

CHAPTER 4
SEISMIC SAFETY IN INDUSTRY - BERKELEY

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Amidst the flurry of seismic safety planning and preparation reports issued from and about various facets of the Berkeley community, a silent void appears in the area of the industrial sector. This is somewhat unsettling since certain industries have the potential for producing some of the greatest physical hazards which could occur in the event of an earthquake. Even without any major incidents such as total building collapse, post-earthquake fires, or the release of toxic substances, damage to industry alone could run well into the millions of dollars. A study of 56 light industries in the San Fernando area after the moderate (Richter magnitude 6.4) 1971 earthquake estimated damages at over two million dollars.^{1, 5} A single firm in the area suffered ten thousand dollars worth of damage solely from falling rolls of paper. Similar types of damage could be avoided in the Berkeley industrial community through low-cost hazard mitigation measures. This could prove to be important to the entire Berkeley community, as industry provides both a tax base for the city and employment for its residents, both vital for the survival of the city. This paper will attempt to establish the present state of preparedness, in regards to seismic safety, of Berkeley's industries.

In the course of the investigation for this paper, it was found that a large majority of communicants within the industrial sector desired to remain anonymous. Thus, in deference to their wishes, all information discussed in this paper will not be referenced in the standard fashion.

Almost all of the industries studied in Berkeley were located in the western half of the city in an area between San Pablo Avenue and the Bay (FIGURE 1). Geologically, the area is characterized by the Temescal formation, alluvial fan deposits composed of interfingering lenses of gravel, silty clay, and sand-silt-clay mixtures, which were washed down from the Berkeley hills.⁴ Such a substrate has a tendency to amplify shock waves in the event of an earthquake, and has a moderate liquefaction potential.² At the edge of the Bay, a few industrial firms are located on artificial fill which is extremely unstable seismically, with both strong shock wave amplification tendencies, and a high liquefaction potential.²

Because of a dearth of information on the subject of seismic safety in industry, and the lack of a knowledgeable intermediary person or organization which could represent the industrial

community in matters of seismic safety, a direct mail survey was used to contact various industrial firms in Berkeley. For logistic reasons, mailing of the surveys was limited to manufacturing firms and chemical laboratories.

