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HOUSING ISSUES AFTER DISASTERS

By

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Abstract

Since 1989, earthquakes and hurricanes in the United States have caused housing losses on the same scale as those typically experienced in disasters in underdeveloped countries. While casualties in the American disasters have been low, the costs of reconstruction have been staggering. This paper documents the housing losses and recovery problems in the Northridge earthquake and compares that experience to other American urban disasters, (the Loma Prieta earthquake, Hurricanes Hugo and Andrew) as well as with those in Mexico City and Kobe, Japan. The paper will demonstrate that the common denominator in urban disasters is housing, and that recovery issues are quite different in cities than in rural areas, precisely because the losses are concentrated in densely populated areas, and the housing loss not only represents a significant financial investment, but also a unique component of the urban infrastructure.

Introduction

The disaster experiences in the United States in the last decade have forced researchers to rethink accepted models for disaster preparedness, hazards mitigation, and recovery. Hurricane Hugo was followed a month later by the Loma Prieta Earthquake in 1989. In the fall of 1991, the Oakland Hills firestorm incinerated more than 3,000 houses in a matter of hours. In 1992, Hurricane Andrew devastated a 40 mile swath of South Dade County, Florida, while riots devastated parts of downtown Los Angeles. In 1993, there was a 500 year flood on the Mississippi river, and more firestorms in Southern California. In 1994, the Northridge

earthquake caused unprecedented damage in a relatively modern suburban section of Los Angeles.

Then, on the first anniversary of Northridge, an earthquake of similar magnitude struck Kobe, Japan, causing thousands of deaths and damaging $150 billion worth of buildings and infrastructure. Kobe's experience brought home the lessons of vulnerability in cities around the globe. The large scale urban disasters of the 1970s (Managua, Tangshan, and Guatamala City) and the 1980s (Mexico City, San Salvador, and Armenia) were no longer confined to developing countries, where the loss of poorly built slums and squatter settlements seemed inevitable (see Table 1). After a relatively quiet century, Americans were dumbstruck - not only by the magnitude and the frequency of the disasters at home, but by the potential for financial loss in the housing sector. Nothing had prepared us for the problems we would confront in the aftermath of large scale disasters in modern cities.

Table 1
Principal Natural Disasters Since 1985 (Urban Areas Highlighted)

	Housing Units Lost Or Major Damage	Number of Deaths	Economic Loss $ Billion
U. S. Disasters			
1989 Hurricane Hugo	36,000	49	$6.40
1989 Loma Prieta Earthquake	11,500	65	$7.50
1992 Hurricane Andrew	80,000	52	$23.00
1993 Midwestern Floods	50,000	48	$15.00
1994 Northridge Earthquake	60,000	57	$20.00
International Disasters			
1985 Mexico City Earthquake	76,000	7,000	$12.00
1986 San Salvador Earthquake	22,800	1,800	$0.80
1988 Leninakan, Armenia Earthquake	100,000	30,000	$18.00
1990 Manjil Iran Earthquake	95,000	40,000	$7.20
1990 Luzon Philippines Earthquake	25,000	1,200	$1.50
1993 Maharashtra India Earthquake	22,000	9,800	$0.30
1995 Kobe Japan Earthquake	200,000	6,000	$150.00

Note: Between 1985 and 1991 cyclones and floods have killed thousands of people in Bangladesh. Very little information is available on the extent of the housing and economic loss.

Source: Pomonis, 1990; Comerio et. al., 1994; UNDRC, 1995.

By the most traditional measures of disaster intensity, that is, by the number of casualties and the numbers left homeless, Northridge and other the recent American disasters were moderate in comparison to their international counterparts. Financially, however, the magnitude of these disasters was shocking. In the five year period between 1989 and 1994, the value of the housing lost in just five disasters totals more than $75 Billion. More than 200,000 housing units were completely destroyed or substantially damaged. An additional 600,000 housing units required significant repairs. The total housing losses are equivalent to the total number of housing units in metropolitan Seattle.

For over a century, Americans have relied on a combination of private insurance, and limited government assistance to recover from the occasional destruction metered out by mother nature. Now, the insurance industry and the government appear to be searching for ways to control costs in future losses by limiting insurance policy coverage and curtailing some government programs. While some changes are necessary, recent experience suggests more effort is needed to match recovery programs with local housing market conditions. Planning for housing recovery in future disasters does not mean simply finding more sources of capital for repairs, it involves finding strategies to limit losses, and targeting insurance and government recovery programs to meet a variety of local conditions.

The Northridge earthquake housing losses

The Northridge earthquake was the first disaster in which systematic information on damaged buildings was compiled into a database and used by government officials to make sheltering and recovery policy decisions. This data, based on local building inspections, suggested that the Northridge earthquake seriously damaged about 60,000 housing units. The greatest majority of these were in apartment buildings. In a period of a few days, inspectors had looked at nearly

100,000 structures, with more than 400,000 units, and they were confident that they understood the extent of the serious damage to residential structures (see Table 2).

