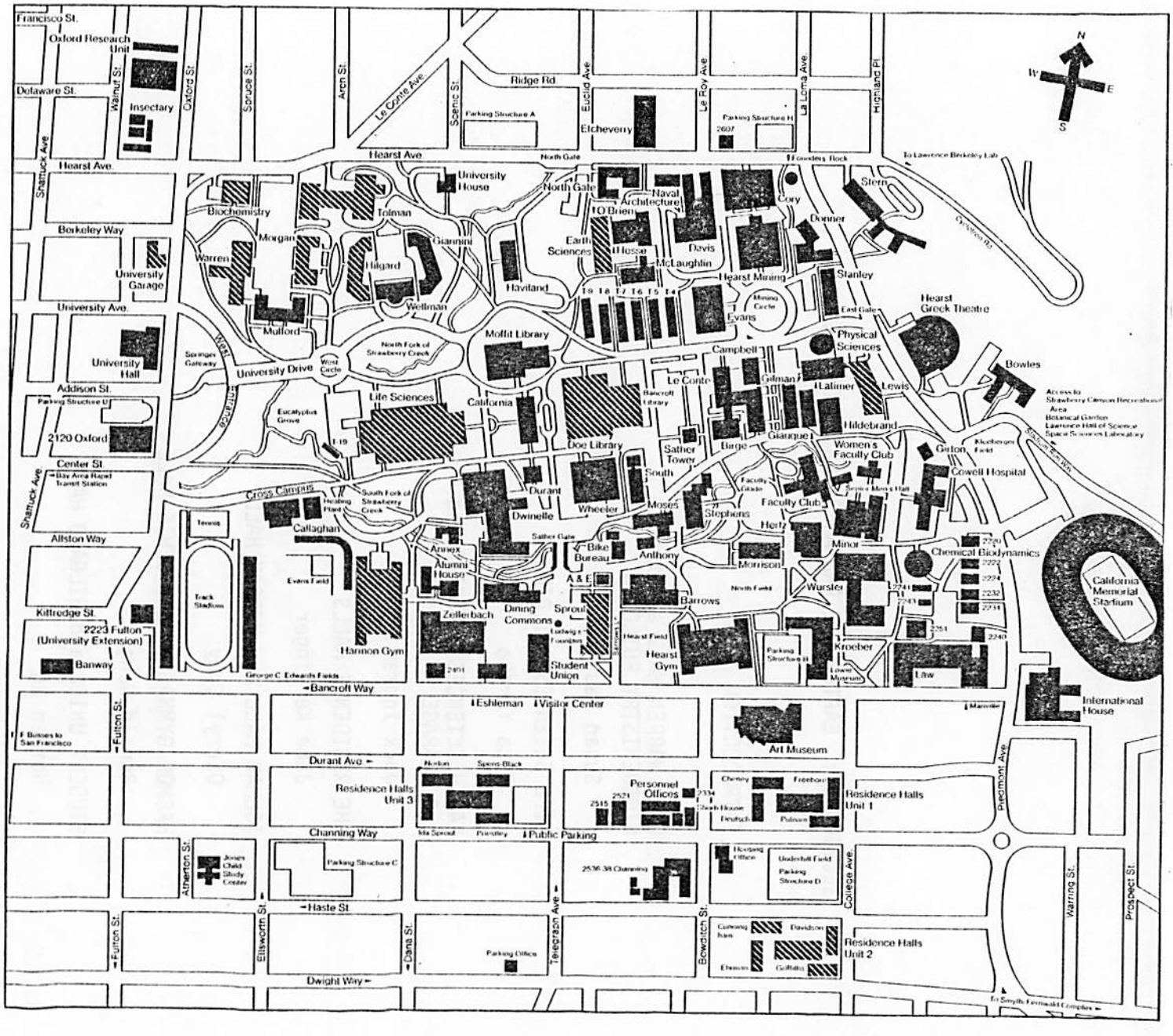

FIGURE 1. Map of Campus, University of California, Berkeley.

Striped pattern indicates buildings surveyed.

INTRODUCTION

The University of California has recognized its responsibility to achieve the maximum level of earthquake safety feasible under present earthquake engineering practices. Official policy regarding seismic safety directs that " . . . the program for abatement of seismic hazards shall include identification and temporary or permanent correction of potential earthquake falling, sliding or rupturing hazards such as, but not limited to, interior and exterior building elements, utilities, equipment, fixtures, furnishings, and other contents which could be dislodged, fall, overturn, slide or rupture during seismic disturbances."[7] To help implement this policy a recent study regarding the structural aspects of building exteriors in terms of seismic safety was carried out on all nine of the University of California campuses, including 52 buildings on the Berkeley campus.[6]

On August 13, 1978, a 5.1 Richter magnitude earthquake occurred off the California coast near Santa Barbara. The highest intensity, VII on the Modified Mercalli Scale, was felt in the vicinity of the University of California, Santa Barbara (UCSB) campus in Goleta. Of the estimated $9.26 million in damages to the public sector, $7.75 million occurred at the UCSB campus. Included in this figure were $5.75 million in damages to buildings, elevators, and utilities, and an additional $2 million to department equipment, chiefly laboratory supplies.[5]

In light of the property damage suffered by the UCSB campus, the Environmental Studies Senior Seminar felt that it would be appropriate to survey the interiors of buildings on the Berkeley campus in terms of seismic safety, not only to identify similar hazards, but also hazards unique to Berkeley. The intent was that such action would facilitate the mitigation of these hazards.

