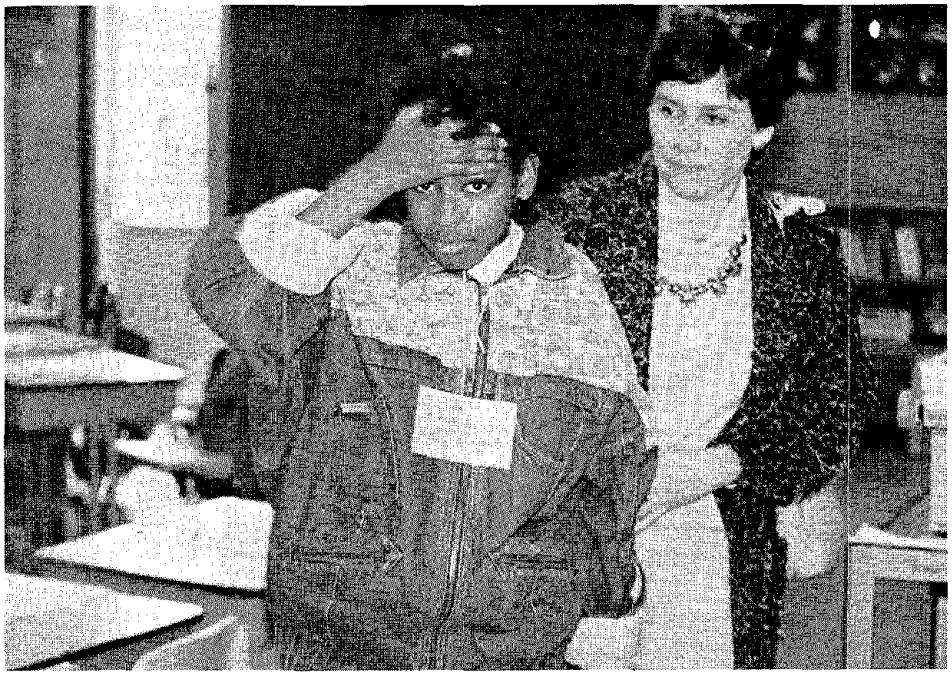
None of the schools described in this article conducted their exercises in a vacuum. The cities of Sunnyvale and Cupertino assisted in writing the scenario, training the staff, and holding the assemblies. Emergency plans were reviewed by city staff and suggestions were made for improvements. Connections were made with the amateur radio clubs and local PTA's. Public Safety agencies supported the exercises with firemen and rigs for realism and evaluators. Every September, the community re-commits itself to preparedness planning. With this level of preparation, these schools will be ready for the next California earthquake!

Drills Can Help Prepare Your School for the Next Earthquake



Drills Can Help Prepare Your School for the Next Earthquake (Cont'd)





Drills Can Help Prepare Your School for the Next Earthquake (Cont'd)

Urban Search and Rescue in Schools: A Disaster Affecting the Future of the Nation

by Jan Smith
President, Urban Search and Rescue and Administrative Director for CMC Rescue, Inc.

When a disaster occurs affecting a populated area that calls for immediate response from the community, it is assumed the local emergency service agencies are initially overwhelmed. The reaction of people may vary, but studies show most people will attempt to assist those in need without regard to their own personal safety. Using the scenario of a moderate or major earthquake provides the ability for every type of hazard to occur simultaneously that will slow down the response time from emergency services personnel and not allow for the normal mutual aid channels to be utilized. If the event occurs during the week between 0800 and 1400 hours when schools are in session, the problems will be magnified.

There are many aspects to address regarding school planning and response, but the specific task of urban search and rescue in a school setting will be the focus of my comments. Breaking the task down into three levels can best address the needs of the staff, volunteers (trained and spontaneous) and students.

Before

Identify whether the need exists to develop a search and rescue team for any disaster. Recognize the possible hazards that may exist at and around the school site with a potential to cause fatalities and/or injuries. Obvious threats for structural collapse would be tornadoes, hurricanes, floods, building compromise, fire, terrorism and of course, earthquakes. Hazards in the community from natural and technological disasters (e.g., hazardous materials spills, fires, utility failure, gas line ruptures) could impact the safety of the staff and students. By doing a "hazard hunt," the need for a search and rescue team will be determined. Once the need is determined, take the next step, which is identifying who will be able to physically and mentally accomplish the goals of a search and rescue team member. Assignment of the team members will then produce the next challenge, which is receiving the necessary training.

The predominant problem of training is not so much the funding, but the time for school staff to receive quality training. In addition to First Aid training, each search and rescue team member should have an overview of emergency operations for the school district (Incident Command) and radio communications (if they don't know what is going on outside, how can they be expected to coordinate and transmit the information on what is going on inside the building?). Each team member should be able to evaluate the hazards prior to conducting a "sweep" of the building to document where victims are trapped. Training should include a combination of lecture and "hands on" exercises to increase the practical skills of each member. Limiting the scope of the training to urban search and rescue skills, the minimum information to be covered for staff members (and volunteers) can be conducted in a four hour course that includes the following:

- Structural Collapse Rescue Situations
- Survival Rate vs. Time of Extrication
- Rescuer Safety and Victim Safety
- Basic Structural Construction Awareness
- Four Stages of Urban Search and Rescue
- Search Methods, Markings and Post Search Critique
- Lifting Heavy Objects

- "Hands on" Lifting Drill
- "Hands on" Utility Control Drill
- "Hands on" Search and Documentation Drill

Conducting drills using some of the above skills should be mandatory at least twice each school year. Doing a "duck, cover and hold" drill monthly is a good way to start, especially if during the first month of school the drill is conducted three times to give the staff and students the practice they need to perform it correctly. This will dramatically reduce the task of the search and rescue teams.

During

When an event occurs that affects the school population, such as an earthquake, each individual must realize they are responsible for their personal safety and should not try to assist others during the critical period, (i.e., the shaking during an earthquake). Spontaneous activation will increase the potential of injury to the rescuer as well as the victim. Even for a short period of time after the event, calm everyone down and begin to assess the hazards before jumping into action. If the event is strong enough to cause concern about the structure, the recommended procedure is to begin to evacuate the classrooms, and move the students to an open area outside. There has been much discussion with regard to how soon to evacuate and what the teacher's responsibility is to those students unable to evacuate. The only guidelines I can provide is to assess the hazards inside and outside the structure. If evacuation is necessary, proceed slowly and carefully, leaving those persons unable to evacuate immediately. Provide the "sweep" teams with information on the location of trapped persons. The rescue teams can then do the rest of the extrication for those victims they are trained to reach.

After

When those persons able to leave the building on their own have done so, the disaster plan should have been activated. The "sweep" teams should assess their safety in re-entering the building and begin to document their findings. They should be able to triage victims to see if they can safely extricate them. If their attempts are unsuccessful, the victims should be documented and the teams continue their search for trapped victims. Part of the above mentioned training will give instruction on how to conduct a search and mark each building and room. When all victims that can be safely removed have been, there still may be victims entombed inside. This information must be transmitted to emergency services personnel (probably the local Fire Department) and a request for assistance must be made. By waiting until you know what kind of skills are needed, if any, the possibility of increased resources is greater. Schools will naturally be a priority for community response and that of emergency services personnel. One of the key factors in the "after" phase of a disaster is to know the location of everyone. Under no circumstances should untrained people be allowed to enter a compromised structure. The threat of further collapse is very real, especially with aftershock potential from an earthquake. Search and rescue teams always work in teams of two members and those members do not ever separate from one another. Communication to the outside of the building is critical. Whenever anyone is inside, an observer on the outside should be in constant communication with each team. If there is any threat to the structure, the team should be instructed to exit immediately. The scene Incident Commander should be appraised constantly of the progress of each team.

Realizing the complexities of response issues under this scenario, the fact of the matter is that parents, community residents and other well meaning citizens will respond to the school for a variety of reasons. This alone will affect the coordination of information and resources. Students can be utilized under limited conditions. Allowing them to perform little or no risk tasks is not only beneficial to the effort, it allows them to feel needed and reduces their psychological trauma. The tasks they may be helpful with are security; basic first aid, if they are trained; assisting with younger students; setting up the shelter areas; communications and documentation of the event. Because of the dangerous nature of the search and rescue tasks, it may be unwise to expect students to be able to effectively deal

with this task. In some cases, students with special training, such as Boy Scouts, may be of some limited assistance. However, concern for the psychological recovery of students should limit their involvement with search and rescue.

Search and rescue appears to be the greatest concern for school personnel. Quality training will make a difference to the safety of the students and staff, as well as allow local emergency services personnel to prioritize the needed equipment and personnel to address specific problems in the area. Hopefully, this type of training will never be needed. However, history tells us that with the average life expectancy, a major earthquake will possibly occur in the United States during the lifetime of today's adult and probably occur during the lifetime of today's child.

COMMUNITY

BASIC URBAN SEARCH AND RESCUE AWARENESS

FOUR HOUR COURSE OUTLINE

SESSION I: **Structure Collapse Rescue Situations**

A. Injured, Not Trapped
B. Non-Structural Entrapment
C. Lightly Trapped
D. Entombed

Survival Rate vs Time of Extrication

A. Need for Speed

Rescuer Safety and Victim Safety

A. Personal Safety Equipment
B. Safety Hazards Around Disaster Sites
C. Medical Considerations
D. Victim Movement Over Debris Piles

Break: **10 min.**

SESSION II: **Basic Structural Construction Awareness**

A. Light Construction
B. Heavy Wall Construction
C. Heavy Floor Construction

Four Stages of Urban Search and Rescue

A. Size-up, Surface Victims, and Scene Management
B. Search Likely Survival Places
C. Selected Debris Removal
D. General Debris Removal

Break: **10 min.**

SESSION III: **Search Methods, Markings, and Post Search Critique**

A. Systematic Search
B. Search Markings
C. Post Search Critique

Lifting Heavy Objects

A. Lifting by Hand
B. Lifting with Hand Tools
C. Crib and Shim

Break: **10 min.**

SESSION IV: **1. Lifting Drill** **Squad Rotation (1-2-3)**

A. Lift Heavy Objects by Hand
B. Lift Heavy Objects with Hand Tools

2. Utility Control Drill **Squad Rotation (2-3-1)**

A. Shut Off and Turn On Common Utility Controls

3. Search & Documentation Drill **Squad Rotation (3-1-2)**

A. Search and Site Survey
B. Documentation of Search and Site Survey

EQUIPMENT LIST FOR SEARCH AND RESCUE COURSE

GIVEN: 36 Students, 3 Assistant Instructors, Slide Projector, Overhead Projector, Screen, Slides, Overhead Transparencies, and Drill Session Equipment

Note: If student number is doubled, the assistant instructors and drill session equipment must also be doubled. The drill session is designed for three squads of students in equal numbers to rotate through each station every 15 minutes.

Drill Session Equipment

Lifting Drill	Utility Control Drill	Search and Documentation Drill
4 Drawer File Cabinet - 2 ea or 6'-8' Folding Table- 2 ea Sand bags, bundles of newspaper, or exercise weights- 200 lbs. Mannequin- 2 ea Crow bar- 2 ea 4' x 2" x 4"-2 ea Phone Books- 8 ea 24" x 4" x 4"- 24 ea 18" x 4" x 4" Wedges- 8 ea	Gas Meter Prop - 1 ea Water Bib Prop- 1 ea Water Main Prop- 1 ea Circuit Breaker Panel- 1 ea Electrical Box with a Knife Switch- 1 ea 12" Crescent Wrench- 2 ea Channel Lock Pliers- 1 ea	6'-8' Folding Table- 2 ea Mannequin- 2 ea

Santa Monica Fire Department
&
Urban Search and Rescue, Inc.

DISASTER ASSISTANCE RESPONSE TEAM (D.A.R.T)

18 HOUR COURSE OUTLINE

CLASS 1

SESSION A: ADMINISTRATION & TEAM ORGANIZATION

1. Introductions and Registration
2. Course Overview
3. Disaster Assistance Response Team (DART) Organization

SESSION B: STRUCTURAL COLLAPSE DISASTER AWARENESS

1. Events Causing Structural Collapse Disasters
2. Basic Structural Collapse Rescue Situations
3. Need For Disaster Assistance Response Teams

SESSION C: STRUCTURAL COLLAPSE DISASTER PREPAREDNESS

1. Introduction to Disaster Psychology
2. Introduction to Self Preparedness
3. Introduction to Non-Structural Hazard Mitigation

CLASS 2

SESSION A: RESCUER SAFETY

1. Introduction to Rescuer Safety
2. Introduction to Safety Equipment and Tools

SESSION B: DART FIRE SUPPRESSION UNIT

1. Introduction to Utility Control
2. Introduction to Hazardous Materials
3. Introduction to Basic Firefighting

SESSION C: FIRE SUPPRESSION WORK STATION

1. Utility Control Work Station
2. Firefighting with a Fire Extinguisher Work Station
3. Firefighting with a Fire Hose Work Station

CLASS 3

SESSION A: DART MEDICAL (I)

1. Introduction to Disaster First Aid
2. Introduction to Airway Management
3. Airway Management Work Station

SESSION B: BLEEDING AND SHOCK

1. Introduction to Bleeding Control
2. Bleeding Control Work Station
3. Introduction to Shock Management
4. Shock Management Work Station

SESSION C: TRIAGE

1. Introduction to Triage
2. Triage Work Station
3. Introduction to Triage Documentation
4. Triage Multiple Victims Work Station

CLASS 4

SESSION A: DART MEDICAL (II)

1. Review of Disaster First Aid
2. Introduction to Head to Toe Assessment
3. Head to Toe Assessment Work Station

SESSION B: FRACTURES AND SPLINTING

1. Introduction to Fractures and Splinting
2. Fracture Splinting Work Station

SESSION C: LIFTING AND MOVING VICTIMS

1. Introduction to Lifting and Moving Victims
2. Lifting and Moving Victims Work Station
3. Introduction to Casualty Collection Points (CCP)
4. Introduction to Burn Care
5. Introduction to Wound Care

CLASS 5

SESSION A: DART SEARCH AND RESCUE

1. Basic Structural Construction Awareness
2. Four Stages of Urban Search and Rescue
3. Introduction to Search Methods and Markings

SESSION B: LIFTING AND CRIBBING

1. Introduction to Lifting and Cribbing
2. Lifting and Cribbing Work Station

SESSION C: DART MANAGEMENT AND DOCUMENTATION

1. Introduction to DART Management
2. Introduction to DART Documentation
3. DART Management and Documentation Work Station

CLASS 6

SESSION A: DART COURSE REVIEW and DRILL PREP

1. Review Key Points of Course
2. Drill Prep and Rules

SESSION B: DART DRILL

1. Conduct DART Field Exercise

SESSION C: DART CRITIQUE AND CERTIFICATIONS

1. Drill Critique
2. Course Critique
3. Issue Certificates

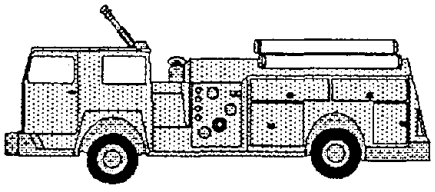
D.A.R.T.

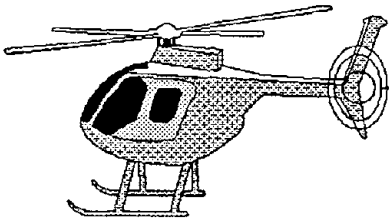
DISASTER ASSISTANCE RESPONSE TEAM

A Disaster Assistance Response Team (DART), is a group of trained citizen volunteers that assist local government and emergency response agencies such as law enforcement and fire service in non-emergency and emergency situations. In Ventura County the program is administered and maintained by the cities. In the unincorporated areas, the instructors are provided through liaison with the Sheriff's Office of Emergency Services.

DART is comprised of community members trained in light search and rescue, first aid, field sheltering, damage assessment, traffic and crowd control, fire safety and suppression, emergency radio communications and critical incident stress components. Training in the these areas is conducted by certified instructors provided by local agencies.

DART relies on community funding and donations to purchase equipment and supplies necessary to carry out its emergency service assistance functions. DART needs community support to serve its vital function to the citizens of the community. If you are interested in setting up a DART team in your community, please phone or write to:
Ventura County Sheriff's Department,
Office of Emergency Services
800 SO. VICTORIA AVENUE
VENTURA, CALIFORNIA 93009--(805) 654-2551



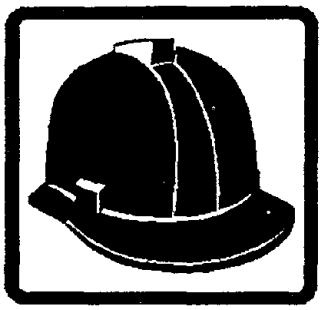


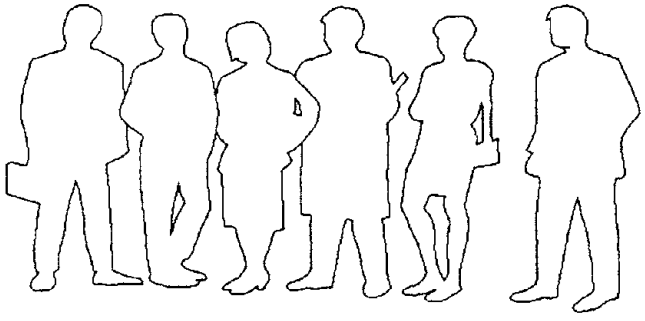
Sponsored by the Ventura County Sheriff's OES

VENTURA COUNTY EMPLOYEE PROGRAM

As a result of presentations made to the Board of Supervisors and the County's Executive Committee on the Loma Prieta earthquake in northern California on October 17, 1989, a joint decision was made that Ventura County employees should receive emergency preparedness training.