Table 2
Northridge Earthquake: Inspected Residential Structures and Units by Type

Unit Type	Inspected Structures		Inspected Units		Vacated Units	
	#	% of total	#	% of total	#	% of total
Single-family	64,405	72.6%	64,405	14.6%	1,936	10.0%
Multifamily	21,400	24.1%	376,234	85.4%	17,393	90.0%
Unknown	2,885	3.3%	na	na	na	na
Total	88,690	100.0%	440,639	100.0%	19,329	100.0%

Source: Comerio, 1995

The damage to housing appeared to be heavily concentrated in multi-family apartments in the San Fernando Valley of the City of Los Angeles. Only 38 census tracts had more than 100 vacant units and there were 15 neighborhoods, dubbed "Ghost Towns" where the majority of the heavily damaged and vacated units were located. In some of the Ghost Towns, typically an area several blocks long and several blocks wide, as much as 90% of the housing was vacated, but the average for all the ghost towns was 40%. By contrast, the severely damaged housing represented only 3% of the housing in the San Fernando Valley, and 1.5% of the housing in the City of Los Angeles (Comerio with HR&A, Inc., 1996).

Impact on tenants

Because of the experience with severe housing problems after the Loma Prieta earthquake, federal and city officials were concerned that they would face similar problems in Los Angeles. The City of Los Angeles in conjunction with federal officials from the Federal Emergency Management Agency (FEMA) and Housing and Urban Development (HUD), and with participation of the California Governor's Office of Emergency Services (OES), used what they

had learned from the damage data to expedite temporary housing assistance for tenants of damaged buildings and to enhance standard housing recovery programs. Three years after the event, it is possible to look back at sheltering decisions, policies, and programs, and to evaluate their effectiveness in rehousing a displaced population, and rebuilding a damaged housing stock.

For victims displaced from their housing, the combination of FEMA short term rental assistance and HUD Section 8 rent vouchers effectively and quickly rehoused 130,000 middle class and low-income families. The majority of the victims found alternate housing within 2 months of the event, largely because there were extraordinarily high vacancy rants (over 8%) in the rental housing market in the San Fernando Valley, and in the City of Los Angeles at the time of the earthquake.

Why were 130,000 households provided with temporary housing assistance, if 60,000 units were severely damaged and of those, only 20,000 vacated? There are a number of explanations: Many of the vacated units were in large apartment complexes. Even if only some units in some buildings were rendered uninhabitable by the earthquake, many tenants were not willing to stay, and owners may have preferred that tenants leave so that they could evaluate their buildings more carefully. In addition, some tenants and/or homeowners may have needed temporary shelter for a few months in order for repairs to be completed. In fact, buildings with non-structural damage are "green-tagged" (safe for occupancy), but fallen plaster, broken glass, stucco failure, and other "cosmetic" damage can render a units uninhabitable, even if it is technically listed as minor damage.

All but 12,000 of the temporary housing recipients received a FEMA housing assistance check for 2-3 months rent. These could be extended for up to 18 months, but most were not. The 12,000 households who received HUD Section 8 rent vouchers were very low-income, and these vouchers were good for 18 months. In fact, HUD extended the time frame twice, after the

18 month period, and about 2/3s of the original recipients have had their emergency vouchers converted to permanent housing assistance vouchers.

The majority of the households which received temporary housing assistance were low- and moderate-income. Most found alternative housing that was similar in size and rent to what they had before the earthquake. The HUD Section 8 recipients typically rented a larger unit, at a rent $200-$500 more than what they paid before the earthquake. Given that these were very low-income families, often living in severely overcrowded conditions, it is not surprising that these households took advantage of the government assistance to improve their housing conditions.

Essentially the combination of expedited temporary housing assistance and the availability of units on the market made the process of rehousing earthquake victims go smoothly in Los Angeles. In addition, the victims lost housing, but not jobs as a result of the disaster. Still, there were groups of victims that were not well served by the traditional government assistance programs. Because federal aid is not available to those who are not legal residents, many immigrant groups, including legal immigrants, did not seek assistance through the Disaster Application Centers for fear of reprisals. These people turned to community organizations and charities for help with personal losses and housing problems. Although there numbers are not well documented, a Red Cross network of voluntary organizations estimates that about 450 non-profit agencies provided some type of disaster service to 160,000 victims seeking help outside the regular channels (Rabinovitz, HR&A, Inc., and Comerio, 1996).

Impact on multi-family owners

Owners of multi-family apartments did not fare as well as their tenants after the quake. The economics of investor owned housing offers little incentive for owners to rebuild damaged buildings, and government loan programs (from the Small Business Administration, and special HUD allocations to the City of Los Angeles) reached less than half of the multi-family units that

were significantly damaged. Most owners were forced to rely on personal finances to make repairs.

Ironically, the owners of the more affordable housing, that is housing serving tenants whose income is less than 80% of the area median, fared better than most landlords after the Northridge earthquake. These were typically small apartment buildings with less than 10 units owned by a single individual, who may have lived in the building. These buildings had few amenities: no community or exercise rooms and no covered parking, conditions that constitute a soft first story). As a result, units in these buildings typically rented for less than the modern complexes. Because these were fully occupied, owners maintained positive cash flows. In addition, these buildings typically had minor damage, and the repair costs were lower. These owners were able to qualify for SBA loans, and they combined federal low interest loans with personal funds to complete repairs.