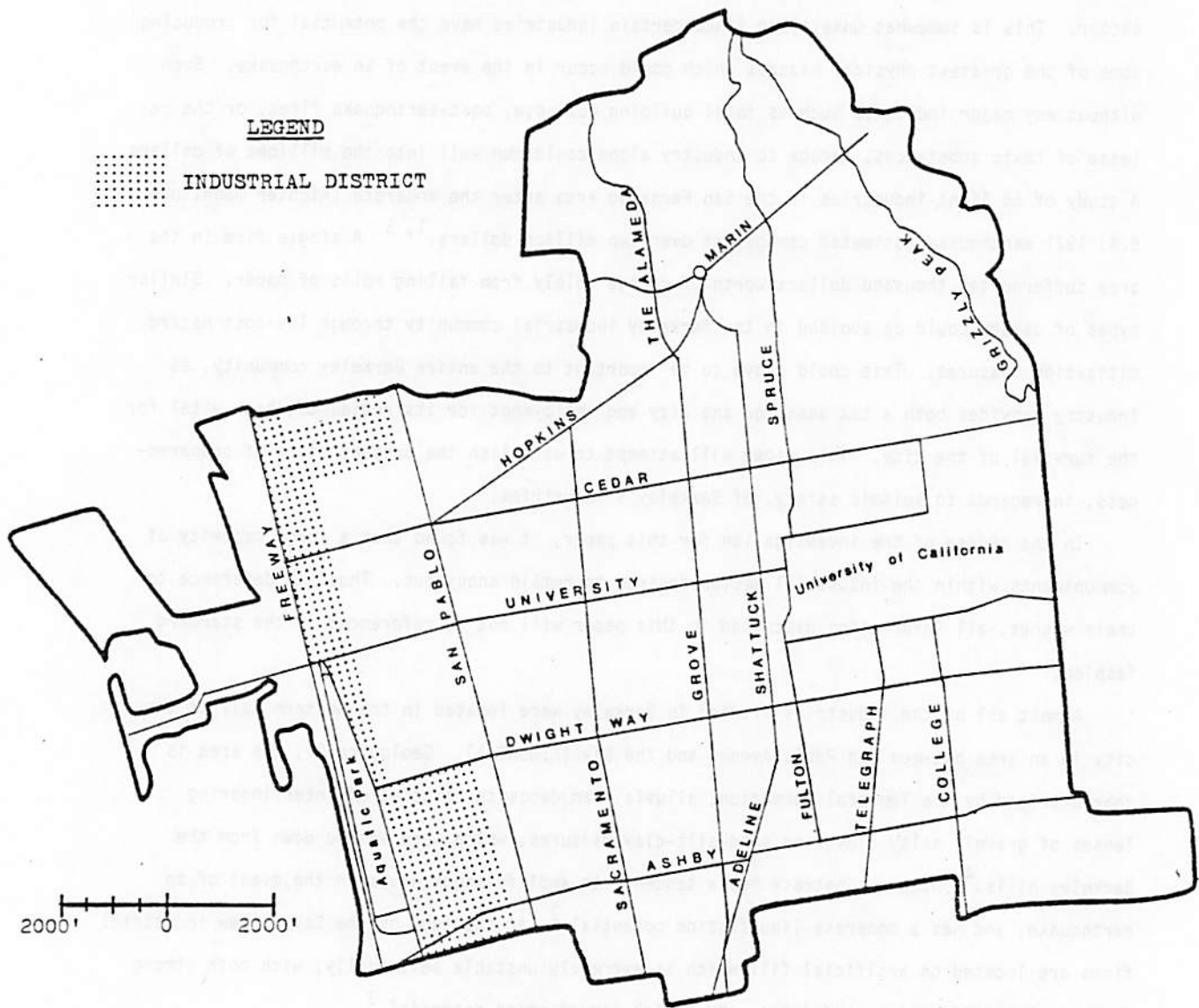


FIGURE 1. General Location of Berkeley's Industries
SOURCE: Berkeley Master Plan¹

	NUMBER	PERCENTAGE
Responses [*]	19	39%
Confidential Option ^{**} : Yes	14	78%
No	4	22%
Meets Uniform Building ^{**} : Yes	3	17%
No	1	5%
Don't know	14	78%
Considered Earthquake Problems ^{**} : Yes	6	33%
No	8	45%
No problems expected	4	22%
Hazard Reduction Measures: Yes	5	26%
No	11	58%
None necessary	3	16%
Have Contingency Plans: Yes	5	26%
No	14	74%
Earthquake Insurance ^{**} : Yes, Full Value	1	6%
Yes, Partial Value	3	16%
Yes, Self Insured	0	--
None	14	78%

Notes: ^{*} Out of a total of 49 surveys.

^{**} One firm did not give response to question.

TABLE 1. Results of Survey, Berkeley

The purpose of the survey was twofold, to examine the general trends of industrial earthquake planning in the Berkeley area, and to establish contacts within the industrial community to aid in a more in-depth investigation of specific plans made by various firms. The actual survey consisted of a cover letter explaining the intent of the survey (FIGURE 2a), and a short multiple-choice survey (FIGURE 2b). Results of the survey can be found in TABLE 1. Firms which gave positive responses to the survey were contacted for specifics on their seismic safety concerns and plans.

In relative terms, the return rate for the survey was excellent; 19 of 49 (39%) of the surveyed firms responded. Responses came from a representative mix of different types of industries, including metal and plastic fabricators, chemical manufacturers, and printers. It is disappointing to note that one of the largest firms in Berkeley, which is located in a seismically critical



DIVISION OF SPECIAL PROGRAMS

BERKELEY, CALIFORNIA 94720

April 2, 1979

Company Name
Address
Berkeley, CA 94710

Dear Sirs:

As part of our Senior Seminar in Environmental Studies, we are examining seismic safety and hazard reduction in various facets of the Berkeley community. Members of our group are studying the possible effects of an earthquake on city government, emergency facilities, transportation, utilities, the U.C. Berkeley Campus, and industry, as well as measures to mitigate such effects. Results of the studies are to be compiled into a joint senior thesis which will be available in June.

We would greatly appreciate your assistance in our study of problems that confront industry in the area of seismic safety by completing the attached survey. We plan to use the results of this survey to assess the amount of planning that has been done by the industrial community as well as to study its future needs.

We hope very much to hear from you. If you desire additional information, are interested in our project, or would like a copy of the completed report, we may be contacted at:

301 Campbell Hall
University of California
Berkeley, CA 94720
642-2628 (messages)

Thank you very much for your time.

Sincerely yours,

Edward Ochi

Enclosures: survey
return envelope

Guy Quan

FIGURE 2a. Cover Letter

Name of Firm: _____

Type of Business: _____

Number of Employees: _____

Name of Person Answering Survey: _____

Position of Person Answering Survey: _____

Phone Number: _____

I wish to have all answers on this survey kept confidential.

_____ Yes _____ No

* * *

1) What year was the building(s) your firm occupies constructed?

2) Does this building(s) meet present Uniform Building Code standards for seismic safety?

_____ Yes _____ No _____ Don't Know

3) Have you considered the problems your firm might face in the event of an earthquake?

_____ Yes _____ No _____ No Problems Expected

4) Has your firm taken any steps to reduce potential problems which would result from an earthquake?

