OPTIMUM SEISMIC PROTECTION FOR NEW BUILDING CONSTRUCTION IN EASTERN METROPOLITAN AREAS

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Internal Study Report No. 30

INCIDENT LOSSES: INFORMATION OBTAINED FROM LOS ANGELES FIELD TRIP, 14 JANUARY TO 23 JANUARY, 1973

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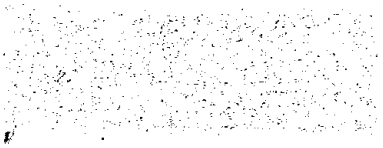

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In studying future losses in high-rise buildings caused by earthquakes, both physical and non-physical costs have been considered. Since the latter remains in the conceptual stage, an effort has been made to identify causes or sources of these costs; i.e., incident losses, and to suggest evaluation methods for assessing them. This study attempts to establish the validity of these concepts by obtaining information from building owners, building occupants, and the public; and from their perception, modify previous descriptions of incident losses and propose revised evaluation methods. Interview questions (Appendix A) are structured to obtain information about earthquake related phenomena in the building, activities of occupants, incident losses perceived during the quake, during final repairs, and subsequent to final repairs. The report describes selection of interviewees, scheduling of interviews, and information obtained. Incident losses are summarized and conclusions are drawn from the information. Appendices include charts on the nature of information obtained, specific building data and descriptive paragraphs of observations made by building occupants.

17. Document Analysis a. Descriptors

Earthquakes
Information retrieval
Damage assessment
Residential buildings
Interviews
Public buildings
California
Cost analysis

b. Identifiers/Open-Ended Terms

Incident losses
Los Angeles

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INCIDENT LOSSES: INFORMATION OBTAINED FROM LOS ANGELES FIELD TRIP, 14 JANUARY TO 23 JANUARY, 1973

I. Introduction

In studying the future losses in high-rise buildings caused by earthquakes, both physical costs (i.e., costs of repairing the damaged buildings) and non-physical costs have been considered. While the physical cost study is near completion, the study of the non-physical costs has remained, to a large extent, in the conceptual stage. Part of the study of non-physical costs has been to identify the causes or sources of these costs (i.e., the incident losses) and to suggest evaluation methods to be employed in assessing these losses (re., Internal Study Report No. 21, "Incident Losses: Identification and Evaluation Methods to be Employed," M. H. Ackroyd and S. T. Hong).

Since the study had remained primarily in the conceptual stage, the need to find evidence to establish the validity of the concepts arose: we needed to know if building owners, building occupants, and the public really do perceive the incident losses as we anticipated they would. Then, with the evidence obtained, we could modify our descriptions of the incident losses and propose revised evaluation methods where necessary.

II. Obtaining Evidence by Means of Interviews

In order to obtain evidence for the existence of incident losses and to see how they are actually perceived, it was decided to interview owners/managers and tenants of buildings in the Los Angeles area

which suffered damage during the February 9, 1971 earthquake. With information obtained from the interviews, it would be possible to revise our descriptions of the incident losses to make them more complete and realistic.

Having decided on interviewing building owners/managers and building tenants, a set of questions was drawn up for the purposes of (1) assessing those incident losses perceived by the person interviewed, and (2) securing information to be used in revision of the scenarios (also described in ISR No. 21). The questions were structured to obtain information about earthquake-related phenomena in the building, activities of the occupants, and incident losses perceived during the quake, immediately after the quake, during final repairs, and subsequent to final repairs. The list of questions is included in appendix A.

III. Selection of People to be Interviewed

The list of buildings included in the MIT data base was searched to find those buildings for which the manager/owner indicated he was willing to further discuss damages in his building due to the earthquake. For each of these selected buildings, the geographic location, the building function, and repair cost ratio were recorded. Also, each building was checked to see if any inconvenience costs were reported on the questionnaire survey of Ayres, Cohen, and Hayakawa. From this information, the buildings were classified into damage states by building function. Each building was assigned a priority rating based on inconvenience cost, repair cost ratio, and geographic location. The highest priorities were given to those buildings with inconvenience

costs indicated, with repair cost ratios closest to the central value of repair cost ratio for that damage state, and with locations that were easiest for the interviewer to reach. Buildings were arranged in order of decreasing priority for each damage state and building function.