A recommendation was made by Sheriff John V. Gillespie, and supported by current County Fire Chief, Rand-Scott Coggan that a train-the-trainer program be developed jointly by the Sheriff's department and County Fire. This program would provide training at a ratio of 1 trainer for every 20 employees in each county department. The Fire department and Sheriff's department committed a minimum of 3 employees each to receive training for the employee program. The initial base of information was received by Sheriff and Fire department representatives by their attendance of training sessions held in Camarillo for the community Disaster Assistance Response Teams. Development of lesson plans for the 4 hour employee training program has taken place since that time.





School Preparedness Supplies and Student Emergency Comfort Kits

by Frances E. Winslow
Director, Office of Emergency Services

If a disaster strikes while the children are at school, will your school be prepared to care for them? If the children need to remain at school for several days, are you prepared?

Many schools have requested parent participation in preparedness. Each child has been asked to make a comfort kit at home that he can leave at school from September through June. Schools should also have some preparedness items to assure the safety of all students, faculty and staff. It is important to provide guidelines to parents on what to include in the backpack, and to let the parents know what items the school has provided.

If funding is a problem, work with the PTA. The safety of the children is paramount, so emergency preparedness items deserve serious consideration in the PTA school gift budget. The local government may be able to assist the school district in developing a cache of basic supplies to be augmented by local efforts. The district should make emergency preparedness a priority, as well.

School Emergency Supplies

The following is a list of basic emergency preparedness supplies that every school should have.

1. **Water**. Strap the water heaters. The water in a water heater will provide 40 gallons of potable water, or a one quart ration for 160 people for one day. Water can be stored in specially designed containers that assure potability for one year or more. Water can also be purchased in foil pouches with a guaranteed five year shelf life. Some schools have had students bring gallon containers of bottled water, but these must be protected from light, and storage may pose a problem.
2. **First Aid Supplies**. Traditional first aid supplies may not be adequate for the types of injuries experienced in an earthquake. Some vendors have designed kits specifically for earthquake-related injuries. Be sure that these kits include splints, ace bandages or stretch gauze, absorbent bandaging (including surgical grade), gauze sponges, triangular bandages, safety pins, scissors, eye cups and tweezers. The most common injuries in an earthquake are crush injuries, broken bones, severe cuts and gashes, and eye injuries from dust and debris. Adhesives deteriorate over time, and heat accelerates this process. Several stretchers should be stored around the building.
3. **Rescue Supplies**. The Search and Rescue Team at your school will need hard hats and dust masks. They should wear goggles and work gloves when moving debris. They need flashlights, crow bars, a short ax, pliers, wire cutters, hammers and duct tape. Batteries are available with a ten year shelf life. Light sticks are a benefit because they can be left with injured people when they are discovered. The light is a "security" measure for the injured person, and it makes it easier for the stretcher team to find them in a darkened room.
4. **Principal's Supplies**. The principal should have a foot locker stocked with emergency response supplies. These should include a bull horn, a whistle, an up-to-date list of students, faculty and staff, a supply of student release forms, rope, tarpaulin and cord, a lantern, a roll of plastic sheeting.

5. **Classroom Supplies.** Every classroom should have a flashlight and a battery-operated portable radio. Alternatively, a flashlight-radio combination with a magneto and crank provides light and communication without batteries.
6. **Sanitation.** If toilets cannot be flushed, an alternative will be needed. Heavy-duty plastic bags with strong twist ties can be used to line toilets. Include pine oil to mitigate odor, extra toilet tissue, and a light source for the rest room, preferably a lantern.

Student Backpack Supplies

1. **Food.** After an emergency, food is important for its psychological benefit. When making a child's emergency backpack, consider the psychological value of food rather than worrying about balanced meals. Select foods that the child enjoys. Purchase packaging that is "flip-top" or "tear open." Avoid foods high in sugar, such as candy, and foods that cause thirst, as liquids will be in short supply. Select beverages that taste acceptable at room temperature. Avoid carbonated or sparkling drinks. Be sure that the child enjoys eating everything that is included in the pack.
2. **Clothing.** Include a sweater or jacket, a cap or sun visor, and a change of clothing, including under clothes and socks. A jogging suit is a good choice because it is comfortable to sleep in. Avoid including tight clothing or anything with loose decorations.
3. **Medical Items.** No medical items should be stored in backpacks. Children with special concerns should be registered with the school nurse or principal. Parents and physician should complete district-required paperwork to leave medication with the appropriate site administrator. It is the parent's responsibility to rotate medication supplies to keep them fresh. Only medications needed for life-threatening conditions should be administered under emergency conditions, e.g. insulin. Psychoacting drugs should only be administered if the physician will sign a statement that they are needed, e.g. Ritilin.
4. **Psychological Care Items.** A blanket, stuffed toy or similar security item should be included for every child in the elementary school. Older children should make their own choices of security items. A photo of the family together at a happy time will help the child feel more secure while he "waits" for parents to arrive at school, especially if he has to wait several days. Parents should include a list of the following phone numbers: day time numbers for each parent, numbers and addresses for any other close relatives living in the area, numbers and address of the family's designated out-of-state contact person. Be sure that every family has completed the student release permission form.

Emergency Supply Storage

Modern schools seldom have adequate space for storing the needed emergency supplies. Consider asking the PTA to purchase a storage shed for your property. It is a good idea to have the emergency preparedness items away from the building. Alternatively, a used sea-going cargo container may be purchased for under $3,000 at most ports and many railroad yards. A local business might donate a storage container that they no longer need.

Financing School Preparedness Supplies: The Pennies for Safety Project

by Terry Gabrielson
Chairperson, Pennies for Safety Project

Introduction

Picture yourself for a moment as the principal of a school with several hundred students enrolled. School is in session and suddenly an earthquakes begins to occur. A flood of thoughts immediately rush through your mind, all relating to the felt need to help preserve the safety of the students, faculty and staff members in your building.

Assuming that everyone under your charge has long since been taught the proper procedures for "duck, cover, hold" and evacuation, what you would probably want most at this moment would include (1) a faculty and staff well trained in the areas of First-Aid and CPR, and (2) a complement of emergency supplies sufficient in quantity and appropriate in type to best enable a proper response to the almost inevitable immediate - and very possibly long-range medical, psychological and basic life-preservation - needs that would present themselves.

The evidence is abundantly clear. Every school located on or near the New Madrid Fault Zone needs to have faculty and staff members adequately trained to be able to properly respond to emergency situations, including earthquake disasters. In addition, prudent judgment dictates that these same schools need to have available, perhaps in every classroom, emergency kits filled with items appropriate and necessary for effective post-disaster response.

Raising Needed Funds

Raising funds for special school projects is, under the best of circumstances, an arduous task. Acquiring funds necessary to buy items needed for emergency kits that may never be used can be even more formidable. In addition, it is costly to develop and make available for faculty and staff members a comprehensive First-Aid and CPR staff development training program. However, it is essential.

How can adequate funds be raised for the purposes of buying emergency kits and training staff in emergency procedures? One viable and tested option is the **Pennies for Safety Project.**

The **Pennies for Safety Project** was recently used very successfully by an entire school district located in Blytheville, Arkansas. The Blytheville Public Schools include eight schools and over 4,000 students. The fund raising approach used by the Blytheville Public Schools, i.e., collecting pennies, can be easily implemented for use by virtually any school or school district.

Basically, the **Pennies for Safety Project** calls on students to collect as many pennies as possible, then contribute them to the school or school district earthquake safety fund.

A natural outgrowth of the school-based **Pennies for Safety Project** is that it can, in all probability, quickly and easily become a community-wide endeavor, with concerned citizens of all ages collecting pennies for the cause. This natural evolution in the scope of the project, of course, requires appropriate communications with various constituencies within the community, whether directly or via the print and non-print media.

Why Pennies?

First, because they are easily accessible to virtually everyone in the community, regardless of income level or chronological age. As soon as school-aged children go home and solicit help for their efforts in collecting pennies, soon parents, grandparents, neighbors and friends - sometimes from distant locations - become enthusiastically involved. Why? again, because of the accessibility of pennies. Nearly every home in America has a collection of pennies stored somewhere within its confines, either as a treasured collection or as an unavoidable nuisance, depending upon point of view. Also, pennies are easy to collect. Never underestimate how quickly these modestly valued coins can combine to provide fund raising muscle.

Spontaneous Competition

Inevitable during the **Pennies for Safety Project** is the springing up of competitions among students, among classrooms, among schools and, yes, even among families in the same neighborhood. Healthy competitions to see who can collect the most pennies seem to occur spontaneously.

These competitions can be fueled or nurtured in order to obtain maximum benefits from the fund raising drive. For example, charts depicting numbers of pennies collected, prizes for the most pennies collected, and public acknowledgment of the leading money raisers are just some of the strategies that can be put to effective use as a means of promoting enthusiasm for the overall project.

Still another reason for collecting pennies instead of other denominations is that this approach avoids direct competition with the strategies normally employed by traditional fund raising groups such as United Way, Red Cross, civic organizations, and so forth.

Further, by collecting pennies, the base or pool population from which money is being sought is significantly broadened to include, at least potentially, almost everyone in the community. The collection of pennies can actually draw direct financial support from otherwise competing fund raising organizations, such as civic organizations.

Still further, the pennies approach also has an appeal that may reach the non-traditional donor in the community.

Finally, the collection of pennies has a certain appeal and novelty to it that helps to pique the interest of individuals throughout the community.

Like watching the rising thermometer used during the annual United Way fund drive, people in the community become interested in knowing "how many pennies have been collected so far?" Understandably, it becomes essential to publicize periodic progress reports as a way of capitalizing on the novelty concept.

Initial Skepticism

Initially, skeptics will make claims such as "There are not enough pennies in this town to reach the goal as stated." Or "Pennies are worthless - they will never collect enough to amount to anything!"

These same skeptics will learn, however, that as soon as a large group of school children - aided by their parents, grandparents, neighbors and friends - begin to collect pennies, the total amount collected grows quickly to impressive sums.

Civic clubs and other community organizations soon take an interest and develop the felt need to contribute one hundred - or five hundred dollars worth of pennies - to the cause. Individuals who have had no direct contact with

the schools for years will suddenly appear with lifetime collections of pennies. Local businesses and industries will learn about the project and they, too, will start individual collections of pennies on their own, then turn over the proceeds to the **Pennies for Safety Project**. The novelty of the campaign is irresistible.

Value of Variety in Approach

Businesses in the community especially appreciate the **Pennies for Safety Project** because they all too often are asked to contribute to virtually every needy cause in the community. Interestingly, due to the nature of the **Pennies for Safety Project**, some local business (and local industries) ultimately put forth far more effort to collect pennies for the cause than would be realized if these same entities were asked for a simple cash donation.

Set a Goal and Stress Novelty

Set a monetary goal for your **Pennies for Safety Project**, then stress the novel features(s) that will be used as a part of reaching your goal. For example, as your ultimate novelty-related goal, you may decide to cover an entire gymnasium floor with the pennies collected. This provides motivation for the entire community.

If you decide to cover an entire gymnasium floor with pennies, calculate the number of square feet contained within the gymnasium floor, then multiply that number times 256 (the number of pennies in one square foot), and you will have arrived at your stated novelty goal, i.e., the total number of pennies needed to cover the entire gymnasium floor.

Next, publicize your goal and make known the number of pennies required to attain this goal.

Inform everyone in the community about (1) the dimensions of your gymnasium floor, and (2) the number of pennies in one square foot.

Also, share with the community interesting and pertinent pieces of information such as: $100.00 worth of pennies weighs sixty pounds, then put out the question: "How many pounds of pennies will be required to cover the entire gymnasium floor?" The local news media will likely be pleased to cooperate in helping to pose this and other similar types of questions to the public at large, all as a part of piquing interest in the overall project. This approach, simply, adds to the intrigue of the project.

Another Approach to Novelty

Instead of setting a goal of covering a certain amount of floor space or a certain number of square feet with pennies, you may prefer to have as your goal the need to collect a specified number of pennies - one million, for example. It is better to announce the number of pennies to be collected rather than merely stating the amount of money to be gathered, again, because of the intrigue or novelty factor. People will enjoy doing their own calculations in order to determine this information. As a result of participants having fun doing the calculations they will, in the process, get a brush-up on their understanding of mathematical place value.

One can readily see how individuals and/or groups can easily become captivated with the notion of collecting "x-pounds" or "x-number of square feet" of pennies.

All Forms of Currency Can Be Converted

Make it known from the onset of the project that there is a willingness to accept all forms of currency as a part of the fund raising effort, whether it is pennies, silver or paper money.

How do you handle other forms of money? Simply make arrangements with the local bank(s) to have on hand an additional supply of pennies, thus enabling you to convert all donations to pennies.

Support From Local Bank(s) Critically Important

Essential to the success of the **Pennies for Safety Project** is the total acceptance for and support by one or more of the local banks. Strong support from at least one of the local banks is an absolute key factor to the overall success of the project.

Arrangements might be made with one of the local banks to store in their respective vault all of the pennies collected during the conduct of the fund raising campaign. Using a bank as a central repository for the collected funds has several benefits, including security, and help to project a business-like approach to conducting the project.

More Pennies Will Be Needed

Sometime during the **Pennies for Safety Project** it is almost certain that the local bank(s) will need to secure additional pennies from the Federal Reserve System, especially as the campaign nears the end and it becomes necessary to convert large cash or check donations to pennies. Large donations are likely to be made near the end of the campaign, especially from civic clubs, PTA's, local businesses and industries, and interested citizens. These checks and large cash contributions, although not imperative, should be converted to pennies in order to capitalize on the novelty factor resulting from the growing number of pennies collected during the campaign.

Pennies are available from the Federal Reserve System in money bags that contain thirty pounds or fifty dollars worth of the coins.

An Essential Factor That Contributes to the Novelty Factor

Another essential ingredient in the **Pennies for Safety Project** is that of putting all of the pennies collected on public display as a part of concluding the overall project. Making this part of the plan widely and well known to the public in advance will almost certainly help ensure the overall success of the project. Psychologically, no one in the community wants to be embarrassed by not meeting an important goal - especially one that involves the safety of children. Further, if people know that the fund raising campaign is near the end and the ultimate goal has not yet been reached, there is a distinct likelihood that sizeable last-minute donations will be made by people who heretofore were only observing from the figurative sidelines.

Earthquake Emergency Kits

In order to determine the amount of money that must be raised as a result of the **Pennies for Safety Project**, it is first necessary to determine (1) the number of earthquake emergency kits required by the school(s), and (2) the contents that are to be included in each kit. Obviously both of these factors need to be taken into account simultaneously because each has a direct bearing on the other. For example, if it is decided that every classroom will receive an earthquake emergency kit, then the contents of the kits need to be geared to that of providing for classroom-size groups of children. If, on the other hand, only one or a few kits will be placed in a given location for the purpose of serving the needs of an entire school wing, then naturally the kit contents will vary dramatically from the classroom-type kit. Although the same types of items will be included in both, the quantity will be different.

A logical approach to answering the questions: "How many emergency kits?" "And where?" is to place a smaller, basic kit in each classroom and one larger, comprehensive kit in, or near, the school office.

Contents of Earthquake Emergency Kits

The contents of earthquake emergency kits will almost certainly vary, based on not only the size of groups to be served, but also by the felt needs of the district emergency preparedness committee (or its equivalent).

The Blytheville Public Schools in Arkansas, after considerable discussion, determined that the items listed below should be included in every classroom kit. It was further decided that such a kit should be provided for every elementary school classroom in he district (in this case, over 300). Still further, it was agreed that twenty-five of the same type of kits should be placed in various strategic locations throughout each of the district's secondary schools.

Earthquake Emergency Kit Contents
As Determined by One School District

1 Backpack
1 Flashlight
2 Batteries
1 Pair of scissors
1 First-Aid Instruction Summary Sheet
1 Pad of paper (for name tags, et cetera)
1 Pen
1 Pencil
1 Light stick
1 Whistle
1 Sewing kit
1 Package of safety pins
1 Solar blanket
1 10 package of gum
1 10 package of life savers
6 Packages of plastic trash bags
2 Packages of small paper bags
2 Packages of paper cups
1 Package of premoistened towelettes
1 Bottle of hydrogen peroxide
2 Small packages of Tylenol
1 Package of Tums
4 Ammonia inhalants
2 Ziplock sandwich bags
1 Box of Telfa Pads
1 Pair of tweezers
1 Box of Band-Aids
2 Cold Packs
1 2" Roller bandage
1 3" Roller bandage
1 Roll of adhesive tape
10 Pairs of disposable gloves
1 Container of waterproof matches
* Toilet tissue
* Sanitary napkins
* Triangular bandages
* Saline solution (optional)

Note: It should be noted that the aforementioned list of contents for classroom earthquake emergency kits is by no means official in the sense that it was determined by any health- or emergency-related agency. The list represents only the contents for emergency that one school district thought reasonable.

Also, in many instances, individual classroom teachers in the Blytheville Public Schools added a variety of donated items to their respective kits.