Owners of large apartment buildings faced several problems. Those with weakened first stories faced very expensive repairs, and these were the buildings which were in poor financial straits before the earthquake. The combination of high vacancies and declining property values resulting from to the southern California recession meant that they had insufficient cash flows, and insufficient equity to take on additional debt. Further, these large properties are rarely held by a singe owner. Typically, they are owned by investors in a limited partnership, so that any one investor may own parts of several properties. The Small Business Administration loan programs limit the amount any individual can borrow and judge a loan application on the ability to repay. Thus, the complex ownership and the poor financial conditions of the large apartment properties made them ineligible for government loans. These owners had to rely on forbearance from their lenders and private capital to make repairs. In all, very few apartment owners had any earthquake insurance.

The City of Los Angeles identified the financing problems faced by apartment owners early, and petitioned HUD for special allocations of Community Development Block Grant and HOME Investment Partnership funds for earthquake repairs. These programs typically grant funds to a city for the construction or rehabilitation of affordable housing. In this case, the City received a special appropriation of $311 million, and an advance on allocations for future years. In all, the city then made loans to repair about 12,000 units that were not eligible for any other assistance (Comerio with HR&A, Inc., 1996).

One year after the earthquake, 30% of the apartment building owners completed repairs, and 60% claimed they had plans to make repairs. Three years after the event, the City of Los Angeles reports that three out of four vacated units have been repaired (Smith, 1997). This represents the repair of severely damaged units, where the counts are reasonably certain. Much of the minor damage was not well documented. We simply do not know the full extent of apartment buildings with minor damage, nor the extent of the repairs. There is no way to estimate the number of tenants living with a lower quality of housing as a result of the earthquake (The Urban Institute and HR&A, Inc., 1996).

Impact on single family homeowners

The most significant housing issue to emerge from the Northridge experience is the revision of our understanding of single family housing losses. In the first three to six months after the event, city officials, housing experts, and insurance companies reviewed the damage data and concluded that single family losses were comparable to those after the Loma Prieta earthquake. Based on inspection data, the city estimated the total housing damages in the range of $1.5 billion dollars, and insurers estimated their losses at $2.5 billion. Two years later, private insurance and government grants and loans have provided $12.6 billion to more than 500,000 homeowners largely for minor (non-structural, non-life-threatening) repairs (see Table 3).

Table 3
Distribution of Post-Northridge Rebuilding and Repair Funds

Program Source	Fund Use	Amount	Recipients	Average	Notes
Private Insurance	Total	$12,254,600,000	333,214	$36,777	(1)
	Residential Repair and Rebuilding	$7,808,000,000	265,116	$29,451	
	Commercial Repair & Rebuilding	$3,405,000,000	15,708	$216,769	
	Other Uses	$1,041,600,000	52,390	$19,882	
Small Business Administration	Total	$3,929,887,000	120,783	$32,537	(2)
	Loans to Homeowners & Renters	$2,480,973,000	98,847	$25,099	
	Loans to Businesses	$1,448,914,000	21,936	$66,052	
FEMA	Total	$7,170,171,273			(3)
	Funds to State & Local Government (includes infrastructure repair)	$2,668,508,735	21,988	$121,362	
	Minimum Home Repair	$841,249,807	287,778	$2,923	
	Individual Family Grant	$214,307,371	214,227	$1,000	
	Temporary Housing	$380,757,856	119,583	$3,184	
	Hazard Mitigation	$124,347,504	423	$293,966	
	Other Programs and Administration	$2,941,000,000			
Dept. of Housing & Urban Development	Total	$836,500,000	n/a	n/a	(4)
	Grants for housing reconstruction	$605,000,000	n/a	n/a	
	Section 8	$200,000,000	n/a	n/a	
	Other Programs	$31,500,000	n/a	n/a	
Other Federal & State Agencies	Various programs and grants	$1,511,000,000	n/a	n/a	(5)
Total		**$25,702,158,273**	n/a	n/a	

Data Sources and Notes:
(1) California Department of Insurance tabulations as of August 1995
(2) FEMA Situation Report - September 6, 1996
(3) FEMA Status of Northridge Earthquake Recovery, September 6, 1996
(4) The Urban Institute, March 1995
(5) Office of Management and Budget, July 30, 1996

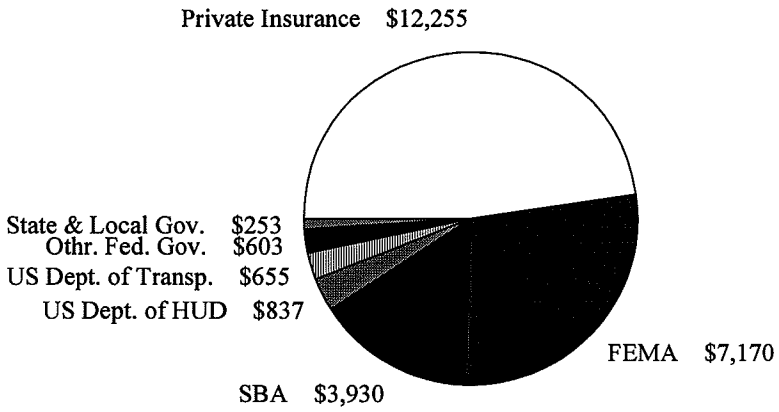
During the post-disaster inspections, 64,000 homes were inspected and all but 7,000 were green tagged. The inspected damaged homes constituted about 25% of the housing stock within 20 km of the fault rupture plane. Officials assumed that because the pattern and proportion of damage was similar to that of pervious earthquakes, these inspected houses were representative of the full extent of the single family damage. However, an analysis of insurance claims and government assistance programs suggests that there was much more damage than originally estimated, and that the damage was distributed over a much wider area.