IV. Scheduling of Interviews

Since it was necessary to use the time most efficiently while in Los Angeles, it was decided to have Ayres, Cohen, and Hayakawa arrange appointments with the building owners/managers prior to arriving in Los Angeles. The schedule of appointments was based on the priority list and the proximity of selected buildings to one another. In all, 22 interviews with building owners/managers were arranged.

Because it was anticipated that there would be little difficulty in scheduling interviews with building occupants, it was decided to make appointments with them while in Los Angeles.

V. Information Obtained from the Interviews

In all, 21 building owners/managers were interviewed, representing 27 buildings in damage states 1 through 6; 21 tenants were spoken to. A more detailed description of the nature of the sources of information for each building is included in appendix B. A summary of the information obtained from the interview follows, while the complete, original form of the information is presented in appendices C and D.

Summary of Incident Losses Incurred

Elevators out-of-function - In most buildings (17 out of 21), at least one elevator was out of service and often all elevators were inoperable for most of the day of the quake. An average of half the elevators were out of service for 5 days. No one attributed a financial loss to the fact that the elevators could not be used, but some people did remark on the slight inconvenience caused by having to use the stairways.

Electrical failures - Only in three instances did any electrical problem occur at all, and in those cases there were only minor difficulties which were remedied in about 1 hour.

Plumbing malfunctions and water damage - In only three buildings were there broken water pipes: one pipe broke on the eleventh floor of one building, causing slight water damage, and two buildings had pipes break in the basement only. Also, two building managers reported that subsequent leaks occurred because of pipes being bent during the earthquake.

Suspended light damage and upset - Not until a building reached damage state 3 did any noticeable upset/damage of suspended lights occur. Typically for damage states 3 through 5, one-third of the lights were disturbed or left hanging with a small number of lights actually falling to the floor.

Suspended ceiling upset and damage - While there is no apparent relation to individaul damage states for the lower damage states, displacement of ceiling panels occurred in 8 out the 13 buildings studied having such ceiling systems. Normally the panels shifted position

in the T-bar framework with few panels actually falling to the floor. In one building (placed in damage state 6), however, most ceiling panels were disturbed or fell throughout the building.

Acoustical ceilings - Essentially no damage occurred to acoustical ceilings in the five buildings with this type of ceiling.

Damages to non-stationary items - Non-stationary items were damaged only in isolated instances resulting in quite small losses. One reason for only slight damages is that in most high-rise buildings the majority of the offices and apartments are carpeted, so that when items fell from desks, countertops, shelves, etc., they would fall on the carpet and not be damaged.

Disruption of building contents - Again, there is no apparent dependence on damage state and, in fact, the disruption appears random in its distribution over the damage states. But this may be due to the fact that in two years (since the quake) the people involved may have forgotten how much disruption actually occurred, since they were much more impressed by other, more spectacular events at the time. However, the major contributors to building disruption and the resulting lost time for cleanup were open-shelf storage of small items, books on shelves, and the opening and overturning of file cabinets.

Delays in opening the building - In only one case was a building closed for more than a day: this building was considered condemned. Also, only 3 out of 24 buildings did not open as usual. All three of these buildings were temporarily closed for one day or less in order to clean up debris and straighten up work areas. No economic loss was reported.

Impairment of building function - In most cases, the entire building was usable immediately after it was opened and if it were not entirely usable, adjustments were made to make room available in other parts of the building for the "occupants" of the closed section. In one apartment building, handicapped/aged occupants on the first floor were relocated to another building during the repairs (the apartment owner had to absorb the losses incurred in the differential monthly rental rates for 3 months).

Lost tenants - Essentially no one moved out of the building or quit their job because of building behavior during the earthquake.

Cleanup and restoring order - Cleanup time varied from building to building and usually consisted of cleaning up fallen plaster and broken glass and reshelving/refiling disrupted books and records.

Inconvenience due to repairs - In no case did final repairs cause a cessation of normal activities. Inconvenience consisted of moving desks aside while workmen made repairs; no interference was caused because repairs were made at times when the building was unoccupied.

Devaluation after repairs - In no case did anyone feel the earning power of the building or the desirability of occupying space in the building was decreased. On the contrary, four people felt that their particular buildings increased in value because they fared so well in the quake.