Each of the eight schools in the Blytheville Public System also received one large earthquake emergency kit for placement in the school office. These large kits contained such items as spine boards, a litter, several blankets, numerous pairs of heavy-duty work gloves, several hard hats, a battery-operated radio, and a host of additional medical supplies. In addition, each school was equipped with a two-way radio system.

Relative Costs of Earthquake Emergency Kits

The Blytheville Public Schools spent approximately $35.00 per classroom earthquake emergency kit. The large kits placed in each office are estimated to have cost between one hundred and two hundred dollars each. Some of the items in the kits were donated by local businesses and industries, and the costs of these items is not reflected in the above-cited figures.

Some Considerations

In the case of the Blytheville Public Schools, it was agreed that all proceeds raised from the **Pennies for Safety Project** were to be spent with **local** vendors only. After seeking bid prices for the numerous needed items from many local vendors, all purchases were made locally. Bulk purchases of the kit items, of course, helped to bring down prices considerably. The final cost for each of the more than 300 classroom kits that were assembled, as cited above, was almost exactly $35.00.

Pre-assembled Kits

Is it possible to purchase kits already assembled? Yes. Various vendors throughout the United States do offer such kits for sale to the public. If the contents and relative costs of these commerically-prepared kits are suitable and reasonable, then simply purchasing these kits is a viable option. Some school districts may prefer to determine for themselves, however, what should be in the kits.

If a school district is willing to seek competitive bids on the various items that comprise the kits, then it may be possible to save considerable sums of money.

Local Donor

In the case of the Blytheville Public Schools, Wal Mart Corporation donated the over 300 sturdy nylon bags that were needed to hold the contents of each earthquake emergency kit. The district then purchased, from various local vendors, virtually all of the items that were needed for complements of the kits.

Assembling Kits is Easy

After all of the bulk orders of individual kit items arrive at a central location in a school district, it requires no more than a few hours, at most, for volunteers to assemble complete kits. P.T.A. members, teachers, administrators and students are a likely source of volunteers.

American Red Cross Kits

The American Red Cross has at least two different sized emergency kits available. One type of kit is contained in a plastic, five-gallon bucket. Contact your local Red Cross organization for more detailed information on kit contents and prices.

Where Should Earthquake Emergency Kits be Located?

Where should earthquake emergency kits be located in order to provide optimum potential value? Simply, where they will most likely be needed in the event of a major disaster such as an earthquake. For example, one kit per classroom is a logical approach. There is also much to be said for having a much larger and more inclusive kit, including such items as a bullhorn, walkie-talkies, a litter, available in each school.

All kits need to be placed in locations where they are easily accessible.

Each classroom may also want to determine the person in charge of the kit should an emergency occur. For example, the student council representative can be the designee who will be responsible for carrying the kit while enroute to the designated outdoor meeting spot during an evacuation. Always have a back-up designee in case of absence or injury.

What About Kit Maintenance?

Some items in emergency kits, such as batteries and hard candy, will need to be replaced, perhaps on an annual basis. It is therefore suggested that some of the monies raised from the **Pennies for Safety Project** be placed into an interest-bearing savings account and that these funds be used to purchase needed replacement items.

Someone at either the school building or district level needs to be given the responsibility of ensuring the proper placement and upkeep of the kits. Each kit should be thoroughly examined at least annually in order to confirm its completeness.

What About Water?

Water can be handled separately and easily by asking students, for example, to bring in suitable containers. These containers can then be sterilized, filled, labeled and stored, according to recommended procedures (See Red Cross manuals, for example).

Two and one-half gallon, plastic containers make ideal vessels for emergency water supplies.

Food

Normally, most school kitchens have at least some food in storage that can be used during emergency situations. Volunteers may be sought, of course, to bring in additional supplies of canned goods, dried foods, and so forth. Each school and school district should work out its own food availability and allocation plan.

Other Necessary Items

Items such as toilet tissue, sanitary napkins, and soap are normally available in schools as regular supply items.

Launching The Pennies for Safety Project

Calling a school assembly and announcing the intended purpose of the **Pennies for Safety Project** is an ideal way to launch the fund raising campaign. This type of kick-off can be supplemented with letters home in which the Project is explained. These letters can include procedures to be utilized for collecting the pennies, the financial goal to be met, and most importantly, an explanation of the ultimate purpose of the Project.

A press conference should also be held, including both the local print and non-print media, for the purpose of announcing the start of the Project. The press conference may be held in conjunction with the school assembly or as a separate meeting.

Of utmost importance, throughout the entire Project, is the regular and frequent issuing of progress reports, i.e., how much money has been raised to-date.

Progress charts (perhaps similar to the United Way Thermometers) posted in strategic locations within each school and throughout the community can effectively help generate even more enthusiasm. Perhaps the local newspaper might be willing to publish a daily or weekly "thermometer" depicting the dollar value of the pennies collected.

Project Time Line

One month is probably a sufficient time to conduct the entire **Pennies for Safety Project.** given the fact that there are approximately twenty school days in one month, maximum effort needs to be put forth, starting from the very first day of the Project. Although everyone involved will need to put forth intense effort during the conduct of the Project, this is offset by the relative brevity of the overall time line.

Penny Collecting Procedures

Pennies need to be collected, counted and placed in either money bags or plastic zip-type bags on a daily basis. Each classroom should be responsible for its own collecting, counting, and bagging. Following the counting of pennies each morning, the teacher should send her or his bag of money to the school office. At that time, a daily building-level count can be completed and posted.

There is much to be gained by making a daily posting of the cumulative amounts of money collected by each classroom as well as by overall school. It is here that many forms of competition will automatically emerge. It is highly beneficial to actively promote competition between and among classes, grade levels, and even schools - to determine who can collect the most pennies. Various prizes can be offered as incentives.

Other Considerations

Careful note should be made of the various individuals who bring in the most pennies (or money in any other form). Their names and pictures should be made available to the press. Surprisingly, some individuals may bring in fifty or one hundred dollars worth of pennies - or more. These types of efforts must receive an appropriate response. In addition to collecting pennies, make it abundantly clear that students, or any other interested parties, may contribute virtually any form or amount of money. Many people will offer checks, folding money and/or silver change.

Special Projects

Some classrooms may be willing to conduct special fund raising activities such as car washes, bake sales, or even lawn mowing - all to collect money for the Project. Again, seize every opportunity to promote healthy competition between and among various participating groups.

Where Should the Money Be Stored?

Perhaps the most secure place to store the pennies and other monies collected during the fund raising campaign is at a local bank. It is important to succinctly articulate the overall fundraising strategies and procedures to a local bank of choice in order to ensure that the entire Project is conducted in both a harmonious and business-like manner. It is likely that a local bank will be willing to offer temporary vault storage space in which to safely store the funds.

As mentioned earlier, fifty dollars (or thirty pounds) worth of pennies fit nicely in a Federal Reserve System-type cloth money bag. Each school should have a supply of cloth money bags on hand, and as they become filled, they can be easily handled for transport to the bank for temporary storage. Of course, each bag must be labeled with the name of the respective school and the amount enclosed.

Contingency Plan for Counting

If the pennies begin to come in so rapidly that it becomes impossible to count them due to practical reasons, then simply have one person hold a money bag while standing on a bathroom scale. Have a second person pour pennies into the money bag until thirty additional pounds register on the scale. Then label the bag as containing $50.00 worth of pennies. This system is fast, works well, and is fairly accurate.

Note: In less than one month, children from the Blytheville Public Schools, with help from the community, collected far in excess of one million - or more than 6,000 pounds - of pennies. It literally took a farm tractor pulling a trailer to haul the pennies from the two local banks to the school gymnasium where the pennies were all placed on the floor, side-by-side, for public display. Almost no one thought it could be done, especially within such a brief time period.

Rationale for Display of the Pennies for Public View

Perhaps the strongest motivating factor that will encourage people from throughout the community to contribute to the **Pennies for Safety Project** (i.e., next to that of providing safer schools for their children) is that of anticipating the viewing of the total amount of pennies collected during the fund raising campaign. Never underestimate the compelling intrigue that can be created from anticipating such a spectacle.

Viewing a public display of copious amounts of pennies for many is a once-in-a-lifetime opportunity. This is especially true if the results of the campaign match or exceed an established objective such as "collecting one million pennies for the safety of our children" or "covering the entire gymnasium floor with pennies, all for the safety of our children." Most people in the community, regardless of chronological age, will almost certainly want to view such an impressive display.

Choosing a Site for the Display

Choosing a site for the penny display depends, in large part, on the total number of coins collected. An ambitious objective, for example, would be to cover an entire gymnasium floor. Do some measuring in advance, remembering that it takes 256 pennies to cover one square foot of floor space. Obviously, it takes a lot of pennies to cover a gymnasium floor. If this is too ambitious, scale it down.

The facility in which the pennies are displayed should be available for a two- or three-day period, ideally a Thursday evening for set-up, Friday and Saturday for viewing, and Saturday night for pick-up and clean-up. School gymnasiums are ideal sites because of the available walking and seating space around the perimeter of the basketball court.

Advertising the Event

Every effort needs to be made to advertise the penny display. Contact the newspaper, and radio and television stations. In addition, letters to parents and flyers sent throughout the community can be helpful in getting the message to a broad base of citizens from throughout the area. People will be genuinely interested in viewing the penny display if they know about it.

Arranging the Display

Assuming the pennies collected during the fund raising campaign have been placed in money bags and stored at a local bank, on the day of the display set-up, a designated crew can be dispatched to the bank to load and haul the coins to the display site. Fanfare can be added during the transit of the pennies by asking the local police and fire departments to serve as escorts. This creates an excellent photo opportunity for the local media.

Once the coins arrive at the display site, the money bags can be evenly distributed across the entire floor surface. Doing some rough mathematical calculations will provide an idea about how far apart from one another the bags should be placed.

If more than one class or school was involved with the fund raising campaign, the floor might be taped, roped or otherwise sectioned off in a way that provides a proportional amount of space for each class or school.

Next, dump the pennies from the bags onto the floor. The pennies can then be easily slid into position, side-by-side. It may help to start on one side of the floor and gradually work toward the opposite side of the assigned space. Given the practicality of time, the pennies need not be perfectly aligned and spaced in rows and columns. Pennies do slide together with a minimum of effort, especially on a varnished or waxed surface.

Does the Floor Surface Need to be Covered?

If reasonable care is taken, it probably will not be necessary to cover the floor with plastic or any other protective coating prior to placing the pennies on the surface for display.

Who Should Arrange the Pennies on the Floor?

The decision regarding who should arrange the pennies on the floor rests with the project organizers. The process goes quickly with adult volunteers such as teachers, but some students or members of clubs might also be tapped to become involved.

Arranging the pennies on the floor is certainly one of the main highlights of the overall Project. Photograph and/or video this event for posterity. Also, it may be decided to have free refreshments and live or recorded music available for the volunteers. The local news media should be invited to participate in this event.

Embellish the Display

Before the display of pennies is opened for public viewing, make arrangements with the local police department, fire department, Red Cross chapter, and any other local emergency response-type agency to become participants in the display. Invite these groups to have available at the site appropriate booths, personnel and pertinent literature. The occurrence of any type of a natural disaster, especially an earthquake, would necessitate a combined response from all of these groups. Therefore, joint participation by all of these organizations during the penny display will help to send the message of solidarity and cooperation to the entire community.

It is likely that local grocers will want to donate food for the event, i.e., food that may be prepared and sold at a 100% profit, the proceeds of which can be added to the overall **Pennies for Safety Project**. It should be a relatively simple matter to identify a group of volunteers to prepare and sell the food that will be sold to the visiting public during display hours.

Display Emergency Kits

It is important to also put on display one or more examples of the earthquake emergency kits that will ultimately be purchased for classrooms as a result of this project. These kits can be placed on display tables and personnel can be made available to explain the kit contents to interested visitors.

More Embellishments

The local American Legion or some other similar type organization may be willing to lend a quantity of American flags to use during the display. One large flag, for example, might be displayed in a prominent location, perhaps directly over the pennies. In addition, an entire series of small flags, standing upright in simple wooden block stands, might be placed completely around the perimeter of the penny display. This same perimeter should also be roped off in order to keep pedestrian traffic off of the pennies themselves.

Security

Volunteers can be sought for the purpose of providing necessary security during the public display hours. It is possible that personnel from the local police and fire departments may offer their services at no cost for this important community event. When the display is closed and locked up each night, it may be feasible to use a silent security system, temporarily loaned from the local police department.

More Display Considerations

Members of local scouting organizations may be invited to help provide security during public display hours. Scouts can be positioned like sentinels around the perimeter of the pennies display. The availability of these young people, along with a display of flags, can help to make a significant impact on the overall impression that needs to be created during the display.

Collect Funds During the Public Display

Be certain to place a series of plastic, five-gallon buckets for additional funds by the main entry of the display. Label one bucket "Pennies," another "Silver Change," and the third "Green Folding Money." It is likely that visitors will be willing to make on-the-spot contributions.

After the Public Display

Several items of business need to be taken care of following the public display of the pennies in order to successfully bring about closure to the **Pennies for Safety Project**. These include (1) picking up the pennies from the floor, (2) counting the pennies, and, finally (3) using the proceeds of the **Pennies for Safety Project** for the intended purpose, i.e., to purchase items needed for earthquake emergency kits and, possibly, to help fund First-Aid and CPR training courses for faculty and staff members.

Picking Up the Pennies From the Floor After the Display

Picking up the pennies from the floor, following the public display, is a surprisingly simple process. At this time, numerous theories will abound as to the best methods (including using a heavy-duty vacuum). But perhaps one of the simplest approaches is to use stiff-bristled brooms and snow shovels. Snow scrapers might also be used to gather up the pennies.

How much time is required to remove a gymnasium floor full of pennies using these tools? Probably no more than one to three hours, depending upon the size of the work crew. The removal process goes faster than one might imagine, and it is likely that many people will covet the opportunity to be a part of this particular clean-up crew.

As the pennies are scooped up in snow shovels, the coins can be easily deposited back into cloth money bags. This is not the time to recount the money.

Have available for transport back to the bank some type of heavy-duty vehicles that can withstand the weight of the coins. It is advisable to have police personnel available during this time.

Recounting the Pennies

Remember the earlier admonition: Make certain to establish a harmonious working relationship with one or more of the local banks? If this type of working relationship has been established well in advance of the public display of the pennies, perhaps, and hopefully, this same bank(s) will be willing to use their coin counting machines to recount the pennies. This is a major consideration - one that must be addressed at the onset of the **Pennies for Safety Project.** The local bank(s) may very likely be willing to count the pennies as a community service. The counting need not be completed with alacrity, rather the process might be stretched over a two- or more-week period of time. (The bank(s) will likely return to the Federal Reserve System any of the $50.00 bags of pennies for which they do not have a need.)

Drawing Closure to the Project

The final activity of the **Pennies for Safety Project** is that of purchasing the items needed for the earthquake emergency kits. A very small group, perhaps two or three at the most, can easily handle acquiring bids, placing orders, and making final arrangements for assembling the kits, once the line items have all been delivered to a central location.

Some of the monies may be held in a reserve account for the purpose of annually replacing needed items.

Consideration should also be given to using some of the funds for sponsoring First-Aid and CPR training courses for faculty and staff members. The monies might be used, for example, to purchase related text materials for those who enroll in the courses.

Financing school preparedness supplies can sometimes seem overwhelming. But with a little ingenuity and community cooperation, it can be done.

Unacceptable Risk: Earthquake Hazard Reduction in One California School District

by Arrietta Chakos
Facilities Grants Liaison, Berkeley Unified School District
and
Sarah K. Nathe
Resource Coordinator, Bay Area Regional Earthquake Preparedness Project

The Mitigation Milieu

It is not surprising, in light of all the pressing problems school administrators have to contend with these days, that school emergency preparedness and hazard reduction are frequently overlooked. Those concerns must compete with a host of other serious issues for the time and attention of the administrator. If there are barely enough hours in the day to deal with immediate complications and questions, simple arithmetic explains why random events that *may* strike at some unspecified time in the future do not compel much administrative action. However, there is more to starting a successful school emergency preparedness than merely getting past administrative distraction or neglect.

Even when an administrator does attend, for one reason or another, to emergency preparedness, he or she must do so with resources and time that can usually be spent on more pressing problems - at least as they are defined by other groups with differing interests and concerns. And those other groups will make it difficult over time to keep on spending money and staff time on planning and mitigating hazards - not certainly because they are malcontents or troublemakers, but because they will continue to push for their causes. And almost nobody, including the administrators, appreciates that a comprehensive preparedness and hazard reduction program can take a long time to put in place and involve almost *everyone* in the district.

It is a commonplace of hazards research that disasters don't change, but actually exacerbate, the social processes in a community or organization. For instance, if a community has inadequate low-income housing and regular conflicts over how to remedy that situation, then a disaster will make the problem worse - it will reduce the low-income dwelling units further and heat up the public discussion on what to do about it. It is equally true to say that hazard mitigation initiatives *before* a disaster exacerbate social dynamics: efforts to reduce vulnerability to loss will intensify debate over nearly all the pertinent social issues, some not even necessarily related to hazards or their reduction. In a school district, for example, with a history of busing difficulties, teacher pay disputes, or bilingual education controversies, an administrative decision to reduce earthquake risk in the district's buildings will not only encounter the usual obstacles related to money expenditures, but may very well raise all those other ghosts before the project is completed.