In fact, 265,000 homeowners received an average of $30,000 in insurance payments; 74,000 homeowners obtained low interest loans from the Small Business administration, averaging $31,000; and 288,000 homeowners received an average of $3,000 each in the Federal Emergency Management Agency's Minimal Home Repair Program. There is some overlap between the insurance and the SBA figures, because owners could supplement insurance with SBA loans. Still, as many as 500,000 homeowners received compensation to repair damaged, and these were distributed in areas as far as 50 km from the fault rupture (Comerio, Landis, and Firpo with Monzon, 1996).

Overall, the total expenditures on the Northridge earthquake by government agencies and private insurance was approximately $25.5 billion. Of this total, half the funds came from private insurance; 40% were from FEMA and SBA, and the remaining 10% was spent by the Departments of Housing and Urban Development, Transportation, and other federal and state agencies (see Figure 1).

How were government and insurance funds spent? Half went to temporary housing and residential repairs, one quarter paid for local government and transportation needs, and 20% was spent on commercial repairs. Obviously, this total does not include expenditures by individuals or funds from private lenders for housing or business recovery. Private investment in post-disaster repairs are almost impossible to estimate, although some economists have suggested that

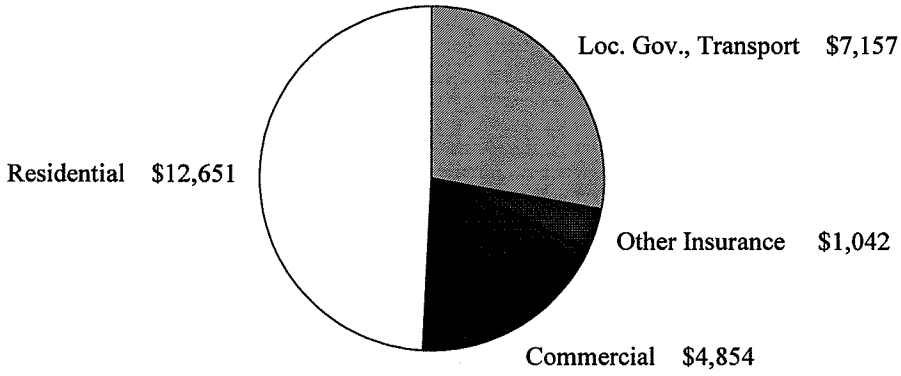
Figure 1: Distribution of Northridge Recovery and Reconstruction Funds by Major Source



Funds in Millions
(Total = $25.7 Billion)

Sources: California Department of Insurance, U.S. Office of Management and the Budget, Governor's Office of Emergency Services.

Figure 2: Distribution of Northridge Recovery and Reconstruction Funds by Major Use



Funds in Millions
(Total = $25.7 Billion)

Sources: California Department of Insurance, U.S. Office of Management and the Budget, Governor's Office of Emergency Services.

private investment could be 2-3 times that of government and insurance expenditures (see Figure 2).

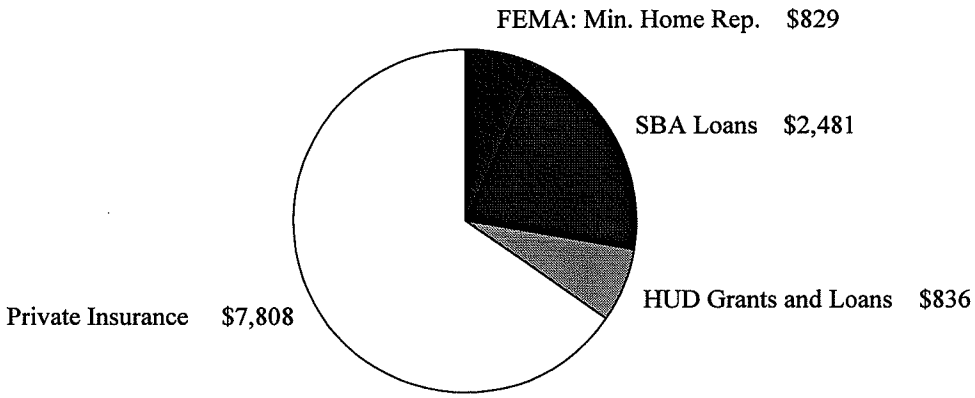
About $12 billion was spent on residential reconstruction. Of this amount, two-thirds came from private insurance and the remainder from government programs (see Figure 3). Of the insurance funds, 50% covered repairs to primary residential structures, 30% was paid out to repair appurtenant structures such as carports, driveways, swimming pools, garden walls, and other outbuildings, 10% paid for loss of contents, and 5% paid for homeowners' temporary living expenses during the time they could not occupy their dwellings (see Figure 4).

If we combine the $4 billion in funds spent by insurers on repairs to the primary residence with the $4 billion spent by government programs targeted specifically toward home repairs, then $8 billion, or two thirds of the total spent on residential recovery, went toward the repair of primary residential space. The financial cost to repair what was largely minor damage shocked the insurance companies and disaster researchers. At the time of the earthquake, inspection data suggested that the damage was concentrated (85%) in multi-family apartments. Two years later, data from the insurance industry and government programs funding repairs suggested that at least half the damage was in single family structures. There are a number of explanations for the discrepancy.