Other information - There were no injuries reported (mostly because of the early hour of the quake), no rescue activities, and no traffic congestion. Also, no cost of repair estimate and supervision was realized because almost all repairs were done either by the buildings'

regular maintenance crews or by the general contractor normally employed by the building management.

VI. Conclusions Drawn from Information Obtained

After reviewing the detailed information, it was noted that there is no trend in the incident damages in some of the lower damage states. Therefore it was decided to collapse two or three damage states into a single state for the purposes of defining and assessing the incident losses in those states. For damage states 1 through 5, the only items which differed with increasing damage state were upset/damage to suspended ceilings and lights, and building closure. Since changes in these categories occurred between damages states 2 and 3, and there was no differentiating the incident damages between damage states 1 and 2 or between 3, 4, or 5, damage states 1 and 2 were combined and referred to as incident state A, and damage states 3, 4, and 5 were combined and referred to as incident state B. For damage states 6, 7, and 8, it is not justified to make further combinations, so they are referred to as incident states C, D, and E, respectively.

Having made this choice of incident states, a revision of the "Scenarios of Buildings in Given Earthquake Damage States" was necessary. This revision has been completed and the new "Scenarios of Buildings in Given Earthquake Incident States" appears under a separate cover.

Furthermore, dollar estimates were made on those incident losses which had sufficient data available from the interviews. In the categories of repair estimate and supervision, property devaluation

after repairs, loss of tenants, loss of business, loss of man-hours due to repair operations, and impact on local economy, the information suggests no economic loss associated with these losses, at least up through damage state 5 (incident state B).

Finally, the incident damages that were reported during the interview were checked to observe what, if any, parameter they are most closely related to. It was noted that upset and damage to conventional suspended ceilings and light fixtures was most closely related to the estimated maximum ground acceleration at the site of the building. Similarly, the fraction of elevators out of service was closely related to the maximum ground acceleration, with most or all elevators going out of service in buildings experiencing a ground acceleration of 0.13 g or greater.

On the other hand, no clear correlation occurred for the other incident damages reported, except for the fraction of the building that was unusable. It was noted that for damage states 1 and 2 (incident state A) the entire building was usable, for damage states 3, 4, and 5 (incident state B) possibl 30% of the building was unusable for up to a week, and for higher damage states the entire building was vacated for up to 3 months (incident state C).

APPENDIX A

Questions to be Asked During Interviews

1. Verify physical damage costs and construction cost.
2. Were you in the building during the quake?
3. Describe, from your own experience as well as from reports from (other) occupants, what was happening in the building during the quake. Specifically, could you feel and/or see any motion of the building? If so, over what fraction of the building could this motion be perceived? What sounds, if any, were heard (e.g., cracking of walls, creaking of steel connections), and over what fraction of the building could they be heard?
4. If the building had light fixtures suspended from the ceiling, were they swinging on their brackets, did the brackets break, the lights fall.... Over what fraction of the building?
5. If the building had suspended ceilings, was shaking strong enough to cause ceiling panels to shake and/or fall out of the framework? Over what fraction of the building?
6. Did the earthquake cause any elevators to go out of function? How many elevators? Out of a total of ___? How long?
7. Were there any electrical failures (power losses, loss of lights)? Over what fraction of the building?
8. Did the plumbing malfunction at all? To what extent?
9. Were non-stationary objects such as chairs, desks, table lamps, books on shelves, etc. shaking, moving, or overturning?
10. How many people were in the building at the time of the quake?

11. How many of these people vacated the building during the quake?

12. How many people were injured, for example, being struck by falling objects, breaking glass, etc? How serious were the injuries?

13. Was anyone killed?

14. Was anyone caused physical pain or injury because a power failure resulted in temporary malfunction of a life support mechanism? Did anyone die as a result of similar circumstances?

15. How did the occupants describe any discomfort or anxiety they may have felt during the quake; for example, were they afraid of being killed, did they enjoy the thrill of it all, etc?

16. Immediately after the quake, what was the typical damage done to each of the following, and over what fraction of the building did this damage extend.

    (a) suspended light fixtures (shades disturbed, hangers broken)

    (b) suspended ceilings (panels fallen, brackets and framework broken or buckled)

    (c) acoustical ceilings (partially dislodged)

    (d) non-stationary items of appreciable individual value, e.g., art objects, television sets, radios, furniture

    (e) non-stationary items of small individual value, e.g., dishes, glasses, picture frames, lamps.