In short, plans are not made nor hazards reduced in a vacuum. Preparing for a school emergency is not like buying a new software package and installing it quickly on the central computer. Emergency preparedness has most to do with organizing people, and that is always complex and time-consuming. Any school preparedness initiative that does not recognize that is doomed - if not to failure, then to unfinished business.

The school board and administration of the Berkeley, California, school district decided, not long after the Loma Prieta earthquake, to spend some money to plan and prepare thoroughly for another earthquake; however, when the decision was made, those administrators had no idea that the earthquake preparedness initiative would end up affecting, and being affected by, nearly every other pressing problem they had been dealing with. Neither did they

dream it would take as long and cost as much as it has. To their credit, the board, administration, and some dedicated parents have kept at the job they started, though it has become extremely difficult. The case study below illustrates how the plot thickened.

Wake-Up Call

In Berkeley, the Loma Prieta earthquake alerted a number of parents to how poorly prepared the school district was for a major quake. Fortunately, the October, 1989, earthquake struck after schools had discharged most of their students for the day, but the disorder caused in Berkeley by stoppages in electricity and phone service alone gave a few observant people a good idea of the chaos that would have resulted had the schools been in session. A few inquiries to individual schools in the Berkeley Unified School District (BUSD), and to the Superintendent's office, revealed that emergency plans were out of date, teachers and staff weren't trained in disaster response, alternate communications equipment was scarce and outmoded, and there were precious few first aid, water, or food supplies anywhere.

The concerned parents formed a special PTA Council sub-committee that took its concerns to the Superintendent and the School Board. After a few months of lobbying and education by the sub-committee, the School Board voted in February of 1990 to implement a comprehensive earthquake/disaster preparedness program; it approved a budget of $193,000 out of reserve monies to fund it. The Board had been persuaded that Berkeley's proximity to the Hayward fault, with its U.S. Geological Survey-assigned 45% probability for a damaging earthquake in the next 30 years, was a compelling reason to upgrade its readiness for disaster.

Comprehensive Preparedness

Among the points made by the PTA Council sub-committee was the legal wisdom and practical sense of complying with a California law in place since 1984 - the Katz Bill (California *Education Code* Section 35295, *et seq.*) - that requires school districts to plan, prepare and train staff and students for earthquake safety and response. Since no monies had ever been appropriated by the State Legislature to support school compliance with the law, few schools had found the money or time to do much. Nonetheless, the sub-committee emphasized, failure to have done anything at all would certainly increase BUSD's liability should a future damaging earthquake cause deaths or injuries in any Berkeley school. Following both the specifications of the Katz Bill and the recommendations in the 1989 *Report of the Earthquake Preparedness Task Force*, by the California State Department of Education, BUSD undertook the following tasks:

- A comprehensive, district-wide disaster preparedness plan and site-specific plans for all 19 schools and all departments.
- Training for all staff in the elements of the plans, as well as an instruction program in first aid and CPR staffed by District personnel.
- Emergency and medical supplies for all school sites, back-up communications equipment using a variety of power sources, and two day's worth of food and water at each school.
- Structural and nonstructural hazards assessments to be completed at each school.

The School Board also appointed the highly motivated parents of the PTA Council sub-committee as a special task force. Its charge was to monitor the preparedness process and BUSD's efforts; the task force worked with administrative staff advisors to make real the School Board's intent. The task force members contacted other school districts in California to determine their plans and strategies. They also consulted with the Bay Area Regional

Earthquake Preparedness Project, (BAREPP) a jointly funded FEMA/State of California project located in Oakland, for information on earthquakes and preparedness; at BAREPP, they spent hours educating themselves to the state of the art by poring over reports, sample plans, risk maps, and vulnerability assessment manuals.

In a few months, BUSD came up with a practical program that suited the community's unique needs. *The Earthquake Disaster Response Plan* was drafted by a planning consultant who had worked closely with district administrators, school principals, and other involved staff members. As stated in its introduction, the user-friendly document is:

> ...designed to provide a framework for protecting students, staff, and school facilities, as well as for organizing the response by school district staff to emergency earthquake/disaster situations...The Plan is designed to improve the ability of school district staff members to rely on themselves and each other to respond effectively without the immediate aid of government responders.

The comprehensive plan outlines the tasks of teams at each school site, the roles various departmental personnel will play in a disaster, and the running of an emergency operations center. The overall plan also lists disaster resources and provides for dispersal of resources from various departments to individual schools. The site-specific plans allow staff at each school to be relatively self-sufficient in the immediate aftermath of a disaster.

Structural Surveys

The preparedness budget also included monies for structural and nonstructural hazard surveys of all school sites. A structural survey consists of an examination of the elements that function to hold up a building - the foundation, load-bearing walls, columns and beams, and roof diaphragm. The nonstructural surveys identified that area also known as "content hazards:" book cases, file cabinets, light fixtures, ceilings, and glass windows. Such items are plentiful in schools and can be extremely dangerous when they are put in motion by an earthquake. Occupants that do not (or cannot) duck and cover during the shaking, run a very high risk of being seriously injured or killed by nonstructural items falling down, tipping over, or flying through the air.

Although public schools in California have been built to stringent seismic design codes since the Field Act was passed in 1933, some of the older buildings (typically constructed before 1976) concern the Office of the State Architect, the state agency that regulates school construction. Although the older Field Act schools were built to the standards of the day, those standards have changed over the years in light of everything engineers and architects have learned about building behavior in earthquakes. A school that met 1955 Field Act design and construction regulations might not meet the 1991 regulations; in an earthquake, the structure could fail in a way that would threaten the safety of the occupants. Especially problematic are the multi-story, non-ductile concrete frame buildings built in the 50s and 60s, but found to perform badly in earthquakes such as the 1971 San Fernando quake and subsequent damaging events.

All the BUSD structures are official Field Act schools, but legal compliance does not guarantee structural safety. The Office of the State Architect is about to begin an evaluation of "buildings currently in use as public schools that were built under outdated code provisions not allowed today." However, such a study of California schools will take years, and BUSD did not feel it could wait that long to protect its buildings, students, and employees. In light of its questionable structures - because of their ages, their type, or their locations near the Hayward fault - the School Board decided that the prudent course of action was to hire its own engineers to evaluate all the school buildings.

In so doing, BUSD has opened public discussion of what may prove to be a significant facilities issue for *all* California school districts. Though the California Seismic Safety Commission and the Office of the State Architect have been questioning the structural integrity of the older Field Act schools for some years, no school district had

actually moved *before* an earthquake to determine whether it had hazardous individual buildings. Neither had a school district requested state funds to help retrofit hazardous buildings. Berkeley is like many other small, urban districts in California: it consists of typically old school buildings, many of which are questionably safe, and has virtually no funds for making significant building improvements.

The building evaluation was begun in June of 1990 by a structural engineering firm that BUSD had used in previous facilities work. The first schools to be inspected were six that had been found to have potential structural problems in a 1978 evaluation. The engineers used the assessment framework provided in a recent publication of the Applied Technology Council, *A Handbook for the Seismic Evaluation of Existing Buildings*. Also known as "ATC 22," the book represents the state of the art in structural vulnerability analysis. The examination revealed that two elementary schools, Cragmont School and Whittier/Arts Magnet School, had structural elements that could fail in a major earthquake. Both schools are non-ductile concrete frame buildings. Cragmont, the flagship of the Berkeley fleet, was built in the 1960's very near the Hayward fault.

This report was delivered by the engineers just as a new Superintendent began her tenure and the school year commenced in the Fall of 1990. On literally her first day on the job, LaVoneia Steele was handed a problem that no one had really anticipated nor warned her about. That it was to grow even larger as the months progressed, and all the schools were structurally evaluated, would have been equally surprising to all concerned. The School Board quickly requested review of the engineering reports by the Office of the State Architect. OSA concurred with the private engineering evaluation and BUSD was advised to relocate students and plan to retrofit the two hazardous school buildings.

This gave rise to lively debates in each school's community. Parents who were concerned about their children's safety disagreed with parents who were more concerned about moving their children or breaking up classes. Teachers and staff members had similarly conflicting opinions. It was proposed that students and staff from Cragmont be relocated in November to Franklin School, a facility some distance away that had not been used for some years, but was found to be seismically safe. Franklin, however, is in "the flats" and Cragmont is in "the hills," a distinction in Berkeley which evokes memories of past disputes over integration, busing, quality and kind of instruction, and equal access. Very quickly, the discussion was complicated by numerous issues other than seismic safety.

Part of the Whittier/Arts Magnet population was relocated to portable classrooms on the school grounds in March of 1991, amid heated deliberations over the safety of the portables, both seismically and in terms of trace hazardous materials found in their walls and floors by the school district's environmental protection officer. Heavy equipment was brought onto the school grounds to prepare the site for the "bungalows" and the noise and dirt created thereby became a great source of distress and distraction. Teachers claimed that for every decibel increase in noise, there was a decreasc in student attention span.

Obviously, not one decision was simple, nor did it have to do *only* with earthquake safety. Every one was entwined with other matters: widely varying perceptions of the earthquake risk, parental concerns over both their children's safety *and* the potentially negative effects of displacement and busing, teacher commitment to quality instruction, the cumbersome processes necessitated by the involved state agencies, divergent interpretations of the engineering reports, the inevitable resistance of people and groups to change, and, certainly not least, the district's monetary constraints. However, issues of public safety and legal liability impelled the School Board to make the initial decisions about closure, relocation, and retrofit without actually knowing where the funding ultimately would be found.

Money and Logistics

The School Board recognized even before all the engineering reports were in that more than two school buildings could be found unsafe. In order to obtain financial help in what could prove to be a multi-million dollar retrofit project, BUSD applied in October of 1990 for State Allocation Board (SAB) grants to "modernize" the seismically unsafe portions of the two schools already found to be hazardous. The State Allocation Board is a state agency that oversees school facilities funding in California. The chief concerns of the SAB with respect to Berkeley's request were that funding Berkeley would set a precedent for other urban school districts in California to ask for retrofit money. It was thought to be a most inopportune time for the State of California to be setting such a precedent as it was becoming clear that the state budget deficit was approaching $13 billion. The legislators had not begun to determine how to balance, as they must, the state budget.

The District also applied to the Federal Emergency Management Agency (FEMA) for hazard mitigation grants to support the Cragmont and Whittier/Arts Magnet retrofit projects. In the counties affected by the Loma Prieta earthquake, FEMA offered matching funds to jurisdictions and to public and private sector organizations proposing hazard reduction projects. BUSD has received preliminary approval of $1.1 million in matching funds for the retrofit of Cragmont school. In making the award, FEMA cited Cragmont's risk of collapse and the fact that it functions not only as a school, but also as the focus of many community activities; additionally, it may be needed as a public shelter following a future damaging earthquake.

In February of 1991, the School District received the structural engineering reports for the rest of its school sites - and the news was not good. The engineers had identified significant structural deficiencies in six additional buildings. Three more elementary schools were found to be *potentially* hazardous, two of which are non-ductile concrete frame buildings. The non-ductile concrete cafeteria at Berkeley High School was ranked as a serious collapse hazard, and the science, shop, and swimming pool buildings were found insufficiently stable to resist major ground shaking. Buildings housing the continuation high school and the adult school were also tagged by the engineers for potential problems.

As soon as the School Board received the engineering reports, it alerted each affected school. Each site *had* established a seismic safety committee, composed of staff, parents, and the principal, to act as liaison between the School District and the community. Those committees were charged, first, with reviewing the report on their school, and then suggesting solutions to the short-term critical problem of safely housing all children and staff in seismically sound buildings. School District administrators and the engineers met with parent, union, and staff groups to answer questions about the reports and to gather information from the community about how best to proceed in each case.

This was at about the same time the district was negotiating with the teachers union over the next three-year contract. In the midst of the raise proposals and the cost of living counter-proposals, it was suggested (incorrectly) by someone that the district had taken the first $193,000 for seismic safety out of the same funding category from which teacher raises should come. The teachers threatened to walk out if they were not given a raise. In fact, they never did, but the possibility added yet another entanglement for the seismic safety proponents. Before the final agreement on a 3% raise was reached, both the original appropriation for earthquake safety was called into question, as were all subsequent expenditures.

Not too surprisingly, in April of 1991, the SAB turned down the Cragmont project on the grounds that the building is under 30 years old, and therefore not eligible under SAB policy guidelines for modernization. The SAB suggested that BUSD apply for the use of state-owned portable classrooms to accommodate the students in buildings found to be unsafe. Repair of the Whittier/Arts Magnet school building was funded as a modernization project, but usually projects in that program are not allowed to use more than 5% of total monies for *structural* rehabilitation. The total expenditure on modernizing a school building is not to exceed 75% of the building's total replacement value, and the

potential costs for Whittier/Arts Magnet could approach that cap. The SAB will make its final decision on fund availability when engineering calculations and architectural drawings are completed for the school.

Planning Ahead

As it happened, the School District was also engaged in a long-term strategic planning effort that would, it was hoped, provide a map of activities for the next ten years. Under the circumstances, a team of staff and community members was included to address the District's facilities crisis. The team was charged with determining what sort of school facilities the community would want, whether they were small, neighborhood schools or a corridor of larger schools in the central portion of the city. The primary planning assumption is that all students should be housed in seismically safe buildings, but even that premise is encumbered with other considerations. Some parent groups would prefer to have their children in the seismically questionable school buildings in their neighborhoods rather than in portables or safer school structures across town; other groups are happier to have their children out of the potentially dangerous buildings, but are not too enthusiastic about the portables.

While the strategic planners continue to define the long-term facilities goals, a small staff group in the District offices has taken all the suggestions from individual sites, factored them in with other financial and administrative constraints, and attempted to formulate them into a solution to the short-term problem of getting students and staff into safe buildings. The Superintendent will soon present to the community and the Board of Education a plan for placing people in the buildings with the least potential for structural failure, for reducing collapse hazards where economically and structurally feasible, and for relocating students into safe buildings or portable classrooms while the retrofit work is underway.

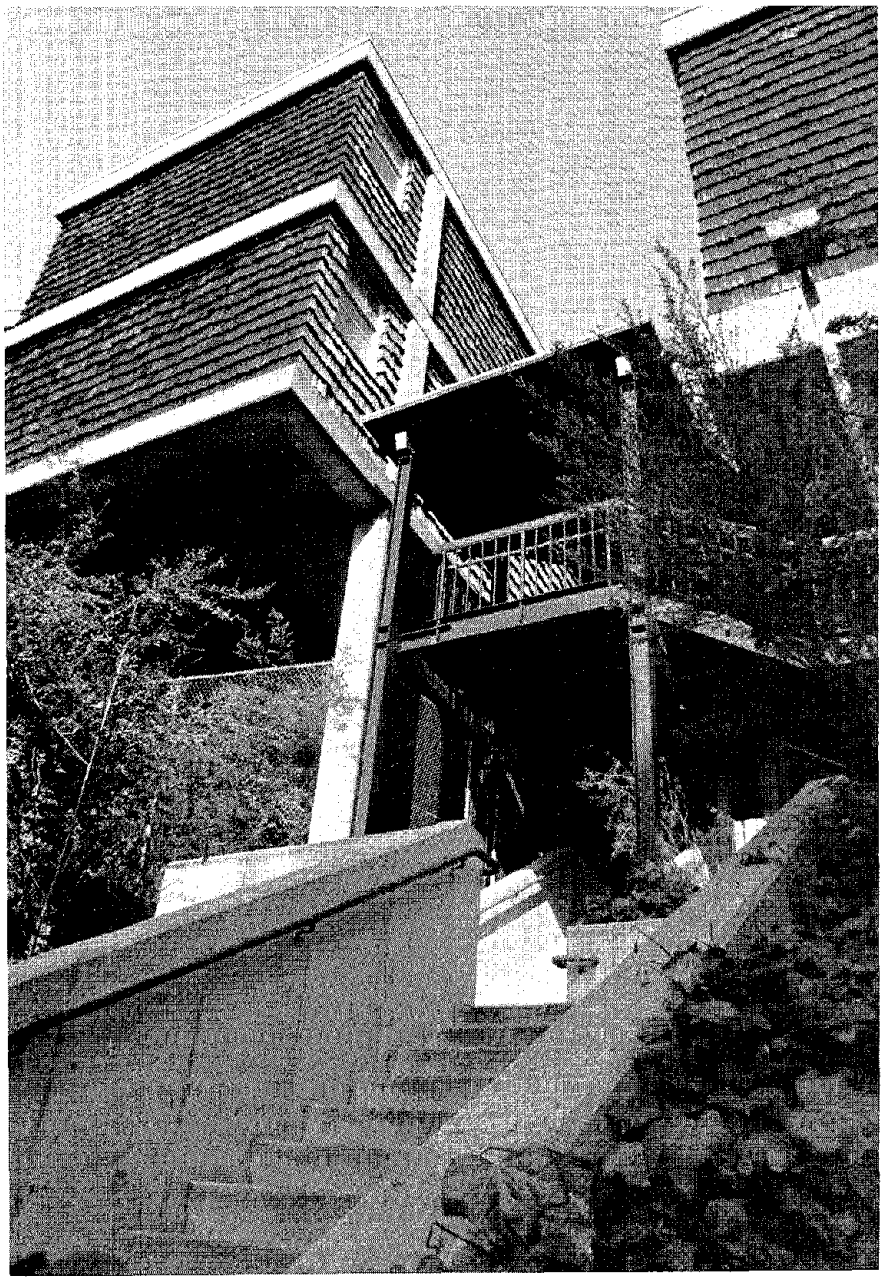
A not inconsiderable problem for the School District is paying for even student relocation costs. For further reconstruction efforts, BUSD will have to raise monies at the local level - and, as already mentioned, some voters in Berkeley are not convinced the structural upgrades are necessary. Nonetheless, some long-term financing schemes will have to be instituted to pay for facilities upgrades necessary in Berkeley's schools, only one component of which is seismic. It will be necessary to float a bond issue. One potential course of action is to offer one in 1992 for a ten-year phased reconstruction plan.