In part, inspection data is always limited and incomplete. Inspectors concentrate on serious structural damage because of the obvious hazards to public safety. Windshield surveys are likely to overlook minor damage in single family homes because it may not be visible from the street. At the same time, multi-family owners or tenants are more likely to call the city for an inspection even if damage appears to be minor, to clarify whether an apartment building can be occupied.

In part, homeowners are more likely to be insured, and have better access to government assistance programs, thus, expenditures for home repairs will be counted as part of disaster costs. Apartment owners are less likely to carry disaster insurance, and many do not qualify for

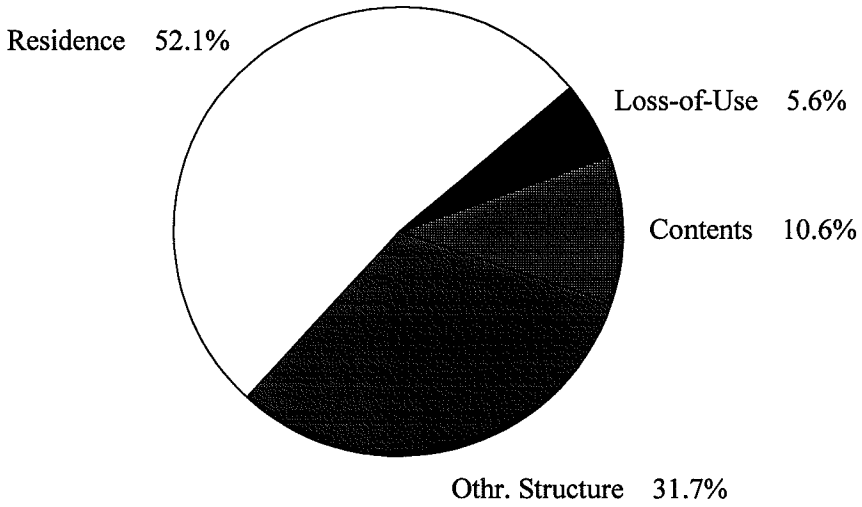
Figure 3: Northridge Residential Reconstruction Funds by Major Source



Funds in Millions
(Total = $11.95 Billion)

Sources: California Department of Insurance, U.S. Office of Management and the Budget, Governor's Office of Emergency Services.

Figure 4: Distribution of Residential Insurance Losses by Loss Type



government loans. These owners are forced to use their personal resources or loans from banks to pay for repairs. As such, their costs are not included in disaster expenditures.

If we review the insurance claims as compared to the damage estimates in past disasters, we find that insurance claims are consistently 3-4 times the number of single family homes listed in the damage estimates (see Table 4). This suggests that the Northridge pattern is not unusual. Damage assessments regularly underestimate the number of single family homes with minor damage. Likewise, estimates of the value of residential losses probably underestimate the total residential losses because they do not include significant private expenditures for multi-family building repairs. Overall, residential losses probably account for even more than a 50% share of total disaster costs.

Comparison to other U.S. urban disasters

In September of 1989, Hurricane Hugo destroyed or substantially damaged 36,000 units in three coastal counties near Charleston, South Carolina. The two most heavily impacted housing types were 1) coastal vacation homes and condominiums, built of light wood frame construction, and developed in a largely *laissez-faire* regulatory context in the 1980s and 2) substandard housing of the rural poor, typically mobile homes placed on uncemented concrete blocks, without proper anchors and hold downs (Miller, 1991; Sparks, 1991, Monday 1992).

Despite the apparent concentration of damage, vacancy rates were high particularly in coastal vacation units. As such, alternative shelter was not a significant issue and nearly half of the residential damage was paid for by insurance. Federal assistance was available for temporary rentals and Small Business Administration repair loans were available to homeowners. Although recovery was reported to be nearly complete within a year of the disaster, about one quarter of those affected had little access to any rebuilding assistance. The rural poor, particularly those in

Table 4: Residential Losses in Recent Urban Disasters

	Hurricane Hugo Septermber 1989	**Loma Prieta Eq.** October 1989	**Hur. Andrew** August 1992	**Northridge Eq.** January 1994	**Mexico City Eq.** September 1985	**Kobe, Japan Eq.** January 1995
Estimated Property Damage	$6.4 Billion	$7.5 Billion	$22.6 Billion	$25 Billion	$12.5 Billion	$90-150 Billion
Estimated Value of Residential Losses	$3 Billion	$2 Billion	$10.5 Billion	$13 Billion	$4.2 Billion	$45-75 Billion
Housing damage as share of total	46%	26%	46%	52%	33%	50%
Damaged Housing Units	112,000	43,000	135,000	500,000	180,000	400,000
Destroyed & severely damaged housing units	36,000	11,500	80,000	60,000	76,000	200,000
% destroyed or severely damaged	32%	27%	59%	20%	50%	50%
% single-family units	71%	40%	63%	11%	0%	70%
% multi-family units	11%	60%	29%	88%	100%	30%
% mobile homes	18%	0%	8%	1%	0%	0%
Number of Insurance Claims	278,000	45,000	300,000	280,000	0	not available
Residential Insurance Payouts	$1.5 Billion	$ .6 Billion	$1.2 Billion	$10 Billion	0	$6 Billion
Residential Vacancy Rate	8%	1%	10%	9%	>1%	>1%

Source: Comerio, *Disasters and Housing,* forthcoming

mobile homes and marginal apartments were dependent on private charities for repairs and reconstruction assistance.