17. How severe was the disruption, if any, of the building contents; what was the degree of upset and over what fraction of the building did it extend for each of the following:

    (a) overturned furniture, lamps

    (b) cabinet doors swinging open, drawers sliding out, and contents falling out

(c) items (such as books, knick-knacks, etc.) falling from open shelves or countertops.

18. Immediately after the quake were the people allowed to re-enter the building or was the building closed until inspected to verify its safety? (if allowed to reenter, go to question 22.b)

19. If the building was first inspected, how much time was required to ascertain whether it was safe or if a structural engineer was required to inspect it?

20. If it was necessary to have an inspection by a structural engineer, how much time was required for him to arrive?

    (a) During this time, were any activities carried on in the building (e.g., cleanup, temporary repairs, etc)?

21. How long did it take the structural engineer to complete the inspection?

    (a) During this time, were any activities carried on in the building?

22. After inspection by the structural engineer, was the building reopened?

    (a) If not: how long was the building out of function?
    what repair activities were carried on in this period (e.g., restoring order, repairs to lights, ceilings)?
    what did the "occupants" do during this period?

    (b) When reopened:
    how much of the building was usable?
    how many of the "occupants" returned immediately?

how many of the "occupants" moved out of the building? and what is the estimate of lost rental income?

when the "occupants" returned, how much time was spent on:

- restoring order (reshelving books, etc.) and who actually did it? in man-hours?
- making temporary repairs of lighting, etc?
- cleaning up broken items, plaster, etc?

23. Did you observe any rescue activities in the city due to the quake? Describe.

24. Did any interruption of normal traffic flow result from consequences of the earthquake? What was the specific cause of the traffic congestion? Was traffic congestion severe enough to have any detrimental effects, for example, impairing rescue activities?

25. After the quake was over and during the process of final repairs, what was the cost of repair estimate and supervision?

26. Did final repair activities interfere with the activities normally carried on in the building? In what manner? How many total man-hours of interruption do you estimate?

27. Sometimes, if a building has had many repairs, or the contents were severely disrupted by an earthquake, people may prefer to rent space in a different building that may not have performed so radically (but is, in fact, equally safe). Do you feel that your building has lost some of its earning value, because of its behavior during the quake, for similar reasons? How would you describe this devalu-

ation? Can you estimate a loss in dollars, in lost rental income, etc?

28. As a result of damages to, or behavior of, most buildings in this area, do you feel there has been any effect on the local economy? For example, a business might have moved to another area of lower seismic activity resulting in a loss of revenue and productivity.

APPENDIX B

Nature of Information Obtained

Building Number	Damage State	Building Function	Indirect Reports Via Mgr.	Direct Report of Mgr.	Tenant Report- In Person	Tenant Report- By Phone	Owner Occupied Building
750	6	0	✓	✓	1		
1779	6	0	✓	✓	2		
(It is suspected that this building is incorrectly classified as state 6).							
69	5	0	✓				
182	5	0				4	
340	5	A	✓	✓			
488	5	0				4	
535	4	0	✓	✓			
664	4	0	✓	✓			
1842	4	0	✓				✓
1845	4	0	✓				✓
87	3	0	✓	✓			
853	3	A	✓	✓	2		
871	3	0	✓	✓			✓
1071	3	0	✓	✓			✓

Building Number	Damage State	Building Function	Indirect Reports Via Mgr.	Direct Report of Mgr.	Tenant Report- In Person	Tenant Report- By Phone	Owner Occupied Building
430	2	0	✓			2	
681	2	0	✓				
682	2	0	✓				
683	2	A	✓				
814	2	0				3	
820	2	0	✓				✓
945	2	H	✓				
999	2	0	✓				
1000	2	0	✓				
51	1	0	✓	✓			
224	1	A	✓				
454	1	0					
886	1	0	✓	✓		2	
1250	1	A	✓	✓			✓
1837	1	A	✓		1		