Pandora's Box

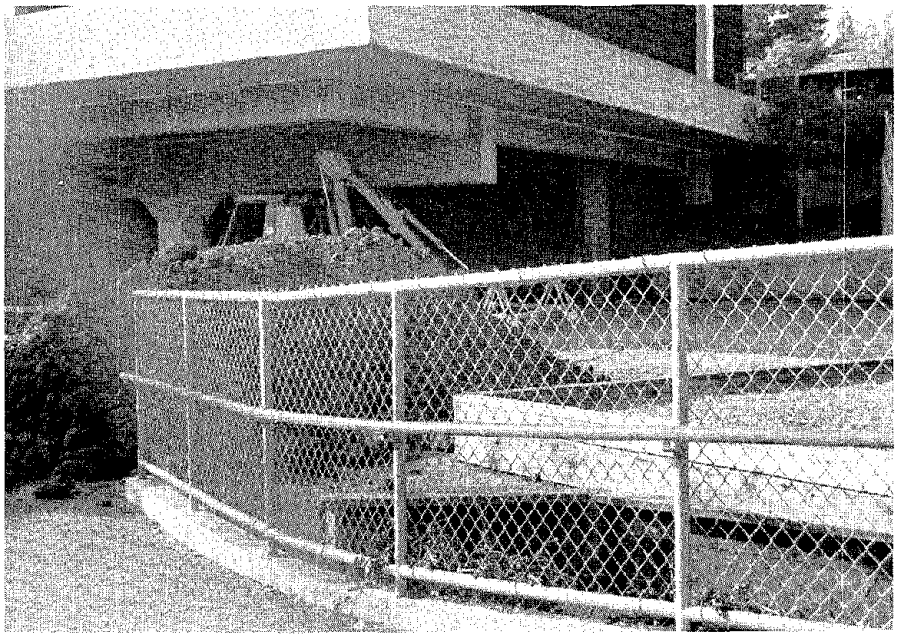
The Berkeley Unified School District has made great progress in preparing for earthquakes and reducing its hazards. In many respects it can serve as a seismic safety model to other districts and communities. The combined efforts of the parents, the teachers, the School Board, Superintendent, and District staff have been exemplary. However, many tasks remain: the fine-tuning of the plans, the continued funding of the preparedness and training aspects of the program, carry out drills and exercises, the reduction in the nonstructural hazards, the development of a disaster recovery plan, and the need to obtain and store securely supplies and equipment. Additional troubling questions remain about the use of schools as community shelters after an earthquake or other disaster. For example, can educational operations be resumed in schools that are also occupied as shelters? If not, where can the students be put?

The need to relocate students while buildings are retrofitted is another nagging problem. But the biggest imponderable, how all the structural repairs will be paid for, is in a category of its own. There was recently an article in the newsletter of the BUSD teacher's union detailing all the thorny issues that have been raised by the school district's embarking on the structural evaluations of the schools. The writer likened the current situation to that which was obtained after Pandora opened the forbidden cask and set loose all the woes and strife that bedevil humankind. What the newsletter writer forgot to mention, however, was that after all the evils had been released, Pandora looked into the cask and what remained was the faint, but pure, light of hope.

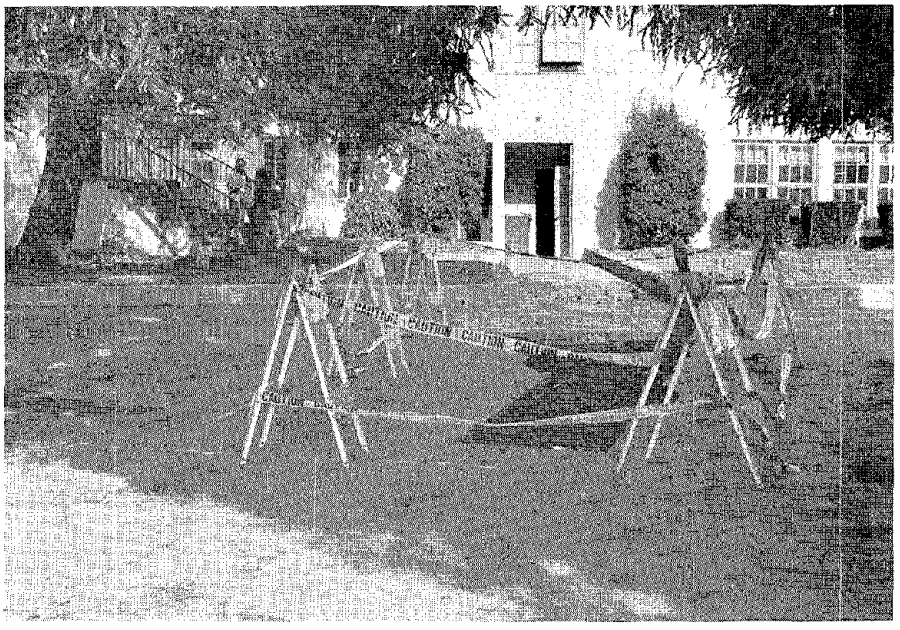
For more information about Berkeley Unified School District's approach, plans, or experiences, contact *Arrietta Chakos, Facilities Grants Liaison, Berkeley Unified School District, 2134 Martin Luther King Jr. Way, Berkeley, CA 94704-1180, (415) 526-7904.* To learn more about California school preparedness requirements and model plans, contact *Sarah K. Nathe, Resource Coordinator, Bay Area Regional Earthquake Preparedness Project, 101 8th Street, Suite 152, Oakland, CA 94607, (415) 540-2713.*



Berkeley's newest school, Cragmont, is a non-ductile concrete frame building. Features of its construction include cantilevered sections and a partial soft story.



Because Cragmont is located very near the Hayward fault, it was important to trench on the property to determine the actual location of the fault.



All school properties in the Special Studies Zone around the Hayward fault were studied in order to find out where the fault or one of its traces lies.

Section 4

Preparedness in Environments Outside the Traditional Classroom

1. Earthquake Preparedness: The School Bus Driver
   by Carole Martens, Earthquake Preparedness Consultant, Seattle, Washington

2. Impact of an Earthquake - Learning from Experience
   by Larry Parsons, Occupational Safety and Training Division Manager, University of California, Santa Barbara

3. Earthquake Hazard Mitigation for Libraries
   by Joyce B. Bagwell, Director, Earthquake Education Center, Charleston Southern University, Charleston, South Carolina

Children and their teachers do not automatically know what to do in an earthquake. In a preliminary study in which 35 students in kindergarten through sixth grade were interviewed, Ross and Shuell (1989)[8] found that only 9% gave clearly correct answers to questions about what to do in an earthquake. In another study involving 45 elementary and secondary educators,[9] almost one third noted that if you were in a skyscraper, you should make your way to the first floor during an earthquake. Eleven percent felt you should go to the basement, 23% said you should go to the storm cellar, and 5% answered you should run out of the building.

After the October, 1989 Loma Prieta earthquake, some fourth graders in a school outside of California wrote the following: "If there were an earthquake, I would go on a plane and I would go to Mexico and I would stay there until the earthquake was over and then I would go back." "If an earthquake came, I would hurry up and go to the store and get some food and go back home and go in the basement and stay there." "If there was an earthquake, I would go to the airport and get on the airplane and go to New York City and stay. I would go buy me a gun." It is apparent that we cannot assume that teachers and students know what to do in an earthquake, even under the most ideal circumstances.

[8] Ross, K.E.K., & Shuell, T.J. (1989, October). Children's beliefs about earthquakes. Paper presented at meeting of the Northeastern Educational Research Association, Ellenville, N.Y.

[9] From a paper in progress, "Investigating Teacher Knowledge of Tectonic Processes: A First Step in Assessing Implications for Earthquake Education," by Katharyn Ross and Andrea Dargush.

Section 4 - Preparedness in Environments Outside the Traditional Classroom

The educational process takes place in a variety of environments within the school. Not all of these environments would be considered the ideal location in the event of an earthquake. If the school community does not automatically know what to do in an earthquake under the most ideal circumstances, we cannot assume they will know what to do in the less ideal environments. Earthquake plans must consider appropriate action on school buses, in the school library, in the cafeteria, when classes are changing, in industrial arts, during gym, and on field trips. Earthquake drills must take place at a variety of times and in a variety of places throughout the school. As educators, we have the responsibility for providing a safe environment for students wherever they are during the school day.

Earthquake Preparedness: The School Bus Driver

by Carole Martens
Earthquake Preparedness Consultant

Introduction

A school bus driver attending an earthquake emergency training workshop in Seattle asked the question. After listening to the plentiful information available to help students, teachers, administrators, custodians, parents, and planners prepare for an earthquake emergency, she wanted to know what she should do if an earthquake occurred during bus route time. It brought to my mind that very little attention had been paid to the potential dilemma bus drivers could face if they had no clear direction on what to do in an earthquake emergency. Should they continue on their routes, return and release students already picked up, or take students to a nearby school if regular transportation routes were disrupted? Through a cooperative effort with the Seattle School District, Laidlaw Transportation Company, and the School Earthquake Safety and Education Project, among others, a two-hour training curriculum and video, plus a testing procedure was developed. Thanks to this caring Seattle school bus driver, Sheryl Everson, a need was identified and "Earthquake Preparedness: The School Bus Driver" training materials resulted. The following information can be used for school bus training in your area with little adaptation. Just substitute seismic information about your geographic area in the introductory section.

Working Lesson Plan
1990-91 School Bus Driver In-Service

INSTRUCTOR'S NAME _____

TITLE OF LESSON Earthquake Preparedness

OBJECTIVES:

The driver will be able to:

1. Demonstrate to students the proper "Earthquake Position."
2. Describe the three steps to be taken when the shaking starts.
3. Describe the proper procedures to follow when taking students to school when an earthquake occurs.
4. Describe the proper procedures to follow when taking students home from school when an earthquake occurs.

EQUIPMENT LIST:

Overhead projector
Screen
TV Monitor
VCR - VHS Format
Videotape: "Earthquake Preparedness - The School Bus Driver"
Handouts/Transparencies

Earthquake Preparedness

I. Introduction

II. Prior to an earthquake

- A. Develop a plan
- B. Inform/prepare student passengers

III. What to do when the shaking starts

- A. Inform the students
- B. Stop the bus
- C. Secure the bus

IV. What to do when the shaking stops

- A. Check the bus and immediate area
- B. Decision time
- C. Procedures to follow when transporting students to school
- D. Procedures to follow when transporting students home from school
- E. Radio procedure
- F. Aftershocks

V. Conclusions

VI. Video Tape - **"Earthquake Preparedness - The School Bus Driver"**

VII. Acknowledgments

VIII. Samples of Report Forms

Introduction

Washington is earthquake country!

Washington has a history of large earthquakes; and earthquakes tend to recur where they have occurred in the past. It is not a question of "if" Washington will have large earthquakes, but one of "When, Where, and How Big" they will be. Advance planning can eliminate some of the fear as well as the danger experienced in major earthquakes.

During, and after a major earthquake, the school bus driver will be one of the most instrumental staff members in restoring order. It will be imperative that the school bus driver be prepared and remain cool, calm, and collected.

Instructor Note: At this time, administer a "Number Game." This consists of a piece of paper on which there are a variety of numbers scattered about (1-60). See pages 4-15 and 4-16.

As you can see, it is much easier to play the game when you have a plan. We know another major earthquake will occur in Washington State. It is extremely important that all school bus drivers have a plan. They must be familiar with their route, plan ahead, and know in their own minds what they will do when a major disaster strikes. If your school district does not currently have an earthquake or disaster plan, work with your district administration to develop one.

It must be kept in mind however, that no matter how school districts try to plan for all eventualities and provide the proper instructions, the bottom line is always that the driver must use his/her own good judgment.

Prior to an Earthquake

A. Develop a plan

1. If your school district does not already have an earthquake/disaster plan in place, work with your administration to develop one.

2. If the bus driver does not have a home/family preparedness plan in place, he/she should develop one to assure the driver's peace of mind about their own family.

B. Inform/prepare student passengers

Student passengers should be instructed on ways to protect themselves. If they are on the bus when an earthquake occurs, they should be instructed to assume the "Earthquake Position." That is:

- Grasp the seatback on the seat ahead of them with their hands.
- Put their head between their arms.
- Protect their head and neck as well as possible.

Note: Those passengers that are seated at outboard seating positions, (next to the windows), should turn their faces slightly inboard (towards the aisle), to protect their faces.

It is strongly recommended that earthquake instruction be given to all students along with emergency evacuation instruction and drills.

When the shaking starts

A. Inform the students

Tell the students "We are having an earthquake" and to assume the earthquake position!

B. Stop the bus

If possible, pull the bus to the side of the road and stop in a location that is clear of:

- Tall buildings
- Power lines
- Bridges, or under/overpasses
- Base or summit of ridge, ravine, or hillside

C. Secure the bus

- Put the transmission in neutral, (park, if so equipped), and set the brake
- Turn off the ignition
- Remove the ignition key and place in your pocket

When the shaking stops

A. Check the bus and immediate area

- Keep the door closed and students in the bus
- Check for injuries and administer first aid as needed
- From inside the bus, survey the immediate area for downed power lines, cracks in the roadway or any other potential hazard

B. Decision time

After students have been taken care of, and the immediate area surrounding the bus surveyed for any unsafe conditions, the driver must decide whether to continue on route or seek assistance. Part of this decision will be based on whether the bus is taking students to school or home from school.

C. Procedures to follow when transporting students to school

If at all possible, complete your route and deliver the students to their school. Unless you receive instructions from a school official or your supervisor, students are not to be returned to their bus stops or homes. Parents have an expectation that once students are placed on a bus, they will be delivered to school. We cannot independently choose to return the students to their bus stops without first assuring their safety.

If you are in the process of completing your bus route, drive by the remaining bus stops and pick up any students who might be waiting there. One important consideration in this decision is the condition of the roadway. The driver must be keenly aware of the roads he/she is traveling and the damage an earthquake could have done to a bridge or overpass. If the earthquake was severe, drivers should avoid traveling across any supporting structures until they have been officially cleared for passage. If continuing on a route does not appear feasible under given circumstances, the driver should proceed to the nearest safe school district building and report to the school administrator. If it is not possible to reach a school district building, another safe public building, such as a library or fire station, should be selected.

D. Procedures to follow when delivering students home from school

After the earthquake has subsided and the driver has made his/her checks on the students and vicinity around the bus, he/she should proceed.

If roads appear passable and there is no major damage visible, proceed on route taking the same precautions when passing supporting structures as in going to school. However, depending on the age of the students, drivers should consider their emotional stability as they let them off the bus. Students who appear emotionally upset are to be kept on the bus until the entire route is completed. In addition, drivers should consider the distance the students' residence is from the bus stop. If the driver suspects it may not be safe for the students, they should be kept on the bus. The dispatcher or supervisor should then be contacted for further instructions. If conditions make it imprudent to continue the route, drivers are to proceed to the nearest safe school district building with their students and report to the school administrator for further instructions. If it is not possible to reach a school district building, another safe public building, such as a library or fire station, should be selected. Students should only be released where there is competent, adult supervision.

E. Communications procedure

1. Use the two-way radio only in the case of extreme emergency.

2. If your bus is not equipped with a two-way radio, tune AM/FM radio to local station.

3. Expect that telephone circuits will be overloaded and inoperable.

F. Aftershocks

Drivers should not wait to see if there are going to be any aftershocks. They should proceed, when it is safe to do so, and treat any aftershocks as separate earthquakes.

Conclusion

You can't do anything to stop earthquakes, but you *can have a preparedness plan.*

As a driver, know what to do:

Before the Ground Shaking:

- You and your district, develop a plan.
- Involve and inform the parents.

During the Ground Shaking:

- Continue forward until you are off bridges and overpasses, if possible.
- Stop your bus away from tall buildings, underpasses, and power lines, if possible.
- Turn off engine, set brake, and put key in pocket.
- Tell your students, "It's an earthquake. Protect your head and hold on to the seat in front."

After the Ground Shaking:

- Reassure the students. Tell them you and the school district have a plan in place to take care of them.
- Check for injuries. Administer first aid.
- From inside the bus, check for downed power lines. Assume all lines are live.
- Check to see whether streets are passable before deciding to continue.
- Avoid crossing bridges and overpasses until they have been inspected and their safety assured.

More information about the videotape

Earthquake Preparedness: The School Bus Driver

Length: 16:44 minutes

Target Group: School bus drivers, school district administrators

Goal: To provide an earthquake preparedness training program

Impetus: Ms. Sheryl Everson, Seattle School District school bus driver with Laidlaw Transit, Incorporated

Developers: Video, training curriculum, and exit drill materials by:

Seattle School District Support Services
Laidlaw Transit, Incorporated
EBI O'Ryan (a private enterprise)
American Motion Pictures Company
School Earthquake Safety and Education Project

Program: Videotape of earthquake preparedness presentation targeted for school bus drivers. Provides information on earthquake zones, typical earthquake damage and goes through a scenario of a morning school-bus route earthquake disaster. Ends with recommendations for appropriate actions. A packet including a two-hour, in-service training lesson plan, driver exit drill procedures, and a one-sheet information flyer for drivers is available.