One month after Hurricane Hugo, the 7.1 magnitude Loma Prieta earthquake struck in Northern California, about 100 kilometers southeast of San Francisco. The most visible losses were collapsed bridges and freeways. The housing damage was concentrated in the downtowns of San Francisco, Oakland, Santa Cruz and Watsonville. Although only 11,500 units were lost or significantly damaged, 60% were rental, and 40% could be categorized as affordable, that is, providing housing for individuals and families whose earnings were less than 80% of the median income in the area (Bolin, 1991; Phillips, 1993; Comerio, Landis, and Rofe, 1994).

What kind of buildings were these? In Oakland, downtown San Francisco and Santa Cruz, the majority were four to six story, unreinforced masonry residential hotels and apartments. In Watsonville, all were pre-1940 wood-frame one and two story single family homes. Most of the units were home to the elderly, the indigent, and/or illegal immigrants. They were part of a concentration of run down buildings that provide affordable housing typical in older downtown districts. Despite the fact that the total number of units lost was small in comparison to the total number of housing units in the region, the concentration in low rent units was significant.

Because the American system of disaster assistance was primarily designed for single family homeowners, there were no assistance programs to fit the needs of the victims. There was little alternative housing available at low rents, so the Red Cross and other agencies sheltered victims for record amounts of time: six months in Santa Cruz county, three years in Oakland and San Francisco, where emergency shelters were eventually converted into permanent homeless shelters. Repair and reconstruction proceeded very slowly and depended on funds from affordable housing development programs. While most of the damaged single family homes were repaired or rebuilt in 1-2 years, only 50% of the damaged affordable apartments have been completed in 5 years that followed (Comerio, Landis, and Rofe, 1994; Dietz, 1995).

Hurricane Andrew struck Florida in August of 1992 with winds up to 145 miles per hour. In South Dade County, just south of the City of Miami, 48,000 units were destroyed, and there were over 100,000 units with damage. Twenty five percent (25%) of the destroyed units and 40% of the damaged units were multi-family apartments near the Homestead Air Force Base. The remainder were single family homes (Metropolitan Dade County Planning Department, 1993). All were lightweight wood-frame of one to three story construction. Many were shoddily built and did not conform to building code standards, as these standards were not rigidly enforced.

The State of Florida and the local Red Cross were severely criticized in both their emergency response and their lack of recovery planning. At the same time, FEMA was criticized for not doing enough and the Army was brought in to construct large tent cities to shelter victims. Given the extent and concentration of damage, the short term task of sheltering victims was enormous. In the longer run, Dade County's 10% rental vacancy rate helped in absorbing the majority of the displaced victims. Because the single family homes were insured, most were rebuilt within two to three years. By contrast, little of the multi-family housing was rebuilt. Without the jobs provided by the airforce base, most renters simply left the area.

Northridge had more in common with the Hurricanes, Hugo and Andrew, than with the Loma Prieta earthquake. In the three disasters, high vacancy rates allowed victims to be easily resettled into the existing housing stock. In the three disasters, homeowners quickly made repairs with insurance funds. By comparison, in the Loma Prieta earthquake, a small number of highly concentrated low-income housing losses caused serious sheltering and repair problems.

International urban disasters

The common thread between recent American urban disaster losses and similar events around the globe is the combination of substantial housing loss with staggering economic loss. While

the casualty rate in disasters in developing countries is a predominant concern, the impact of urban housing loss is an issue for rich and poor nations alike. The urban losses most comparable to the United States experience were in 1985 in Mexico City and 1995 in Kobe Japan. The contrast in government policies implemented after these two disasters demonstrate the significance of government policies on private housing recovery.

Mexico City, Mexico

While the 1985 earthquake's epicenter was 400 km from Mexico City, the soft soils of the lakebed underlying the city amplified the shock waves. Official estimates of 7,000 dead and 76,000 units destroyed (180,000 units damaged) were certainly low. The majority of the damage was concentrated within three of the sixteen districts that comprise the Federal District. Although the damage represents only a tiny portion of the housing in Mexico City, the physical and social concentration of damage combined with severe housing shortages created difficult sheltering and recovery problems.

Two of the damaged areas, the Cuauhtemoc and V. Carranza wards were filled with overcrowded tenements housing working families at minimal (controlled) rents. Owners of the slum properties had no incentive to rebuild. When residents organized politically, and refused to be moved to a new town site outside the city center, the Mexican government, supported by a World Bank loan, and concessions in the national debt restructuring, decided to rebuild and sell the subsidized units to disaster victims. Victims were temporarily housed in tin structures in the streets, land was expropriated, and some 88,000 housing units were repaired or rebuilt in government sponsored programs in a two year period. An additional 7,400 units were repaired by private charities and Non-Governmental Organizations (DFF, 1986, 1987; SEDUE, 1987; Echeverria, 1991; Comerio, forthcoming).