Because of time constraints, the survey was limited to a sample of 13 buildings (FIGURE 1). In some instances a building was chosen for the survey because of the special hazards it represents (e.g., the U.C. Garage); others were selected because of their use by large numbers of persons (e.g., Doe Library).

Methodology

Since a checklist is a valuable tool to ease the monumental task of making a building survey, we decided to prepare a checklist to organize and classify our raw data. By taking a moderate sample of different rooms in a building with a checklist, we could identify hazardous situations without the need to inspect every room.

We classified rooms into three main types: office, classroom/lecture hall, and laboratory. Each kind of room had common types of hazards that were categorized on the checklist. Of these hazards, both personal safety and property damage were taken into account. Armed with a rough checklist, we inspected our buildings. The checklist then underwent several revisions to arrive at its present form (TABLE 1).

It is hoped that our work will act as a catalyst to other campuses to become active in seismic safety awareness.

BUILDING						
1. No auxiliary power supply.						
2. Untempered glass.						
3. Roofing tiles or parapets over exits.						
OFFICE AREAS						
1. Unsecured shelves.						
2. Unsecured cabinets.						
3. Unsecured bookcases.						
4. Heavy objects overhead.						
5. Unlatched file cabinets.						
6. Loose ceiling tiles.						
7. Unsafe lighting fixtures.						
8. No emergency refuge areas.						
9. Loose ventilation grates.						
LABORATORIES						
1. Loose ceiling tiles.						
2. Unsafe lighting fixtures.						
3. Unsecured cabinets.						
3. Unsecured equipment.						
4. Inadequately secured gas cylinders.						
6. Heavy objects overhead.						
7. Glass objects overhead.						
8. Blocked exits.						
9. Fire hazards:						
a. Cluttered work area.						
b. Spilled chemicals.						
c. Missing fire extinguisher.						
d. Inaccessible fire extinguisher.						
e. No overhead sprinklers.						
10. Inadequate first aid:						
a. No emergency shower.						
b. No emergency eyewash.						
11. Poor chemical storage:						
a. Open containers.						
b. No rail on shelves.						
c. General clutter.						
12. No emergency refuge areas.						
LECTURE HALLS						
1. Ornamental ceiling fixtures.						
2. Loose plaster on ceiling, walls.						
3. Poorly secured overhead objects.						
4. Unsafe lighting fixtures.						
5. Loose ventilation grates.						
6. No emergency refuge areas.						
HALLWAYS, STAIRWAYS and EXITS						
1. Blocked exits.						
2. Locked exits.						
3. Cluttered hallway.						
4. Cluttered stairway.						
5. No fire extinguishers.						
6. No lighted EXIT signs.						
7. No auxiliary lighting.						
8. Inadequate number of exits.						
9. Unsafe exits.						
10. Loose plaster on ceiling, walls.						
11. Unsafe lighting fixtures.						
COMMENTS:						

TABLE 1. Checklist for Survey of Campus Buildings

ROOMS				
1. Objects hanging over beds.				
2. Objects hanging over desks.				
3. Bed under a window.				
4. Unsecured bookcases.				
5. Loose material on ceilings, walls.				
6. Blocked exit.				
7. Unsecured equipment.				
8. No safe emergency refuge.				
HALLWAYS, STAIRWAYS and EXITS				
1. Blocked hallway.				
2. Blocked stairway.				
3. Locked emergency exit.				
4. No fire extinguisher.				
5. Outdated fire extinguisher.				
6. Partially discharged fire extinguisher.				
7. Loose material on cielings, walls.				
8. No EXIT signs.				
9. No emergency lighting.				
LOUNGES, LAUNDRIES, etc.				
1. No fire extinguisher.				
2. Unsecured equipment:				
a. Vending machines.				
b. Televisions, stereos.				
c. Clothes washers				
d. Clothes driers.				
e. Refrigerators.				
f. Stoves.				
3. Inadequate exits.				
4. Blocked exits.				
5. Locked exits.				
6. Inaccessable fire extinguisher.				
7. General fire hazards.				
COMMENTS:				

Results

We found that there are certain hazardous situations common to all the buildings surveyed. For example, falling light fixtures and breaking windows are likely to be problems everywhere. Therefore, we will cover these common hazards first, as they apply to offices and laboratories. Then we will discuss the special problems of each building separately. These common hazards will be explained in the same order in which they are presented in the sample checklist.

Offices

Shelves: Most office shelves are of a standard type which measure 8 feet tall by 5 feet wide. They are of light metal construction and are free standing; that is, they are not secured to the wall. We consider them to be a hazard, for in the event of moderate shaking, it is likely that they will topple over, and possibly injure persons in their path.