Ordering: Video:

American Motion Pictures Company
2247 15th Avenue West
Seattle, WA 98119
(206) 282-1776

Cost: $20 including tax and shipping

Lesson Plan Packet available from:

Carole Martens, Earthquake Preparedness Consultant
8035 42nd Avenue, NE
Seattle, WA 98115
(206) 524-4921

Cost: Free of charge
Request any comments or revisions by recipients be shared with sender

Acknowledgments

This material was developed in cooperation with:

Washington State Department of Community Development, Division of Emergency Management
Seattle School District Support Services
Laidlaw Transit Inc., Seattle
School Bus Driver Training Planning Committee, SPI

First Semester Emergency Exit Drills
(Special Services)

1. Emergency Exit Drills are to be conducted on (fill in appropriate dates).

2. All drills are to be conducted in the school load zone upon arrival at the school in the morning. If you service more than one school, conduct one drill for all students at the first school you arrive at in the morning.

3. School officials are aware of the drills and have been requested to provide assistance.

4. The evacuation portion of the drill is to be via the front service door of the bus and NOT THROUGH THE SIDE OR REAR EMERGENCY EXIT DOORS.

5. Instruct the students of the exact procedures to safely and quickly exit from the bus. Those Special Program students who cannot participate in the actual exit drills due to their handicap or age shall only receive verbal instructions.

6. Demonstrate the items below and check them off. Complete all the spaces. Return this form to dispatch following the morning run.

Check List for Driver

	TRIP #1 RT#_____	TRIP #2 RT#_____
1. Instruction on opening exit doors.	_____	_____
2. Exit Procedures (assembly point after disembarking from bus).	_____	_____
3. Instruction on removal of first aid kit.	_____	_____
4. Instruction on removal of and handling fire extinguisher.	_____	_____
5. Instruction on setting out road reflectors.	_____	_____
6. Instruction on seeking emergency help.	_____	_____
7. Wheelchair evacuation with Bus Supervisor's assistance if applicable.	_____	_____
8. Instruction regarding motor shut off, setting hand brake and spring brake (maxi), removing ignition keys.	_____	_____
9. Instruction on earthquake procedures.	_____	_____
10. Number of students.	_____	_____
11. A) Actual evacuation time (if applicable)	_____	_____
B) Exit Drills not complete due to limited student's abilities.	_____	_____

CONTROL #_____ SCHOOL TRIP #1_____ SCHOOL TRIP #2_____

DRIVER: _____ DATE: _____

C:EEDSS

First Semester's Emergency Exit Drills

1. Emergency Exit Drills are to be conducted on (fill in appropriate dates).

2. All drills are to be conducted in the school load zone upon arrival at the school in the morning. If you service more than one school, conduct one drill for all students at the first school you arrive at in the morning.

3. School officials are aware of the drills and have been requested to provide assistance.

4. The evacuation portion of the drill is to be via the front service door of the bus and NOT THROUGH THE SIDE OR REAR EMERGENCY DOORS.

5. Instruct the students of the exact procedure to safely and quickly exit from the bus. Point out that students seated nearest to the exit to be used are to exit first and assemble all of those on the bus at a certain sport designated by the driver. Be very specific that no one is to push or shove and that they must not jump from the stairs.

6. Demonstrate the items below and check them off. Complete all the spaces. Return this form to dispatch following the morning run.

	TRIP #1 RT #_____	TRIP #2 RT #_____
DEMONSTRATE:		
1. Instruction on earthquake procedures.	_____	_____
2. Setting parking brake or Maxi, putting in gear.	_____	_____
3. Turning off ignition and lights, removing key.	_____	_____
4. Location and use of Fire Extinguisher.	_____	_____
5. Location of First Aid Kit and Reflectors.	_____	_____
6. Instruct students how get emergency help.	_____	_____
7. Demonstrate how to open all emergency exits.	_____	_____
8. Explain which windows will push out and tell how.	_____	_____
9. Explain assembly point and preventing injury.	_____	_____
10. Actual evacuation time (minutes and seconds).	_____	_____
11. Number of students.	_____	_____

ALL STUDENTS ARE TO BE INSTRUCTED TO THE EXTENT OF THEIR ABILITY TO UNDERSTAND AND PARTICIPATE IN THE DRILL. IF YOUR STUDENTS ARE UNABLE TO PARTICIPATE, PLEASE INDICATE WHY:

_____

_____

_____

CONTROL #_____ SCHOOL TRIP #1 _____ SCHOOL TRIP #2_____

DRIVER:_____ DATE: _____

C:EEDL

_____

Emergency Exit Drill

BUS RUN_____

In the compliance with WAC 392-145-040, METRO will conduct an emergency drill on _____. All students riding AM trips on route number 700 through 865 will be instructed by the operator on the points listed below. The drills will be held at the school loading zones. Caution: Operators will show the location and how to use only. DO NOT OPEN emergency escape hatches on Flyer coaches or emergency windows on 700 type coaches. DO NOT break emergency glass on rear door. If a route services two schools, perform the drill at the first school load zone.

Check List for Bus Drivers

Check Items As They Are Covered:

	TRIP #1 RT#_____	TRIP #2 RT#_____
1. Instruction on earthquake procedures.	_____	_____
2. Instruct students on how to shut off motor.	_____	_____
3. Instruct students on how to set parking brake.	_____	_____
4. Instruct students on location of fire extinguisher.	_____	_____
5. Instruct students on getting emergency help (radio).	_____	_____
6. Instruct students on how to open and the procedure to exit through emergency exit, windows, doors and hatches. (See CAUTION above.)	_____	_____
7. Evacuation time (in minutes and seconds) using both doors.	_____	_____
8. Number of students instructed:	_____	_____

ALL STUDENTS WILL BE INSTRUCTED TO THE EXTENT OF THEIR ABILITY TO UNDERSTAND AND PARTICIPATE IN EXIT DRILLS. IF IT IS UNFEASIBLE TO CONDUCT EXIT DRILLS OR THE INSTRUCTIONAL ALTERNATIVE, IT WILL BE NOTED ON THIS FORM.

RETURN THE COMPLETED FORM TO YOUR BASE DISPATCHER

C:EEDM

Numbers Game Instructions

Each participant is given two copies of the Numbers Game sheets, to be placed face down until instructions are given.

Instruct participants that at the given signal, they are to turn over one Numbers Game sheet and begin circling the numbers in order: 1, 2, 3, etc. Give them twenty or thirty seconds to do so.

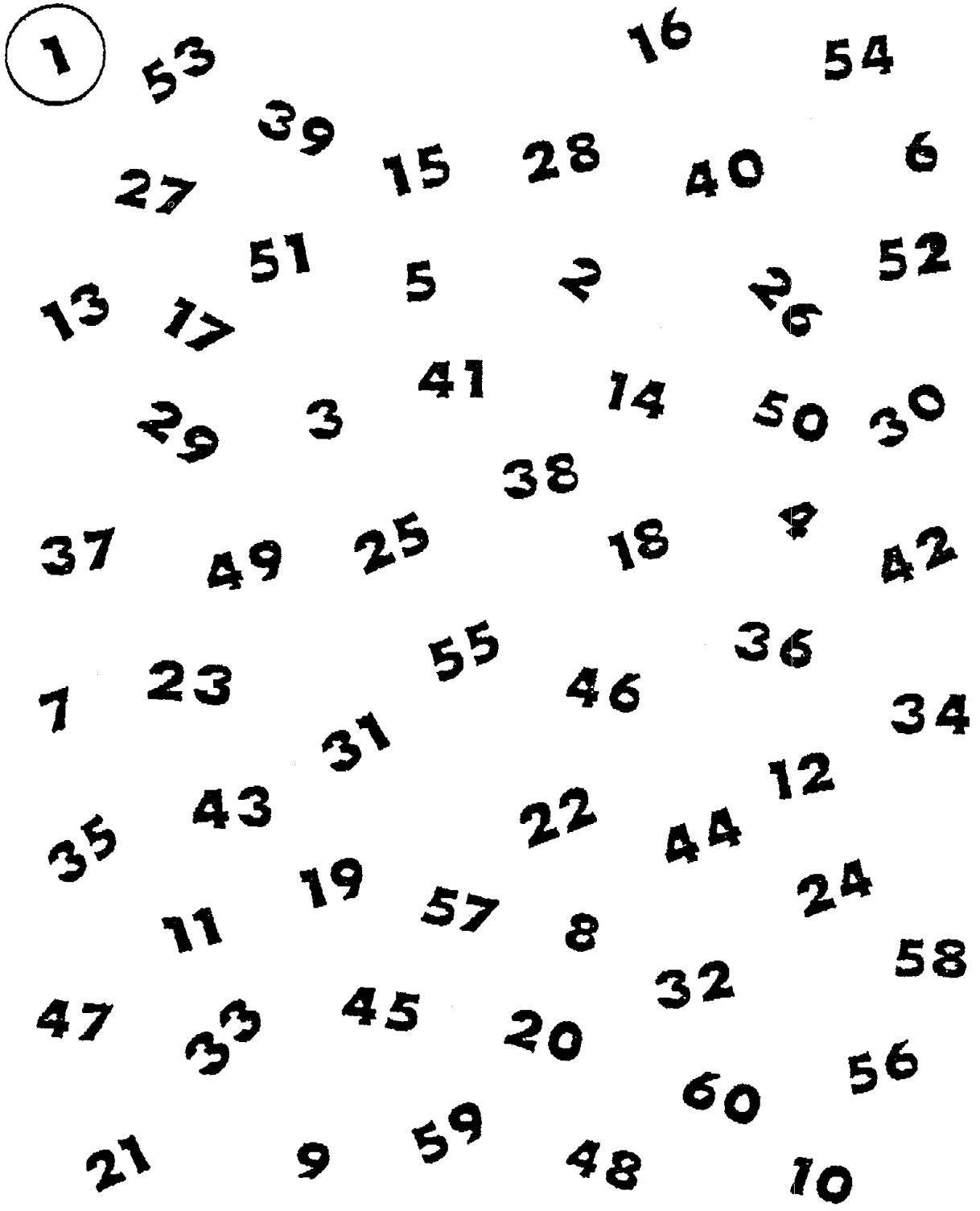
At the end of that time, ask who got the most numbers circled.

Then instruct them to fold the second paper in half from top to bottom and fold in half again from side to side. Point out to them that all of the numbers on the left side of the paper (when opened up) are uneven numbers and all of the numbers on the right side of the paper are even numbers.

Further, in the upper left hand portion, the numbers are 1, 3, 5
in the upper right hand portion, the numbers are 2, 4, 6
in the lower left hand portion, the numbers are 7, 9, 11
in the lower right hand portion the numbers are 8, 10, 12
in the upper left hand corner, the numbers continue with 13, 15, 17
and so forth

After the explanation, have students go through the exercise again. You will find that they will get many more numbers circled after they have received proper instruction and information. Make sure you emphasize that it was much easier to play the game when there was a plan. It will also be easier to respond appropriately in an earthquake if there is a plan.

THE NUMBERS GAME



Impact of an Earthquake - Learning from Experience

by Larry Parsons
Occupational Safety and Training Division Manager
University of California, Santa Barbara

My interest in seismic safety is based on personal experience with earthquakes which have effected schools in California from 1978 to the present. The majority of information is based on the Santa Barbara Earthquake of 1978, and its effect on the University of California at Santa Barbara. Since the 1978 earthquake, I have also studied the Whittier/Narrows Earthquake in 1987 and its effects on the California State University in Los Angeles, and the 1989 Loma Prieta Earthquake and its effects on the University of California at Santa Cruz.

There are many things that can be done before an earthquake occurs that will reduce the chances of injury and property damage. It sounds simple enough. We had heard these words spoken over and over again, but unfortunately, in most cases, one must experience a disaster before the meaning sets in and action occurs. Earthquake preparation takes time, money and most of all, commitment. With tighter budgets and competing demands for the dollars spent in education, it will take a strong commitment on the part of school administrators to accomplish the goals of earthquake preparedness.

The University of California at Santa Barbara is located on the coast of California, approximately 100 miles north of Los Angeles, and has a population of 25,000 students, faculty and staff. Prior to the 1978 earthquake, the major buildings on campus were evaluated structurally for seismic integrity and rated from very poor to good. Although all of the buildings were built according to the Uniform Building Code in effect at the time of construction, two buildings were rated very poor, eight buildings were rated poor, and 37 buildings were rated fair to good. These ratings were based on brief observations of blueprints, a cursory look at the exterior of most buildings, and a judgmental opinion regarding the seismic performance of each building.

In 1978, I was working as a Safety Engineer in the Office of Environmental Health and Safety at the University of California in Santa Barbara. As a member of the safety staff, I was directly involved in the documentation and evaluation of the damage resulting from the 1978 earthquake.

The earthquake occurred on August 13, 1978, a Sunday afternoon, at 3:57 p.m. The Richter magnitude was 5.7 and the shaking lasted approximately 20 seconds. The timing of the earthquake was fortunate. Since school was not in session, very few people were on campus. Most offices were closed and the campus was virtually deserted. There were no serious injuries to anyone on campus, but the overall structural damage amounted to more than four million dollars. There is no doubt that had the University been in session at the time of the quake, numerous injuries and possible fatalities would have occurred.

The earthquake caused the derailment of a train north of the campus, damaged the main roadway overpass to the campus, and started a fire in a mobile home park. This left only the on-campus county fire engine to respond to emergencies on campus. As a result of the shaking, several fire alarms and security alarms went off immediately. The electrical power surged on and off and then went off for several hours. Major non-structural damage occurred throughout the campus. The following is a summary of the damage:

1. An eight inch water main broke.
2. Chemicals were thrown off of shelves in science buildings.
3. Compressed gas cylinders broke away from their supports.
4. Several research monkeys and rats were set free.
5. Light fixtures came loose and fell to the floor.
6. Ceiling tiles, and in some areas, entire suspended ceilings, collapsed.
7. Over 500 bookcases and vertical files fell over.
8. Plumbing leaks were numerous.
9. Windows shattered throughout campus.
10. Eighteen elevators were damaged.
11. Roads, walkways and bikeways were cracked.
12. Card catalogs in the library flipped over.
13. Heavy glass doors came off their hinges.
14. Several office doors were blocked by falling bookcases.
15. Television sets fell to the floor in the Student Health Center.
16. Tiles fell from the roofs of the buildings.
17. Ventilation systems and cooling systems on the roofs of many buildings were severely damaged.
18. Moderate structural damage occurred including cracked shear walls.
19. Seismic joints were damaged.
20. More than 280,000 books fell from library shelves.

The damage that occurred at Santa Barbara was, in varying degrees, similar to what I observed in Los Angeles in 1987 and Santa Cruz in 1989. Much of the non-structural damage, which is common in moderate to severe earthquakes, could have been reduced and in some cases eliminated with a very small expenditure of time and money.

After the 1978 earthquake, the University adopted a policy for Seismic Hazard Reduction that requires the securing of bookcases and cabinets over 42 inches in height (attachment 1). The Southern California Earthquake Preparedness Project (SCEPP) has developed a *Check List of Non-Structural Earthquake Hazards* which has been useful in providing guidelines for identifying non-structural hazards.

Other lessons learned were:

1. While it is important to evaluate the structural integrity of school buildings according to the latest information available, the buildings should not be given a verbal rating such as poor or satisfactory, but should be prioritized for seismic correction based on a review of their predicted performance in a creditable earthquake.
2. Administrative support and involvement from the highest level is necessary to create an effective seismic program.
3. Non-structural damage can be significantly reduced by simple attachments and code compliance.
4. An Emergency Operations Plan stressing lines of communication should be written in a simple checklist format.
5. All planning should include coordination with local emergency response organizations such as police and fire departments and the local Red Cross.
6. Mutual aid agreements should be clear and in writing.
7. Control of information is critical, especially to the news media. Accuracy is essential and rumors and speculation should be avoided.
8. A policy on the retention of students in elementary schools is a mandatory part of disaster planning and should be thoroughly communicated to parents.

9. Staff and faculty should be aware of their responsibilities as State Disaster Service Workers in a declared emergency.
10. A system of identification of critical personnel, such as a picture I.D. card, should be developed.

The written word for CRISIS in Chinese combines two characters, one signaling danger and the other opportunity. We are fortunate to have the opportunity to learn from recent seismic events. It now takes a personal commitment from all of us to put this experience into actions that will reduce the suffering in the next disaster.

References

Degenkolb Associates. (1981). Seismic Hazard Survey University of California Buildings.

Steinmetz, W. H. (1979). Earthquake! How One Campus Survived. Risk Management.

Felszeghy, S. F., & Miller, R. K. Engineering Features of the Santa Barbara Earthquake of August 13, 1978.

For additional information, please contact me at (805) 893-2040 or write to Larry Parsons, P.O. Box 14583, Santa Barbara, CA 93107.

Attachment 1

Policy P-5512
February 1, 1985

POLICY ON SEISMIC HAZARD REDUCTION

I. REFERENCES:

University Policy Regarding Seismic Hazards, adopted 1975.