APPENDIX C

Function	Building Number	Damage State	Repair Cost Ratio	Height (Stories)	Elevators		
					Total	No. OOF	Time OOF
O	750	6	.2583	6	2	2	
O	1779	6*	.4000	6	2	0	
H	340	5	.1077	10	5	1,1,3	7 hrs,2 mos,11 hrs
O	69	5	.0830	11	5	0	each elevator closed for 3 wks for plaster repairs
O	841	5	.0805	11			
O	535	4	.0615	7	2	1,1	<8 hrs,2 wks
O	1842	4	.0400	6	2	2	1 wk
O	1845	4	.0667	3	--all--		1 wk
O	664	4	.0427	5	2	2	30 hrs
O	87	3	.0173	5	2	1	2 days
O	430	3	.0147	7	10	2	a few hrs
O	1071	3	.0133	11	11	1	1 day
O	871	3	.0208	5	2	2	24 hrs
A	853	3	.0161	6	2	2	1 hr
H	945	2	.0114	6	4	1,1,1	1 hr,6 hrs,24 hrs
O	820	2	.0115	11	3	1	1 wk
O	1000	2	.0055	8	2	1,1	2 days,2 wks
O	999	2	.0037	5	--all--		4 hrs
O	681	2	.0058	7			
O	682	2	.0050	5			
A	683	2	.0055	7		0	0
O	51	1	.0005	13	4	2	18 days
O	866	1	.0012	5	4	4	1 day
A	1250	1	.0023	12	2	0	0
A	224	1	.0005	19			
A	1837	1	.0008	19			

* not really 6, because of bad building value information

Building Number	Electrical Problems	Plumbing Problems	Damages to Suspended Lights
750	None	None	50% fell or were hanging
1779	None	None	~6 fixtures fell in unrented areas
340	None	None	{No susp. lts.}
69	-	-	2 broken light covers
841			
535	None	Later, due to bent pipes	Many disturbed. 2 lights fell. $500-600
1842	None	Some A/C pipes broke	A few fixtures fell
1845			20% displaced. A few lights fell
664	None	None	No damage
87	None	2" waterline broke-boiler rm.	{No susp. lts.} A few broken screens on fixed lights
430	None	None	
1071	None	broken waterline-11 flr.	1/3 of lights fell throughout building
871	None	Some water pipes broke in basemt.	
853	No elec.for 1 hr.	None	{No susp. lts.}
945	Only 1 phase on emerg. gen.-1 hr.	None	{No susp. lts.}
820	None	None	No damage
1000	None	None	No damage
999	None	None	No damage
681	None	None	
682	None	None	Lights in Conf. Rm. fell
683	Emerg.lghtng. was out	None	
51	None	? Not directly	No damage to ceilings or lights
866	None	None	several lights left hanging slightly
1250	None	None	{No susp. lts.}
224	None	None	No damage
1837	None	None	No damage

Building Number	Damages to Suspended Ceilings	Damages to 'Acoustical' Ceilings	Damages to Non-Stationary Items
750	Most panels fell or were disturbed throughout building	-	Aquariums fell. Desks damaged by falling concrete. "Extensive personal damage."
1779	-	-	no damage
340	-	No damage	No damage
69	No damage	-	No damage
841			
535	Most panels shifted position-2 panels fell	-	No damage
1842	Edge panels knocked loose	-	No damage
1845	20% displaced	-	Computer equip. was damaged
664	Very minor damage	-	"None reported"
87	------{Plaster ceilings}a few broken screens on fixed lights---		"Nothing drastic"
430			No damage
1071	-	No damage	No damage
871	5 flr-a few brackets broke; most panels fell-less damage elsewhere		4 TV's damaged; occasional table lamp
853	{No susp. ceil.}	No damage	No damage
945	plaster susp.ceil. 6 flr-a few holes		Occasional table lamp fell and broke
820	------{mostly acoustical ceilings}--- No damage	several panels fell	No damage
1000	No damage	-	1 art object; several lamps
999	No damage	-	1 art object; several lamps
681			
682			
683			
51	-- No damage to ceilings or lights --		"Minute"
866	80% of one ceil. fell 20' 5% of all panels fell 2.5% of all panels damaged	-	2 urns damaged = $500 Misc. ash trays
1250	-	No damage	A few knick-knacks fell and broke
224	No damage	-	No damage
1837	Ceiling displ. 2" down on east side-no panels fell	-	No damage