Kobe, Japan

In Kobe, the epicenter of the 7.2 Richter magnitude earthquake was directly beneath the city, and 6,000 people died in the event. The damage to buildings and infrastructure, as well as the economic losses dwarfed those in Mexico City and Northridge. Port facilities, freeways and railroads were extensively damaged. About 4,000 commercial, industrial, and public buildings were heavily damaged or collapsed. In total, approximately 400,000 housing units in 190,000 buildings were damaged. According to government estimates the cost of reconstruction is estimated at 15 trillion yen, or $150 billion US dollars (EQE International, 1995; Funahashi, 1995; UNCRD, 1995; Comerio, forthcoming).

The displaced population lived in shelters for months, and virtually every neighborhood schoolyard or park is still crammed with temporary units (Asano, 1995; Eadie, 1995; Hyogo Cultural Center, 1995). What are the prospects for recovery? Access to private recovery funds are limited by a lack of insurance. Only about 7% of Japanese homeowners carry an earthquake endorsement on their policy, and the payout is capped at 50% of the value of the structure (EQE International, 1995). Although the government has developed a three year plan to build 125,000 units, and some land has been acquired, no construction has begun 2 years after the event, nor have the bonds necessary to finance the construction been sold. It appears that housing recovery in the heavily damaged wards of central Kobe will take years (Tomioka, 1997; Comerio, forthcoming).

Can American and European cities expect the devastating losses experienced in Mexico City or Kobe? The answer is yes, and no. Certainly, the financial and physical losses experienced in Andrew and Northridge are a fraction of what could happen in a slightly larger disaster, slightly closer to the urban core. Certainly, the older sections of European cities have building conditions and populations densities that mirror those in Mexico City or Kobe. But to answer

the question, will there be a crisis here, cities need to take stock of the risks they face, the condition of their housing inventory, and the state of their housing markets.

Urban recovery issues

The recent American disasters, like Mexico City and Kobe, have been perceived as individual and unique events, and recovery planning has not taken advantage of the opportunity for comparative research on urban disasters. What can these recent urban disasters teach us? First, traditional measures of geological or hydrometeorological intensity, casualty rates, or even the numbers of people made homeless are not the appropriate indicators of a need for outside aid. As hurricane Andrew and the Northridge earthquake indicate, damage to large numbers of well insured single family homes does not cause a recovery crisis. The losses may cause temporary housing shortages if all the housing in a particular locale is uninhabitable as happened in Andrew, but if a disaster happens in a weak housing market, as in Northridge, then even temporary housing is not an issue.

Second, the concentration of housing losses in a particular market sector is a much more important indicator of a possible housing crisis than the number of housing units lost. What Mexico City, Loma Prieta and Kobe have in common is that in each case, there were concentrated losses of multi-family housing in dense urban neighborhoods. The fact that the losses represented only a tiny percentage of the total urban housing stock was irrelevant. In each of the cities, vacancy rates in rental housing were extremely low, crowding was common, and "choice" was unheard of, particularly at the bottom of the housing market. In these earthquakes, the victims were predominantly low and moderate income renters, or as in Kobe, renters and homeowners without insurance. The victims were people whose lives were tied to an urban core, to jobs, to services and the social net that cities provide.

What distinguishes Mexico City, Loma Prieta, and Kobe is that there was no alternative temporary housing for victims and there was no system of insurance or governmental aid in place to assist in the rebuilding of lost housing. By contrast, the hurricanes, Hugo and Andrew, occurred in metropolitan areas with high vacancy rates and victims found alternative temporary housing relatively quickly. The storms largely affected single family homes with insurance and these were repaired quickly. But even in these cases, rental housing was largely unreplaced and the uninsured owners of mobile homes and marginal dwellings relied on charities to help them rebuild.

What distinguishes Mexico City from all the others is the unprecedented political commitment of the national government to rebuild. In the months immediately following the earthquake in 1985, displaced residents refused to be moved to new towns on the outskirts of Mexico City. Fearing political unrest, the President of Mexico used the special relationship between Mexico's national government and Mexico City (one in which the Mayor is appointed by the President) to provide the funds and the operational structure to mount a rebuilding program. With a combination of World Bank loans and concessions on Mexico's international debt restructuring, the government used agencies in the Federal District combined with the Ministry of Urban Development and Ecology, and a newly created agency, *Renovacion*, to expropriate land and oversee the construction of 48,000 new units and the repair of an additional 46,000 (DFF, 1986, 1987; SEDUE, 1987; Echeverria, 1991; Comerio, forthcoming).

The Northridge recovery is an interesting comparison because the housing losses were also concentrated in apartments, albeit, middle class apartments in a suburban section of Los Angeles. As in the hurricane cases, rental vacancy rates were high and alternative temporary housing was not difficult for victims to find. The federal government provided significant funds to assist victims in finding alternative shelter. Three weeks after the event, no one was camping in the parks and on the streets. Similar to the Mexico and Loma Prieta situations, the losses were

concentrated in apartments in a few neighborhoods. The apartment buildings were typically uninsured and heavily leveraged, making the cost of additional financing to pay for reconstruction infeasable in a weak rental market. Clearly, the majority of the damaged apartments would not have been repaired had it not been for a proactive effort on the part of the City government to secure non-disaster federal housing loan funds and target them for repair programs (Comerio with HR&A, Inc., 1996; Smith, 1997).