II. POLICY:

Earthquakes are a source of continued concern on the University of California, Santa Barbara Campus. It is the policy of the University, to the maximum extent feasible by present engineering practices and funding, to provide reasonable levels of earthquake safety for its faculty, students, staff, and public. This policy includes the following program for abatement of immediate seismic hazards:

A. All appurtenances such as bookcases over 42 inches in height, wall cabinets, display cabinets, lockers, heavy and large laboratory equipment, and compressed gas cylinders shall be fastened to wall or floor in a manner to preclude their falling over in a moderate earthquake.

B. All lockers, cabinets, or any other fixtures permitted in corridors by the Fire Marshal must be firmly attached to prohibit their falling or breaking.

C. Shelving containing bottles of chemicals must have seismic retaining strips or devices installed.

D. Storage of large, heavy items must be maintained as low as possible. Heavy items that must be maintained at a level above 42 inches must be attached or restricted in such a manner as to preclude their falling in a moderate earthquake.

E. All campus personnel shall have earthquake emergency training conducted periodically within their departments.

F. Overall responsibility for compliance and funding of this policy rests with department chairpersons and department heads. The Office of Environmental Health and Safety will act in an advisory capacity and assist as required.

Robert A. Huttenback
Chancellor

Earthquake Hazard Mitigation for Libraries

by Joyce B. Bagwell
Director, Earthquake Education Center
Charleston Southern University

Introduction

Librarians within the Charleston, South Carolina region expressed concern that library faculty, and staff of the colleges, universities and local libraries, were not aware of what they could do to reduce the risk of being hurt during an earthquake. The question of what measures could be taken to mitigate earthquake damage within libraries and at home prompted the Staff Development Committee of the Charleston Academic Library Consortium to request a workshop outlining earthquake preparedness strategies.

The material presented here was designed to assist librarians in the development and modification of an earthquake safety program for their individual institutions and homes. However, it can only be useful if each reader implements an earthquake preparedness plan in his/her institution.

As a personal reflection, I have found that the most important factor in the ultimate success of undertaking an earthquake preparedness plan is not the amount of money spent, but rather, the amount of interest and enthusiasm for achieving a well developed program. Experts in emergency management advocate spending wisely and purchasing the items that serve the greatest need. Travel the road of least resistance, and learn from the mistakes that others have made.

We Live In South Carolina - Why Should We Be Concerned?

On August 31, 1886, South Carolina was shaken by an earthquake of intensity X that heavily damaged the low country (Bollinger, 1972, 1977, 1983; Dutton, 1987; Talwani, 1982; Tarr, 1977; Shedlock, 1987, 1988). The aftershocks of this damaging earthquake continued for a period of years (Seeber & Armbruster, 1987). From 1754 to 1970, 438 earthquakes occurred in South Carolina. Of those, 402 occurred in lower South Carolina (Bollinger, 1977). Since 1973, there have been over 150 earthquakes in South Carolina, with more than half of these being felt in the low country. On November 22, 1974, an earthquake of magnitude 3.8 (first estimated to be 4.5) shook the Charleston-Summerville area and was felt as far away as Columbia and Aiken, South Carolina (Benson, Stanford, & Fogle, 1975; Talwani, 1977). Residents were frightened and reported some damage, i.e., cracked chimneys, plaster, steps, etc. In April 1975, a tremor of 2.5 occurred in Summerville. There was no damage, but the earthquake was felt by many (Talwani, 1977).

In 1976, the U.S. Geological Survey (USGS) set up a seismic monitoring network at the Baptist College at Charleston (renamed Charleston Southern University (CSU), November 13, 1990). The institution is located within the meizoseismal zone of the Charleston 1886 earthquake. The seismic stations were placed in an eight mile radius around the Middleton Place area. The area had the highest intensity during the 1886 Charleston and November 22, 1974 events. Presently, in Lower South Carolina, a seven station network of 15 channels is monitored at Charleston Southern University. Since the 1976 installations, the public has become aware of the seismic network, particularly because of the felt earthquakes of magnitude 2.0 to 3.3 in the South Carolina low country (Shedlock, 1988). Area residents call the news media and the Earthquake Center at CSU to confirm that the shaking they felt was indeed an earthquake, and if so, what size, or was this shaking the result of a sonic boom or chemical explosion?

Every year since 1977, the South Carolina Low Country Seismic Network has recorded local earthquakes as well as earthquakes from all over the globe. The seismic network at Charleston Southern University has recorded 35 earthquakes located between Middleton Place and Summerville from January 7, 1990, to November 23, 1991. Thirteen of these events were felt. CSU is responsible for monitoring the seismic equipment, collecting data, conducting intensity surveys, and supplying the USGS with accurate daily records of recorded earthquakes on the master helicorder at CSU.

The Earthquake Education Center began in 1983 as a pilot program funded by the Federal Emergency Management Agency (FEMA) to develop an earthquake education program on how to prepare for an earthquake for the public and specific target audiences, thus reducing the loss of life should a damaging earthquake occur. The threat of earthquakes in South Carolina and the southeastern U.S. is realistic, the preparedness level for such an event is not. The CSU Earthquake Education Center responds to this threat however, by working with the South Carolina Emergency Preparedness Division (SCEPD) to maintain earthquake education programs to help an area that is prone to earthquakes become a better prepared populace.

A logical question that the public might raise is, "Where is the fault?" No one knows where the fault in Lower South Carolina lies; therefore, the hazard is spread over a large area (Hays & Gori, 1983; Stewart & Rhea, 1986). Current research is focused on determining where the fault is located. The purpose of establishing the Earthquake Education Center is to enhance the public's knowledge of what to do in case of an earthquake and aid target audiences in mitigating earthquake preparedness plans.

Earthquake Safety Planning Strategies

In preparing earthquake safety plans, the first step is to examine the emergency plan in place for other hazards, then determine the need required to integrate safety procedures specifically for earthquakes. This should be an appendix of the facility's overall comprehensive emergency plan. In many communities, emergency response plans are prepared on the assumption that institutions will look after themselves (FEMA, 1990). In planning, develop a support network among the members of your facility, then utilize the following personnel to provide you with input. The resources listed below can be vital to your own support network. Don't hesitate to call on them for information and advice (FEMA, 1990).

In many communities, emergency response plans are prepared on the assumption that schools will look after themselves. In these same communities, school plans are generally developed on the assumption that essential services and emergency assistance will be provided by community agencies (FEMA, 1990).

Planning strategies should assume that water, gas, electricity, food supplies, communication systems, and transportation systems will not remain available and operative (FEMA, 1990). From the recent experiences of Hurricane Hugo, one hospital in Charleston, South Carolina had planned on the availability of back up generators. Unfortunately, these generators were dependent upon the City of Charleston water supply for the coolant. When the City's water supply failed, the generators ran hot without the water coolant and became inoperable (Dr. James B. Edwards, President of the Medical University of South Carolina, personal communication, January 23, 1992).

Little effective attention has been given to the necessity for self-sufficiency and the state of isolation that could realistically confront any facility after a major earthquake. Good communication procedures among the various buildings on a campus and communication among the lifelines within the community are important.

Don't hesitate to call on some experts for more information and advice. Eventually, you'll have your own support network, which might include:

- Local emergency services officials (e.g., fire, police, city emergency managers);
- Community American Red Cross chapter representatives;
- Experts on geology, structural engineering, and architecture at your local college or university or in private practice;
- School district and/or city building inspectors;
- Members of local environmental groups, civic organizations, and retirement associations;
- Community/neighborhood representatives with special skills (e.g., ham radio operators, building engineers, doctors, nurses, and medical paraprofessionals); and
- Safety experts in business and industry.

Making Your Plan: Hazard Identification

The first step in making earthquake safety plans would be to designate an earthquake safety committee, secure information from the proper authorities within your facility, and carry the following checklist with you to the first committee meeting. The checklist should stimulate ideas of which issues should be addressed first and who will be responsible for carrying out the task. Have available planning guideline resources that organizations such as the Federal Emergency Management Agency (FEMA), American Red Cross, Southern California Earthquake Preparedness Project (SCEPP), Bay Area Regional Earthquake Preparedness Project (BAREPP), and National Center for Earthquake Engineering Research (NCEER) can provide for you. The Earthquake Education Center at Charleston Southern University can also provide you with information. The resources will only give you a guide. The members of your committee should modify the outline to meet the specific needs of your institution. The following pages provide a step by step checklist. Take one step at a time.

Conclusion

The damage to California libraries during earthquakes in the 1970's and 1980's and the necessity of a raised level of awareness about emergency plans concerned the members of the Charleston Library Consortium. They wanted an earthquake preparedness plan to be more than a book that takes up shelf space in libraries. In the workshop for the Charleston Library Consortium, the participants became involved in working on checklists of actions that could be taken to reduce the risks for librarians, students, and others being hurt during an earthquake. The hands-on activities which explained the cause and effects of earthquakes enhanced their interest in earthquake preparedness not only for the library, but for their homes and families as well.

Should you decide to have a workshop for librarians, the sample agenda could be used a guide. Historical and recent earthquake information for your specific area could be substituted for South Carolina information.

References

Benson, A. F., Stanford, C.F., & Fogle, G. H. (1975). Intensity survey of Charleston, South Carolina earthquake November 22, 1974, Earthquake Notes, 46, 15-26.

Bollinger, G. A. (1972). Historical and recent seismic activity in South Carolina. Bulletin of the Seismological Society of America, 62, 851-854.

Bollinger, G. A. (1977). Reinterpretation of the intensity data for the 1886 Charleston, South Carolina earthquake, In Rankin, D.W. (Ed.). Studies related to the Charleston, South Carolina earthquake of 1886 - A preliminary report. (U.S. Geological Survey Professional Paper 1028, 17-32). Washington, D.C.: U.S. Government Printing Office.

Bollinger, G. A. (1983). Speculations on the nature of seismicity at Charleston, South Carolina. In G. S. Gohn (Ed.), Studies Related to the Charleston, South Carolina Earthquake of 1886 - Tectonics and Seismicity. (U.S. Geological Survey Professional Paper 1313, T1-T11). Washington, D.C.: U.S. Government Printing Office.

Dutton, C.E. (1889). The Charleston earthquake of August 31, 1886. U.S. Geological Survey Ninth Annual Report, 1887-88, 203-528.

FEMA, (1990). Guidebook for developing a school earthquake safety program. Washington, D.C.: Federal Emergency Management Agency.

Hays, W., & Gori, P. (Eds.). (1983). The 1886 Charleston, South Carolina earthquake and its implications for today. Proceedings of Conference XX. Reston, VA: U.S. Geological Survey.

Seeber, L., & Armbruster, J. G. (1987). The 1886-1889 aftershocks of the Charleston, South Carolina, earthquake: A widespread burst of seismicity. Journal of Geophysical Research, 92, (B3), 2663-2696.

Shedlock, K. M. (1987). South Carolina earthquakes. U.S. Geological Survey Open-file Report 87-437, 1-17 Reston, VA.

Shedlock, K. M. (1988). Seismicity in South Carolina. Seismological Research Letters. 59(4), 165-171.

Stewart, R., & Rhea, S. (1983). Scientific contributions and future uses of seismic networks in the Charleston, South Carolina area. In W. W. Hays & P. L. Gori (Eds.), Proceedings of Conference XX: A Workshop on "The 1886 Charleston, South Carolina Earthquake and its Implications for Today." U.S. Geological Survey Open-File Report 221-23.

Talwani, P. (1977). An intensity of the April 28, 1975 Summerville, South Carolina earthquake. Bulletin of the Seismological Society of America. 67 (2), 547-549.

Talwani, P. (1982). Internally consistent pattern of seismicity near Charleston, South Carolina. Geology, 10, 654-65.

Tarr, A. C. (1977). Recent seismcity near Charleston South Carolina, and it relationship to the August 31, 1886 earthquake. U.S. Geological Survey Professional Paper 1028, 43-57. Washington, D.C.: U.S. Government Printing Office.

Step-by-Step Checklist[10]

HAZARD IDENTIFICATION

WHAT	WHO	WHEN
• **STEP ONE:** Obtain or draw a map of the library and surrounding environment.	_____	_____
• **STEP TWO:** Identify potential earthquake hazards in_____.	_____	_____
• **STEP THREE:** Identify earthquake and other hazards throughout _____ the library.	_____	_____
• **STEP FOUR:** Identify potential hazards along building evacuation routes.	_____	_____
• **STEP FIVE:** Identify potential hazards in the area surrounding the library.	_____	_____

[10] Resource: Guidebook for Developing a School Earthquake Safety Program (FEMA, 1990).

EARTHQUAKE DRILLS

WHAT	WHO	WHEN
• **STEP ONE:** Hold a staff meeting to discuss earthquake dangers and response actions.	_____	_____
• **STEP TWO:** Hold a special meeting or workshop with _____ to discuss preparation activities.	_____	_____
• **STEP THREE:** Develop procedures for holding library earthquake drills.	_____	_____
• **STEP FOUR:** Determine and discuss procedures for evacuating the library.	_____	_____
• **STEP FIVE:** Plan for the unexpected.	_____	_____
• **STEP SIX:** Designate an outdoor evacuation assembly area.	_____	_____
• **STEP SEVEN:** Practice and evaluate the effectiveness of your earthquake drills.	_____	_____

IMMEDIATE RESPONSE AND CARE REQUIREMENTS

WHAT	WHO	WHEN
• **STEP ONE:** Anticipate first-hour priorities.	_____	_____
• **STEP TWO:** Assess staff skills and identify training requirements.	_____	_____
• **STEP THREE:** Develop procedures and assign roles and responsibilities.	_____	_____
• **STEP FOUR:** Prepare simple response checklists for each staff member.	_____	_____
• **STEP FIVE:** Discuss and coordinate your plan with _____.	_____	_____
• **STEP SIX:** Inform staff of your earthquake response plan and their role in an emergency.	_____	_____
• **STEP SEVEN:** Discuss your earthquake response plan with library and school administrators.	_____	_____
• **STEP EIGHT:** Exercise your response plan.	_____	_____

COMMUNICATION

WHAT	WHO	WHEN
• **STEP ONE:** Determine on-site communication needs.	_____	_____
• **STEP TWO:** Determine off-site communication resources and develop reporting procedures.	_____	_____
• **STEP THREE:** Submit a copy of your communication plan to school and library officials.	_____	_____
• **STEP FOUR:** Develop procedures for conveying emergency information to library and school officials.	_____	_____

POST-EARTHQUAKE SHELTER PLANNING

WHAT	WHO	WHEN
• **STEP ONE:** Develop a list of care and shelter planning assumptions.	_____	_____
• **STEP TWO:** Estimate the number of persons requiring care and shelter.	_____	_____
• **STEP THREE:** Determine short-term care and shelter requirements.	_____	_____
• **STEP FOUR:** Identify additional requirements for long-term care and shelter.	_____	_____

Checklist for Head Librarian

1. Be knowledgeable of responsibilities for emergency preparedness, including elements of your plan.
2. Appoint an assistant and alternate.
3. Order a site and building hazard survey by a qualified structural and civil engineer.
4. Order removal or correction of hazards, as feasible.
5. Appoint a chairperson for an Emergency Preparedness Committee (to serve more than one year to allow for continuity).
6. Cooperate with chairperson of Emergency Preparedness Committee (to see that terms of the Plan are carried out).
7. Become informed of school policies and plans relating to emergency preparedness.
8. Require all staff to periodically review emergency plans and procedures.
9. Require all staff to periodically check preparations for their own areas.
10. Recommend that all staff hold current first aid certification. Recommend that a number of staff hold current CPR certification.
11. Develop procedures for protection of vital records.
12. Develop a procedure for releasing staff members.
13. Encourage all staff to prepare family emergency plans. Test regularly.
14. Near the end of the school year, require the Emergency Preparedness Committee to prepare a list of supplies needed for the following school year.

General Earthquake Information

The following earthquake information can be found in a brochure written by FEMA - Earthquake Checklist.

1. During an earthquake, remain calm and quickly follow the steps outlined below.

2. IF INDOORS, seek refuge in a doorway or under a desk or table. Stay away from glass windows, shelves, and heavy equipment.

3. IF OUTDOORS, move quickly away from buildings, utility poles, and other structures. Caution: Always avoid power or utility lines as they may be energized. Know your assembly points.

4. If in an automobile, stop in the safest place available, preferably away from power lines and trees. Stop as quickly as safety permits, but stay in the vehicle for the shelter it offers.

5. After the initial shock, evaluate the situation and if emergency help is necessary, call Campus Public Safety, if on campus, or _____ if off campus. Protect yourself at all times and be prepared for aftershocks.

6. Damaged facilities should be reported to Campus Public Safety and Maintenance. NOTE: Gas leaks and power failures create special hazards. Please refer to the section on Utility Failures.

7. If an emergency exists, activate the building alarm. CAUTION: THE BUILDING ALARM ONLY RINGS IN SOME BUILDINGS - you must report the emergency by phone.

8. When the building evacuation alarm is sounded, walk to the nearest marked exit and ask others to do the same.

9. ASSIST THE HANDICAPPED IN EXITING THE BUILDING! Remember that elevators are reserved for handicapped use. DO NOT USE ELEVATORS IN CASE OF FIRE. DO NOT PANIC.

10. Once outside, move to a clear area at least 500 feet away from the affected building(s). Keep streets, fire lanes, hydrants and walkways clear for emergency vehicles and crews.