Building Number	Disruption of Furniture	Disruption of Doors	Disruption of Books
750	Chairs & file cabinets overturned throughout building	Doors & drawers opened, contents fell out	All books thrown to floors (bookshelves built into walls)
1779	----------	"No material evidence"	----------
340	2 out of 14 microwave ovens fell & damaged		Small number of books fell from library shelves
69	None	None	None
841			
535	Some chairs overturned on 6 and 7 flrs.	Several instances on south side of 7 flr.	Most books on floor on 6 & 7 flrs; very few elsewhere
1842	90% of 7-8 foot bookcases overturned		Most books fell off shelves
1845	"	In 1 dept, several drawers opened, contents fell out.	"
664	----------	"No major cleanup"	----------
87	None	Very little disturbance	A few books fell in isolated instances
430	None	None	Several books fell - not many
1071	None	"Assumed yes"	Most books fell from shelves-9 flr.law library; incidental elsewhere
871	Water jugs overturned occasionally	File cabinets opened and overturned	About half the books fell from shelves
853	None	Doors opened-mostly top flrs.,some contents out	Some books fell from shelves
945	Sterilizers moved;several shelves collapsed	Various cabinet doors open-contents out occ.	
820	Several floor lamps overturned	1 set of files opened & fell over	A few books fell in 8 flr.law library
1000	Desks slid about a bit	None	
999	Desks slid about a bit	None	
681	Furniture slid about	Drawers opened	A few books fell-2 flr. All books fell-7 & 8 flrs.
682	Some files overturned	Drawers opened	
683			
51	2 sets bkshelves fell over	Opened a crack here & there	All books fell (60% of bldg. had books)
866	2 file cabinets opened & tipped 15°		1/2 bkshelves lost half their books
1250	None	---------- "None reported"	----------
224	None	None	None
1837	None	None	All books fell from shelves over 30% of bldg.

Building Number	Disruption of Shelf Items	Building Open/Closed (Time Closed)	When Open, Fraction of Bldg.Usable	Number of Occupants Coming in As Usual
750		"Vacated" for 3 mos.	All	All returned within 12 mos.
1779	"No material evidence"	Open	All	All but one (personal matter)
340	All charts in Chart-room fell to floor	Open	No patients on 5 flr.til 1 yr.later	All
69	None	Closed for 3 hrs.	All	All but 2 ("rumor")
841				
535	Ash trays & lamps fell on 6 & 7 flrs. mostly	Open	All	All except those w/home damages
1842		Open	All	90%
1845		Open	All except 3 flr.for 1 wk.	90%
664	"No major cleanup"	Open	All	"No fear absenteeism"
87		Open	All	95% because of home damages
430		Open	All	All
1071	Most items fell over thru bldg.	Closed for 1 day	All	All
871		Open	All except 4 flr.-1 day 5 flr.-8 days	1st day-all but 4 & 5 flrs.
853	Ash trays fell to floor	Open	All except 1 flr.-5 mos.	1st flr. handicapped moved away for 3 mos.
945	6 flr.-central service area-bottles,etc.fell	Open	All	All
820		Open	All	All
1000		Open	All	All except a few w/home damages
999		Open	All	All except a few w/home damages
681		Open	All	All
682		Open	All	All
683		Open	All	All
51		Open	All	All
866	All open-shelf filing spewed onto floor	Closed for day of quake	All	80%
1250	None reported	Open	All	All
224	None	Open	All	All
1837	Bottles of liquor fell to floor over 30% of bldg.	Open	All	All

Building Number	Number of Occupants Moving Out	Time Spent in Restoring Order, Cleaning Up and Making Temporary Repairs	Interruption or Inconvenience Caused by Final Repairs
750	None	-	-
1779	None		"Nominal"-moved desks temporarily
340	None	2 days cleaning up glass & boarding windows	5 flr.closed to patients (1 yr.)
69	None	0	None
841			
535	None	2 wks.-3 men	None (plasterer worked at night)
1842	.4% quit jobs	10 days	Moved desks temporarily
1845	.4% quit jobs	10 days	Moved desks temporarily
664	None		Minor: taken as none
87	None	"Almost none"	None
430	None		"None whatsoever"
1071	None	{Couldn't estimate}	"No more than normal"
871	None	300-400 man-hrs.	Small inconvenience-people relocated during repairs
853	1 couple moved back to Colorado	1-1.5 hrs.for 15 people	Noisy & dirty in office for 2 wks.
945	None	Cleanup-20 men, 2 days	Handled normal patient load-relocate patients
820	None	4 people-1/2 day to straighten keypunch files	Moved desks aside-"no inconv."
1000	None	Cleaned stairwells of debris - ? hrs.	None
999	None	Cleaned stairwells of debris - ? hrs.	None
681	None		
682	None		
683	None		
51	None	Cleanup-pick up shelves 2 maint.men-15-18 hrs.	Occupants relocated to other offices temporarily
866	None	Emerg.repairs-95 man-hrs. Emerg.plast & ceil-280 man-hrs.	None
1250	None	Several days to clean up broken glass	None
224	None		None
1837	None		None