_____ Yes _____ No _____ None Necessary

5) Does your firm have any contingency plans for checking damage or hazardous conditions after an earthquake?

_____ Yes _____ No

6) Does your firm's insurance policies cover earthquake induced damage?

_____ No

_____ Yes, for the full value of the firm

_____ Yes, for part of the value of the firm

_____ Yes, self insured for earthquake damage

* * *

Additional Comments (feel free to continue on back): _____

FIGURE 2b. Survey

area, chose not to participate in the survey, although initial interest was expressed by a company representative. Almost all firms responding to the survey provided the name of a person who could be contacted for further information.

Responding firms varied in size from 20 employees to over 150, with an average of approximately 63. Contrary to initial expectations, there was no correlation between the amount of seismic safety planning and the size of the company, when the responses were divided into groups of companies with over or under 50 employees. It had been expected that the larger firms, which were theoretically more secure in the marketplace, would be more prepared for an earthquake than small firms which could not afford to invest either time or money in safety planning and modifications. This opinion was shared by one firm which returned the survey with the comment "Small companies do not make extensive plans to combat the unexpected forces of nature . . . surviving in the marketplace is challenge enough." There was also no correlation between the age of the building(s) occupied, which ranged from 50 years old to new, and the amount of planning done.

Roughly 33% of the firms responding to the survey stated that they had considered potential earthquake problems. Another 20% felt that no problems were expected, a somewhat unreasonable assumption since, in the words of one communicant, "the only safe structure would be a parking lot or a chicken farm." About 25% of the surveyed firms stated that they had taken some steps toward hazard reduction and/or had a contingency plan for the event of an earthquake.

A large majority of the responding firms (78%) had no form of insurance protection against earthquake damage. Three firms felt that they had partial coverage under various non-earthquake insurance policies including personal injury policies and equipment damage policies. Only one firm actually had earthquake insurance for the full value of its operation.

The results of the survey may be misleading; it is probable that a larger percentage of the companies which did not respond to the survey have not considered seismic safety problems than in the group which did respond to the survey.

Amongst those who responded and stated that they had made contingency plans, most plans appeared to be insufficient, consisting of building evacuation plans which were nearly identical to fire and bomb threat evacuation procedures. One firm contacted did have a fairly good contingency plan, based on employees' noting damage to their working areas before evacuating the building, and reporting observed damage to the plant engineer. The building would then remain off-limits to re-entry until the plant engineer could make a walk-through inspection of the entire premises. If structural damage was suspected, an independent structural engineer would

be called in under a standing contract agreement. This same company had modified much of its equipment to avoid the spilling of hazardous materials in the event of an earthquake through the use of a rather ingenious system of self-closing valves and "suicide sections" in pipe arrays, which were designed to break before critical storage tanks were damaged. Funds were also being allocated to upgrade the structure of the building itself, to improve its earthquake resistance.

Although most industries in Berkeley are located in a seismically critical area, it is clear that few firms have properly addressed the question of seismic safety. The state of seismic safety awareness may perhaps be best summarized by the comment made by one company on its survey, "We never really thought about it." Another firm commented more strongly, "I feel all concern addressed to the fear of earthquakes is ridiculous in face of world and public priorities over hazards and real, not speculative, dangers."

The inclusion of private industries in at least part of the community's seismic safety planning process might serve to convince skeptics of the reality and urgency of the dangers of earthquakes, as well as to inform companies which are presently uninformed. The Berkeley Chamber of Commerce, which was contacted early in this project, has no information on seismic safety hazards and planning. This organization would seem to be an ideal vehicle for conveying planning considerations, since it has no governmental affiliation. The city government of Berkeley would be a somewhat less viable alternative, as it already has somewhat of a reputation of being anti-business. State or Federal regulations requiring all firms in seismically active areas to prepare seismic safety plans should also be considered.

Individual industries may wish to consider initiating earthquake hazard reduction programs on their own to avoid potentially cumbersome government regulations. If the building(s) a firm occupies are structurally sound, there are several low-cost measures which can be taken to reduce common earthquake hazards. Shelves should be equipped with "seismic strips" or retaining lips to prevent the spilling of the shelves' content, and should be fastened to the floor or a wall to prevent tipping. Ventilator grills, suspended (false) ceilings, and diffusers on light fixtures should be secured with restraining wires to prevent their falling during an earthquake. Pendant type fluorescent light fixtures should be equipped with safety cables when possible, or replaced. Heavy machinery should be bolted to the floor to prevent shifting and possible damage to supply lines. Heavy objects should be stored at floor level to prevent falling hazards.

Securing equipment against falling hazards and preparation of an earthquake contingency plan are two low-cost measures which could significantly reduce injury and property damage in Berkeley's industrial sector when the next major earthquake occurs.

REFERENCES CITED

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