11. If requested, assist emergency crews as necessary.

12. A Campus Emergency Command Post may be set up near the emergency site. Keep clear of the Command Post unless you have official business.

13. DO NOT RETURN TO AN EVACUATED BUILDING unless told to do so by a College official.

IMPORTANT: After an evacuation, report to your designated area assembly point. Stay there until an accurate HEADCOUNT has been taken. The Senior Building Coordinator will take attendance and assist in the accounting of all building occupants.

Earthquake Hazard Mitigation for Libraries Workshop

Agenda

1:00 p.m. - 1:10 p.m.	Welcome Introductions
1:00 p.m. - 1:30 p.m.	Historical and Recent South Carolina Earthquakes Definitions of Terms: Earthquake Fact Sheet
1:30 p.m. - 2:00 p.m.	Causes and Effects of Earthquakes Demonstrations/Slide Show/Overhead Projector/Hands on Models
2:00 p.m. - 2:20 p.m.	How To Plan at School and Home: Make Assignments
2:20 p.m. - 2:30 p.m.	Break
2:30 p.m. - 3:15 p.m.	Group Assignments/Discussions Fill Out Checklists/Plans
3:15 p.m. - 3:30 p.m.	Summary Groups Reports on Plans
3:30 p.m. - 3:46 p.m.	Earthquake Preparedness Film: i.e. Earthquake Don'ts and Do's
3:46 p.m. - 4:00 p.m.	Visit Seismic Lab

Section 5

Last Word

This publication just begins to touch on some of the issues that need to be considered when developing a comprehensive earthquake education program for schools. But education has to be a continuing process. As certain issues are addressed, others will be revealed. The following list, by no means all-inclusive, provides additional issues for schools to consider in this on-going process:

- Generating Concern When There Is None; how to get the school community to accept the concept of preparedness
- Training of School Substitutes
- Back-up Disaster Plans
- Activating the PTA
- School Resumption Plans
- Psychological Plan to Deal With Mass Fatalities
- Earthquake Education for Developmentally Delayed Parents
- Planning and Training for Structural Collapse Rescue Situations
- Effectively Using High School Students After the Earthquake
- Post-Earthquake Security Issues
- Dealing With Post-Earthquake Stress
- Effectively Using Technology in Earthquake Education Programs

NATIONAL CENTER FOR EARTHQUAKE ENGINEERING RESEARCH
LIST OF TECHNICAL REPORTS

The National Center for Earthquake Engineering Research (NCEER) publishes technical reports on a variety of subjects related to earthquake engineering written by authors funded through NCEER. These reports are available from both NCEER's Publications Department and the National Technical Information Service (NTIS). Requests for reports should be directed to the Publications Department, National Center for Earthquake Engineering Research, State University of New York at Buffalo, Red Jacket Quadrangle, Buffalo, New York 14261. Reports can also be requested through NTIS, 5285 Port Royal Road, Springfield, Virginia 22161. NTIS accession numbers are shown in parenthesis, if available.

NCEER-87-0001 "First-Year Program in Research, Education and Technology Transfer," 3/5/87, (PB88-134275/AS).

NCEER-87-0002 "Experimental Evaluation of Instantaneous Optimal Algorithms for Structural Control," by R.C. Lin, T.T. Soong and A.M. Reinhorn, 4/20/87, (PB88-134341/AS).

NCEER-87-0003 "Experimentation Using the Earthquake Simulation Facilities at University at Buffalo," by A.M. Reinhorn and R.L. Ketter, to be published.

NCEER-87-0004 "The System Characteristics and Performance of a Shaking Table," by J.S. Hwang, K.C. Chang and G.C. Lee, 6/1/87, (PB88-134259/AS). This report is available only through NTIS (see address given above).

NCEER-87-0005 "A Finite Element Formulation for Nonlinear Viscoplastic Material Using a Q Model," by O. Gyebi and G. Dasgupta, 11/2/87, (PB88-213764/AS).

NCEER-87-0006 "Symbolic Manipulation Program (SMP) - Algebraic Codes for Two and Three Dimensional Finite Element Formulations," by X. Lee and G. Dasgupta, 11/9/87, (PB88-219522/AS).

NCEER-87-0007 "Instantaneous Optimal Control Laws for Tall Buildings Under Seismic Excitations," by J.N. Yang, A. Akbarpour and P. Ghaemmaghami, 6/10/87, (PB88-134333/AS).

NCEER-87-0008 "IDARC: Inelastic Damage Analysis of Reinforced Concrete Frame - Shear-Wall Structures," by Y.J. Park, A.M. Reinhorn and S.K. Kunnath, 7/20/87, (PB88-134325/AS).

NCEER-87-0009 "Liquefaction Potential for New York State: A Preliminary Report on Sites in Manhattan and Buffalo," by M. Budhu, V. Vijayakumar, R.F. Giese and L. Baumgras, 8/31/87, (PB88-163704/AS). This report is available only through NTIS (see address given above).

NCEER-87-0010 "Vertical and Torsional Vibration of Foundations in Inhomogeneous Media," by A.S. Veletsos and K.W. Dotson, 6/1/87, (PB88-134291/AS).

NCEER-87-0011 "Seismic Probabilistic Risk Assessment and Seismic Margins Studies for Nuclear Power Plants," by Howard H.M. Hwang, 6/15/87, (PB88-134267/AS).

NCEER-87-0012 "Parametric Studies of Frequency Response of Secondary Systems Under Ground-Acceleration Excitations," by Y. Yong and Y.K. Lin, 6/10/87, (PB88-134309/AS).

NCEER-87-0013 "Frequency Response of Secondary Systems Under Seismic Excitation," by J.A. HoLung, J. Cai and Y.K. Lin, 7/31/87, (PB88-134317/AS).

NCEER-87-0014 "Modelling Earthquake Ground Motions in Seismically Active Regions Using Parametric Time Series Methods," by G.W. Ellis and A.S. Cakmak, 8/25/87, (PB88-134283/AS).

NCEER-87-0015 "Detection and Assessment of Seismic Structural Damage," by E. DiPasquale and A.S. Cakmak, 8/25/87, (PB88-163712/AS).

NCEER-87-0016 "Pipeline Experiment at Parkfield, California," by J. Isenberg and E. Richardson, 9/15/87, (PB88-163720/AS). This report is available only through NTIS (see address given above).

NCEER-87-0017 "Digital Simulation of Seismic Ground Motion," by M. Shinozuka, G. Deodatis and T. Harada, 8/31/87, (PB88-155197/AS). This report is available only through NTIS (see address given above).

NCEER-87-0018 "Practical Considerations for Structural Control: System Uncertainty, System Time Delay and Truncation of Small Control Forces," J.N. Yang and A. Akbarpour, 8/10/87, (PB88-163738/AS).

NCEER-87-0019 "Modal Analysis of Nonclassically Damped Structural Systems Using Canonical Transformation," by J.N. Yang, S. Sarkani and F.X. Long, 9/27/87, (PB88-187851/AS).

NCEER-87-0020 "A Nonstationary Solution in Random Vibration Theory," by J.R. Red-Horse and P.D. Spanos, 11/3/87, (PB88-163746/AS).

NCEER-87-0021 "Horizontal Impedances for Radially Inhomogeneous Viscoelastic Soil Layers," by A.S. Veletsos and K.W. Dotson, 10/15/87, (PB88-150859/AS).

NCEER-87-0022 "Seismic Damage Assessment of Reinforced Concrete Members," by Y.S. Chung, C. Meyer and M. Shinozuka, 10/9/87, (PB88-150867/AS). This report is available only through NTIS (see address given above).

NCEER-87-0023 "Active Structural Control in Civil Engineering," by T.T. Soong, 11/11/87, (PB88-187778/AS).

NCEER-87-0024 "Vertical and Torsional Impedances for Radially Inhomogeneous Viscoelastic Soil Layers," by K.W. Dotson and A.S. Veletsos, 12/87, (PB88-187786/AS).

NCEER-87-0025 "Proceedings from the Symposium on Seismic Hazards, Ground Motions, Soil-Liquefaction and Engineering Practice in Eastern North America," October 20-22, 1987, edited by K.H. Jacob, 12/87, (PB88-188115/AS).

NCEER-87-0026 "Report on the Whittier-Narrows, California, Earthquake of October 1, 1987," by J. Pantelic and A. Reinhorn, 11/87, (PB88-187752/AS). This report is available only through NTIS (see address given above).

NCEER-87-0027 "Design of a Modular Program for Transient Nonlinear Analysis of Large 3-D Building Structures," by S. Srivastav and J.F. Abel, 12/30/87, (PB88-187950/AS).

NCEER-87-0028 "Second-Year Program in Research, Education and Technology Transfer," 3/8/88, (PB88-219480/AS).

NCEER-88-0001 "Workshop on Seismic Computer Analysis and Design of Buildings With Interactive Graphics," by W. McGuire, J.F. Abel and C.H. Conley, 1/18/88, (PB88-187760/AS).

NCEER-88-0002 "Optimal Control of Nonlinear Flexible Structures," by J.N. Yang, F.X. Long and D. Wong, 1/22/88, (PB88-213772/AS).

NCEER-88-0003 "Substructuring Techniques in the Time Domain for Primary-Secondary Structural Systems," by G.D. Manolis and G. Juhn, 2/10/88, (PB88-213780/AS).

NCEER-88-0004 "Iterative Seismic Analysis of Primary-Secondary Systems," by A. Singhal, L.D. Lutes and P.D. Spanos, 2/23/88, (PB88-213798/AS).

NCEER-88-0005 "Stochastic Finite Element Expansion for Random Media," by P.D. Spanos and R. Ghanem, 3/14/88, (PB88-213806/AS).

NCEER-88-0006 "Combining Structural Optimization and Structural Control," by F.Y. Cheng and C.P. Pantelides, 1/10/88, (PB88-213814/AS).

NCEER-88-0007 "Seismic Performance Assessment of Code-Designed Structures," by H.H-M. Hwang, J-W. Jaw and H-J. Shau, 3/20/88, (PB88-219423/AS).

NCEER-88-0008 "Reliability Analysis of Code-Designed Structures Under Natural Hazards," by H.H-M. Hwang, H. Ushiba and M. Shinozuka, 2/29/88, (PB88-229471/AS).

NCEER-88-0009 "Seismic Fragility Analysis of Shear Wall Structures," by J-W Jaw and H.H-M. Hwang, 4/30/88, (PB89-102867/AS).

NCEER-88-0010 "Base Isolation of a Multi-Story Building Under a Harmonic Ground Motion - A Comparison of Performances of Various Systems," by F-G Fan, G. Ahmadi and I.G. Tadjbakhsh, 5/18/88, (PB89-122238/AS).

NCEER-88-0011 "Seismic Floor Response Spectra for a Combined System by Green's Functions," by F.M. Lavelle, L.A. Bergman and P.D. Spanos, 5/1/88, (PB89-102875/AS).

NCEER-88-0012 "A New Solution Technique for Randomly Excited Hysteretic Structures," by G.Q. Cai and Y.K. Lin, 5/16/88, (PB89-102883/AS).

NCEER-88-0013 "A Study of Radiation Damping and Soil-Structure Interaction Effects in the Centrifuge," by K. Weissman, supervised by J.H. Prevost, 5/24/88, (PB89-144703/AS).

NCEER-88-0014 "Parameter Identification and Implementation of a Kinematic Plasticity Model for Frictional Soils," by J.H. Prevost and D.V. Griffiths, to be published.

NCEER-88-0015 "Two- and Three- Dimensional Dynamic Finite Element Analyses of the Long Valley Dam," by D.V. Griffiths and J.H. Prevost, 6/17/88, (PB89-144711/AS).

NCEER-88-0016 "Damage Assessment of Reinforced Concrete Structures in Eastern United States," by A.M. Reinhorn, M.J. Seidel, S.K. Kunnath and Y.J. Park, 6/15/88, (PB89-122220/AS).

NCEER-88-0017 "Dynamic Compliance of Vertically Loaded Strip Foundations in Multilayered Viscoelastic Soils," by S. Ahmad and A.S.M. Israil, 6/17/88, (PB89-102891/AS).

NCEER-88-0018 "An Experimental Study of Seismic Structural Response With Added Viscoelastic Dampers," by R.C. Lin, Z. Liang, T.T. Soong and R.H. Zhang, 6/30/88, (PB89-122212/AS). This report is available only through NTIS (see address given above).

NCEER-88-0019 "Experimental Investigation of Primary - Secondary System Interaction," by G.D. Manolis, G. Juhn and A.M. Reinhorn, 5/27/88, (PB89-122204/AS).

NCEER-88-0020 "A Response Spectrum Approach For Analysis of Nonclassically Damped Structures," by J.N. Yang, S. Sarkani and F.X. Long, 4/22/88, (PB89-102909/AS).

NCEER-88-0021 "Seismic Interaction of Structures and Soils: Stochastic Approach," by A.S. Veletsos and A.M. Prasad, 7/21/88, (PB89-122196/AS).

NCEER-88-0022 "Identification of the Serviceability Limit State and Detection of Seismic Structural Damage," by E. DiPasquale and A.S. Cakmak, 6/15/88, (PB89-122188/AS). This report is available only through NTIS (see address given above).

NCEER-88-0023 "Multi-Hazard Risk Analysis: Case of a Simple Offshore Structure," by B.K. Bhartia and E.H. Vanmarcke, 7/21/88, (PB89-145213/AS).

NCEER-88-0024 "Automated Seismic Design of Reinforced Concrete Buildings," by Y.S. Chung, C. Meyer and M. Shinozuka, 7/5/88, (PB89-122170/AS). This report is available only through NTIS (see address given above).

NCEER-88-0025 "Experimental Study of Active Control of MDOF Structures Under Seismic Excitations," by L.L. Chung, R.C. Lin, T.T. Soong and A.M. Reinhorn, 7/10/88, (PB89-122600/AS).

NCEER-88-0026 "Earthquake Simulation Tests of a Low-Rise Metal Structure," by J.S. Hwang, K.C. Chang, G.C. Lee and R.L. Ketter, 8/1/88, (PB89-102917/AS).

NCEER-88-0027 "Systems Study of Urban Response and Reconstruction Due to Catastrophic Earthquakes," by F. Kozin and H.K. Zhou, 9/22/88, (PB90-162348/AS).

NCEER-88-0028 "Seismic Fragility Analysis of Plane Frame Structures," by H.H-M. Hwang and Y.K. Low, 7/31/88, (PB89-131445/AS).

NCEER-88-0029 "Response Analysis of Stochastic Structures," by A. Kardara, C. Bucher and M. Shinozuka, 9/22/88, (PB89-174429/AS).

NCEER-88-0030 "Nonnormal Accelerations Due to Yielding in a Primary Structure," by D.C.K. Chen and L.D. Lutes, 9/19/88, (PB89-131437/AS).

NCEER-88-0031 "Design Approaches for Soil-Structure Interaction," by A.S. Veletsos, A.M. Prasad and Y. Tang, 12/30/88, (PB89-174437/AS). This report is available only through NTIS (see address given above).

NCEER-88-0032 "A Re-evaluation of Design Spectra for Seismic Damage Control," by C.J. Turkstra and A.G. Tallin, 11/7/88, (PB89-145221/AS).

NCEER-88-0033 "The Behavior and Design of Noncontact Lap Splices Subjected to Repeated Inelastic Tensile Loading," by V.E. Sagan, P. Gergely and R.N. White, 12/8/88, (PB89-163737/AS).

NCEER-88-0034 "Seismic Response of Pile Foundations," by S.M. Mamoon, P.K. Banerjee and S. Ahmad, 11/1/88, (PB89-145239/AS).

NCEER-88-0035 "Modeling of R/C Building Structures With Flexible Floor Diaphragms (IDARC2)," by A.M. Reinhorn, S.K. Kunnath and N. Panahshahi, 9/7/88, (PB89-207153/AS).

NCEER-88-0036 "Solution of the Dam-Reservoir Interaction Problem Using a Combination of FEM, BEM with Particular Integrals, Modal Analysis, and Substructuring," by C-S. Tsai, G.C. Lee and R.L. Ketter, 12/31/88, (PB89-207146/AS).

NCEER-88-0037 "Optimal Placement of Actuators for Structural Control," by F.Y. Cheng and C.P. Pantelides, 8/15/88, (PB89-162846/AS).

NCEER-88-0038 "Teflon Bearings in Aseismic Base Isolation: Experimental Studies and Mathematical Modeling," by A. Mokha, M.C. Constantinou and A.M. Reinhorn, 12/5/88, (PB89-218457/AS). This report is available only through NTIS (see address given above).

NCEER-88-0039 "Seismic Behavior of Flat Slab High-Rise Buildings in the New York City Area," by P. Weidlinger and M. Ettouney, 10/15/88, (PB90-145681/AS).

NCEER-88-0040 "Evaluation of the Earthquake Resistance of Existing Buildings in New York City," by P. Weidlinger and M. Ettouney, 10/15/88, to be published.

NCEER-88-0041 "Small-Scale Modeling Techniques for Reinforced Concrete Structures Subjected to Seismic Loads," by W. Kim, A. El-Attar and R.N. White, 11/22/88, (PB89-189625/AS).

NCEER-88-0042 "Modeling Strong Ground Motion from Multiple Event Earthquakes," by G.W. Ellis and A.S. Cakmak, 10/15/88, (PB89-174445/AS).

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