Building Number	Devaluation After Repairs	Interviewee Located in Same Bldg.	Remarks
750	None	✓	See tenant report
1779	None	✓	See tenant reports
340	None	✓	
69	None		
841			Waiting for responses via mail
535	None	✓	
1842	None		
1845	None		Information was obtained in interview for Building #1842
664	Increase in value due to stability	✓	
87	None	✓	
430	None		Interview by phone with building supervisory engineer
1071	None	✓	Small water damage was caused on 11 flr. Clerks & lawyers put back own books.
871	None	✓	People on 4 & 5 sent home 1 day only. Book reshelving-extra janitors, regular maintenance, clerks
853	None	✓	See tenant reports
945	None	✓	
820	None	✓	
1000, 999	Increase in value because of good performance	✓	Information was obtained during interview with one manager
681	None		Classrooms — Calif. State University at Northridge
682	None		Admin.& Class. — Calif. State University at Northridge
683	None		Residence Hall — Calif. State University at Northridge
51	None	✓	
866	Increase in value	✓	Clerks did refiling-took up 2 weeks
1250	Increase in value	✓	
224	None		Twin buildings
1837	None		See tenant report

APPENDIX D

Observations Made by Occupants of Buildings

State 6 Bldg.#750 Office

Observations of pharmacist, located on first floor. Most of the small bottles on shelves in the direction of shaking fell to the floor, while few bottles fell from shelves oriented perpendicular to the direction of shaking. The file cabinet drawers slid open. Pane glass from door shattered. Elevators worked for about 10 minutes only. Some stairway connectors were sheared as a result of shaking and the stairways were rickety when used. Electricity was on and off for a while. Ceiling and tiles fell out of the framework. Building was vacated for 3 months, except for the pharmacist and his assistant, who carried on business through an opening in the front wall. It took 2 people a 40-hour week to clean up and restore order.

State 6 Bldg.#1779 Office

Observations of optometrist, located on first floor. No damage to ceilings or lights; a few cracks in the plaster walls. Since all of his lenses, eyeglass frames, etc., were secured, there was no upset in his area. As a result he spent no time in cleanup and restoring order. Also, the final repairs did not interfere with normal activities.

State 5 Bldg.#182 Office

Observations of tenants made via telephone:

Rm. 607 - No disruption; no inconvenience at all; repair work was done around tenant.

Rm. 810 - No disruption; no inconveniences

Rm. 821 - Didn't "know of any inconveniences."

Rm. 717 - No inconveniences; "walking up and down the stairs was a little bother."

State 5 Bldg.#488 Office

Observations of tenants made via telephone:

Rm. 1104 - A number of lenses fell off the shelves: it took 3-4 hours to return them to their proper places. No repairs were made inside; no inconveniences were felt.

Rm. 1115 - No disruption; no inconvenience.

Rm. 718 - No disruption; no inconvenience.

State 4 Bldg.#535 Office

Second-hand observation: there was a man in the elevator at the time of the quake. He heard a counterweight fall and crash through the top of an elevator car. No one was injured.

State 4 Bldg.#1842 Office

Second-hand observation: occupants heard a "tremendous" roaring and creaking sounds of the steel frame and loose joints. The 300-gallon surge tanks, which were suspended from the ceiling, were swinging and hitting the ceiling. One man, in the building during the quake, was

knocked down by the shaking and could not keep standing up. Seismographs recorded accelerations in building 180 of 0.18 g in the basement and 0.36 g on the ninth floor. Parking areas were disrupted as a result of fallen debris, broken glass, etc.