At the same time, homeowners in the Los Angeles basin received billions of dollars in insurance settlements and government low interest loans for repair of minor damages. Like hurricane area residents, many in the greater Los Angeles region took advantage of homeowners insurance and disaster assistance, not only to repair damage but to redecorate and improve their properties (Comerio, Landis, and Firpo with Monzon, 1996). The discrepancy between the recovery assistance available specifically for homeowners and the limited assistance for repairs in multi-family housing is both troubling and telling. In the American setting, where homeownership is perceived as the predominant and ideal form of housing, disaster policy follows general housing policy in favoring homeowners.

In reality, there are as many units of multi-family housing as there are single family detached homes. Even in Los Angeles, the land of the bungalows, 56% of all housing is in multi family buildings (HR&A, 1994). In California, nearly half of the housing units in the state are multi-family. Nationally, the number of multi-family units is about forty percent (US Census, 1990, 1993). Such statistics are comparable, if not higher, in cities around the globe.

It is not surprising that in a world where 75% of the population of developed countries and 47% of people in developing countries live in urban areas (UN, 1987), urban disasters in the last decade have damaged housing on an unprecedented scale. What is surprising is the lack of attention to the unique circumstances of urban housing recovery. In terms of damage, Northridge is the likely model for future urban disasters in developed countries. Although only a

small percent of a city's total housing stock will be affected, in some neighborhoods, 50% to 80% of the housing will be uninhabitable, and a majority of that will be in multi-family structures (Comerio, 1995; and Comerio, forthcoming). The capacity to rehouse victims will depend entirely on the availability of undamaged housing at comparable rents.

In terms of recovery, the Kobe experience, not that of Mexico City, is the likely scenario. American insurance companies have stopped offering disaster insurance or have severely limited coverage in homeowner policies. At the same time, lenders appear to be willing to make loans on residential properties in high hazard areas, without safety inspections or mitigation requirements. In future disasters, Americans are likely to find themselves in circumstances similar to those in other countries, with limited private insurance and limited access to capital for post-disaster rebuilding. Unfortunately, public assistance for private housing repairs will also diminish as governments are unable to cope with the public as well as the private costs of recovery.

Housing policy lessons

The scale of the potential losses due to earthquakes or hurricanes in major urban centers is staggering. Recent urban disasters have made it clear that housing is the single greatest component of all losses in terms of economic value and in terms of buildings damaged. As a result, the potential for a major housing crisis exists if there is no mechanism to provide alternative housing for victims, or if there is no capacity to finance the repair or reconstruction of units lost in a reasonable time frame. While there is no question that government's primary role is the restoration of services and public infrastructure, the dramatic and significant housing losses in recent urban disasters raises questions about the need to improve conditions in the existing private housing stock, which represents about 70% of the total building stock.

However, recent experience has also demonstrated that not every natural disaster in an urban area causes a housing crisis. Because the scale of metropolitan areas are large and housing resources are varied, one can no longer measure the magnitude of the disaster in terms of units affected or victims displaced. Instead, it is important to look at the loss in relation to existing housing resources and conditions in the housing market. If the number of units lost or rendered uninhabitable is very large, but represents only a small percentage of a particular housing type in soft market, alternative housing may not pose significant problems. Whereas, even if the numbers lost are small, if they represent a majority of housing types in a limited price range, then shelter will be a critical issue.

There are eight important lessons that can be learned from recent urban disasters:

1. Damage to residential stock constitutes the majority of the damage.
2. The major structural damage commands media attention and often frames government response, but it is the minor damage that costs the most to repair.
3. Just as we have learned that there is a surprising amount of redundancy in the transportation infrastructure, so too is there redundancy in the housing stock.
4. Governments have made significant advances in improving emergency response, but there has been little preparation for the much bigger task of coordinating and paying for post-disaster rebuilding.
5. Private insurance is and will continue to be the primary fund source for private rebuilding.
6. To maintain a functioning insurance market, governments need to improve loss estimation and rate setting models, and to increase the level of research into the links between specific building designs, appropriate mitigation and retrofit steps, and reconstruction costs.
7. Government rebuilding programs need to be more efficient and targeted to complement rather than substitute for insurance coverage.

8. Mitigation policies and programs must be viewed as part of the funding for recovery, and not simply as disaster preparedness.

Taken together, these lessons suggest that in future urban disasters, we can expect life-threatening major structural damage will be confined to a small portion of the overall damage, but that the cost of repairs for residential damage will be astronomical. Most important, neither the private insurance industry nor any national government is prepared to respond with rebuilding assistance comparable to that expended in Mexico City or even Northridge. In this light, mitigation becomes an essential component of recovery, because the best way to reduce the cost of post-earthquake rebuilding is through reduction of damages.

Although many cities in high hazard regions are bolstering their building codes and improving infrastructure in anticipation of major earthquakes and hurricanes, codes for new construction or retrofit codes applied to a narrow spectrum of building types (such as unreinforced masonry), are inadequate policy in the face of the potential for damage in the existing building stock. Best building practices must be combined with strategies for hazard mitigation, improved lending practices, and an improved climate for private insurance. Finally, disasters must become an urban policy priority. With an increasingly urbanized population in high hazard zones in countries around the world, we literally cannot afford to do otherwise.

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