Recommendations: Fasten the shelves to the wall. In the short term, until repairs are made, it might be a good idea to re-arrange one's room so as to reduce this hazard.

File cabinets: There are two types, both floor models measuring about 4 feet tall. The critical feature distinguishing the two is how the file drawers open. In one model there is a lock mechanism which prevents the drawer from sliding out on its own; this is not the case with the other, which might slide open during an earthquake, and for this reason we consider it unsafe.

Recommendations: Replace the hazardous model or re-arrange its location.

Closets: Large two-door metal closets pose two hazards: one, as with shelves, they might fall over; and two, their swinging doors present the same hazard as do the file cabinets.

Recommendations: Fasten to the wall and/or re-arrange.

Blockage of doorway: With small offices there is usually just a single doorway. We found that in many instances, shelves and closets were arranged so that if they fell they would block the door, thus rendering the doorway temporarily impassable. This could be a major problem in terms of flight or rescue.

Recommendations: Re-arrange the room.

Mobile trays and carts: These include, for example, typewriter trays. They could slide and injure someone.

Recommendations: Make sure brakes are put on those that lack them and that the brakes are used.

Falling objects: These include things like coatracks and hanging plants.

Recommendations: Be mindful of their location. For items that are significantly large, consider securing them to the floor. Move hanging plants so that they will not cause injury if they fall.

Windows: All glass installed after 1971 must be either tempered or safety glass.[18] Tempered glass shatters into tiny balls; safety glass, like that in car windshields, has a sheet of plastic in between two sheets of untempered glass. The only older glass that has been replaced by these types is that which is in frames within 18 inches of the outside ground level, or which is part of an entranceway door. Thus, the majority of glass windows are the type that are very dangerous. This problem is compounded by the fact that people like to place their desks right next to the window.

Recommendations: Move the desk, or at least put something in between the desk and the window.

Lights: The lights that we consider to be the most hazardous are the ones that are suspended from the ceiling. Experience has shown that they tend to fall before lights that are attached directly to the ceiling do.

Recommendations: Install lateral bracing between the vertical supports or replace the suspended models.

False ceilings: The panels and lights in the false ceilings are not fastened in the support grid, but merely rest in place. Therefore, they could and do fall out and down. There were instances of this having occurred at Santa Barbara.

Recommendations: Install some type of fasteners on the ceiling panels.

Laboratories

Work bench shelves: Many do not have lips or safety stripping to prevent lab materials from falling off. This absence of safety retainers was the rule with most of the other types of shelves as well.

Mounted wall shelves: These are bracketed to the wall. The danger is with what is stored on them that might fall off.

"Free" wall shelves: The same type found in the offices.

Recommendations: Install safety retainers.

Gas cylinders not secured: There are three ways cylinders are secured: with a chain, a bench clamp, or a floor ringstand. We feel that the bench clamp is the only acceptable method, as the other two will not prevent the cylinders from falling over. This proved to be the case in the labs at the Santa Barbara campus.

Recommendations: Convert to the bench clamp.

Mobile equipment: Instruments such as centrifuges are generally mounted on a mobile apparatus. This situation is a hazard to persons in their way and is also a potential source of damage to the rather expensive instruments.

Recommendations: Put brakes on the equipment.

Free-standing equipment: Large items such as computers, refrigerators, and incubators are usually not braced down on the tabletops. The risk of injury and great financial loss is unnecessarily taken.

Recommendations: Fasten them down.

Eyewash not present: These should be in a lab in any circumstance. Even in the case of an earthquake rupturing the water pipes, there will still be sufficient head to allow at least a couple of emergency washes.

Shower not present: Same as above for eyewash.

Recommendations: Install the eyewash and/or shower.

Fire extinguisher not present: Sometimes this and the eyewash were located outside of a lab in the hall. This is unsatisfactory because it is possible that the doorways of some labs could become blocked and then the persons inside would be without this equipment.

Recommendations: Get both items inside the labs.

Glassware stored on high shelves: This common practice is dangerous.

Recommendations: Institute storage procedures that are safer, for example, placing large bottles closer to the floor. This should be done in conjunction with the installation of seismic retainers on the shelves.

Too little storage space: This is a big problem for many departments. Some of the resultant hazards are the inadequate storage of hazardous chemicals, glassware and apparatus on high shelves and in cluttered hallways.

The University is a large consumer entity. Each day it receives massive infusions of food and materiél. Efficiency and cost effectiveness dictate that these items be purchased in standardized bulk quantities. Thus, as we can see from the checklist, it is common for a typical office to have a "standard issue" of desk, file cabinet and shelf.

The disadvantage of this system is that if a particular object is found to be of a hazardous design, there is automatically a multiplicity of that hazard. This feature of the system works the other way as well, in that any prescribed remedy can be parcelled out on a similarly standardized and cost efficient manner.

We feel that the majority of our recommendations can be undertaken without an excessive drain on the University's resources.