State 4 Bldg.#664 Office

Second-hand observation: the security guard, in the building during the quake, heard sounds of glass breaking. Both elevators were activated by the shaking. The building was described to have "rolled."

State 3 Bldg.#1071 Office

Second-hand observation: Boilerman said the building "shook like hell" and he turned off the gas.

State 3 Bldg.#871 Office

Second-hand observation: the janitor was outside, behind the building, sweeping the parking area when he saw the building shaking and heard the sounds of glass breaking. All the people working in the building at the time stayed in the building and the radio announcer, in fact, did not interrupt his normal broadcasting.

State 3 Bldg.#853 Apartment

Observations of building manager, who was awake and preparing to shave at the time of the quake. He could hear dishes rattling in the

cupboards and could hear and see items on the dresser falling off. He said that on the higher floors people had difficulty standing and some people were rolled out of bed. Motion was described as a rocking movement, like standing on a board which was balanced on a rolling cylinder (teeter-totter effect). Tenants (awakened by the motion) came out of their rooms and congregated in the halls, but did not leave the building because they were not fully-dressed. Hanging light fixtures were swinging like pendulums.

Observations of tenants in apt. 604: they were still in bed when they were awakened by the bed shaking and moving about. This being their second earthquake experience, they remained in bed during the shake. In this time, they heard the sound made by the breaking of a decorative, water-filled jug on the patio after falling. Non-stationary items (knick-knacks, etc.) were not disturbed; no disruption was caused at all.

Observations of tenant in apt. 403: they were still in bed when they were awakened by the bed shaking. The wife thought her husband was shaking the bed at first. They stayed in bed until the shaking stopped. Nothing in the apartment was disturbed; one wall had a plaster crack. Repairs caused a slight inconvenience but the tenants "didn't mind it."

State 2 Bldg.#945 Hospital

Second-hand observation: building was 85% occupied at the time of the quake. People could hear the sounds of cracking partition walls throughout the building. People stayed in their own areas,

as recommended by the nurses. As observed 45 minutes after the quake, there was no chaos and activities were proceeding as usual.

State 2 Bldg.#683 Apartment (Dormitory)

Second-hand observation: the emergency lighting was out and some of the door locks jammed closed so that some people were locked in their rooms. These people had to break the locks to get out. Most people left the building via stairways instead of using the elevators (this was the established evacuation procedure).

State 2 Bldg.#814 Office

Observations of tenants made via telephone:

Rm. 215 - There was some fallen plaster, but this was cleaned up by the building management. There was no disruption, no books fell, etc. No inconvenience was caused by the final repairs.

Rm. 510 - One corner of the acoustical ceiling fell out. In the law library, less than half the books fell from the shelves. During the final repairs, the secretary had to move her desk for half the day, but there was no effect on business.

Rm. 437 - Part of the ceiling fell, "terrifying" the secretary. No inconvenience was caused during repairs.

State 2 Bldg.#430 Office

Observations of tenants made via telephone:

Rm. 720 - A lot of books fell from the shelves in the library only. A couple of large planters fell over and spilled soil onto the floor. One lamp fell over. No inconvenience during repairs.

Rm. 606 - A few books fell from the shelves. No inconvenience during repairs.

State 1 Bldg.#51 Office

Second-hand observation: A night watchman was in the building at the time of the quake. When the building manager came in, he found the "excited" watchman standing under a large beam over the doorway where he could consider himself safe.

State 1 Bldg.#1250 Apartment

Observations of building manager, located on first floor. The tenants were awakened by the shaking. They could hear the sound of window panes squeaking in the casings. Chandeliers were swinging back and forth but weren't damaged. Most tenants fled to the lobby (but not outside) until the shaking stopped.

State 1 Bldg.#1837 Apartment

Observations of tenant: the tenants panicked and congregated in the lobby via stairwells. The tenant interviewed couldn't walk and was knocked down, heard "squeaking sounds" throughout the building, and "thought it was the end."

State 1 Bldg.#454 Office

Observations of tenants made via telephone:

Rm. 502 - There was no disruption or inconvenience during repairs. Repairs were made on weekends.

- There was no disruption, or inconvenience. There was only some cleanup of plaster by the building management.