Natural Hazard Research

THE HYATT SKYWALK DISASTER AND OTHER LESSONS IN THE REGULATION OF BUILDING

William L. Waugh, Jr.
Georgia State University

and

Ronald John Hy
University of Arkansas, Little Rock

February 1995

Working Paper #91

PREFACE

This paper is one of a series on research in progress in the field of human adjustments to natural hazards. The Natural Hazards Working Paper Series is intended to aid the rapid distribution of research findings and information. Publication in the series is open to all hazards researchers and does not preclude more formal publication. Indeed, reader response to a publication in this series can be used to improve papers for submission to journal or book publishers.

Orders for copies of these papers and correspondence regarding the series should be directed to:

The Natural Hazards Research and Applications
Information Center
Institute of Behavioral Science #6
Campus Box 482
University of Colorado
Boulder, CO 80309-0482
(303) 492-6819
E-mail: jclark@colorado.edu

Table of Contents

The Hyatt Skywalk Disaster and Other Lessons in the Regulation of Building

Introduction

The emergency management literature often focuses on the lessons of major disasters and how they can inform future action. Indeed, the current disaster aid process requires formal state and local action for identifying and addressing problem areas in order to mitigate future disasters. Enforcement of building standards is one of the oldest forms of government-mandated disaster mitigation. Royal decrees to transform wooden, fire-prone buildings into stone structures marked turning points in European urban history. Governments in the U.S., however, have generally been less willing or less capable of regulating construction. As a consequence, there have been a few major structural failures and thousands, if not millions, of minor ones.

This is a preliminary examination of the use of building codes as disaster mitigation tools. Using the Hyatt skywalk disaster in Kansas City in 1981 as a reference point, the analysis will seek to determine whether the same kinds of problems with building code adoption and enforcement existed in more recent disasters. If so, what can be done to encourage better regulation of building construction to reduce exposure to structural failures? The specific questions examined in this paper are: 1) What was learned about hazard mitigation from the Hyatt skywalk collapse in 1981? and 2) Were the problems identified in that disaster alleviated?

Building codes are getting more and more attention. Hurricane Andrew alone caused $15.4 billion in losses to the insurance industry, much of which could have been mitigated if building codes in south Florida had been adequately enforced. Such enforcement is primarily a state and local responsibility; most communities rely on a regional or national standard such as the American Insurance Association's National Building Code, the International Conference of Building Officials' (ICBO) Uniform Building Code, the Building Officials and Code Administrators' (BOCA) Code, and

the Southern Building Code Congress International's code (Hy, 1990: 240-241). [1]

The Lessons from the Hyatt Skywalk Disaster

On Friday night, July 24th, 1981, approximately 1,500 people gathered at the Hyatt Regency Hotel in Kansas City for an informal tea dance. Just after 7:00 p.m., a 120-foot, 90,000-pound concrete skywalk fell onto a second skywalk and into the crowded lobby. Of the approximately 50 people on the upper walkway, 100 on the lower walkway, and 200 on the lobby floor directly underneath, 113 were killed and almost 200 others were injured seriously enough to require medical assistance. The gruesome drama went on for over 12 hours as survivors and bodies were uncovered.

The collapse of the suspended walkways onto the lobby of the Hyatt Regency was an unusual event, to say the least. Structural collapses are not common occurrences in the United States. The emergency response was remarkable, despite a number of major problems. The bigger issue, however, was the structural flaw that caused the collapse. How did it happen and who was responsible? In the investigation that followed, the Federal Bureau of Standards tested the building materials, the Occupational Safety and Health Administration checked its records for early warning signs of impending problems, building contractors and construction managers were investigated, the city's building code enforcement and inspection processes were investigated, and, ultimately, the state's licensing process for professional engineers was examined (Waugh, 1988).

The resulting reports indicated that a variety of factors may have contributed to the collapse. First, the nature of the skywalks' design may have contributed to the fatal weakness. That conclusion was reached by the American Institute of Architects (AIA) in an earlier study of five failures of "long span construction" like the Hyatt skywalks. The AIA found that these "long span" projects possessed

---

1. This paper focuses on standards for buildings, rather than standards for construction of bridges, dams, and other structures.

similar characteristics, including:

- design and construction oversight difficulties due to the considerable complexity of the construction projects, which used the services of hundreds of contractors and subcontractors;
- use of light materials and exotic designs;
- lack of redundancy in long-span supports;
- strong pressures to reduce costs; and
- too little oversight and inspection (Waugh, 1988).

Other investigations cited the failure of city building code enforcement. The exotic Hyatt designs may not have been monitored as closely as they should have been, but that was not an unusual problem given the limited resources of most city building departments in relation to the technical difficulties inherent in regulating exotic designs and large-scale construction projects. The building code itself was cited as inadequate because the swaying of the spectators on the walkways to the music below likely created synchronous "harmonic motion" that contributed to the failure. Normal foot traffic would not normally create such motion, unless all were walking in step or moving side to side. Moreover, if the city building code had conformed to the local seismic risk zone designation, the construction may have accommodated the swaying motion. Finally, the code administrator who reviewed the design drawings in question had examined as many as 100 other sets of hotel design drawings on the same day. Thus, the effectiveness of oversight by overworked administrators was questionable at best (Waugh, 1988).

News media investigations also found city building inspectors to be low-paid, low-skilled employees who often shirked their responsibilities. Many inspections were suspect because of poor recordkeeping. And, as attention focused on faulty skywalk supports, the investigations followed the design and approval process from the desks of the architects to the computers of the structural

engineers to the design and fabrication contractors and the city code administrators. Ultimately, blame was placed upon an engineer who approved the support designs and the steel fabrication firm that built the supports. The state of Missouri's regulation of professional engineers was also questioned because the engineer who approved the designs lacked proper state credentials (Waugh, 1988). The structural engineers were found at fault and their licenses were revoked by the state of Missouri in 1987. The state's investigation also concluded that the building codes were adequate, albeit poorly administered during the construction of the Hyatt Regency (Hy, 1990).

In some measure, the building industry learned that the skywalk disaster was very similar to other lesser structural failures. Architects, structural engineers, and construction management firms learned that major failures can result in extremely costly liability suits. However, whether the skywalk lesson has helped them deal more appropriately with pressures to build quickly and at the lowest costs is uncertain.

What did the Kansas City government learn? The building department underwent major changes following a media investigation several years later, when reporters followed inspectors and discovered that many were not attending to their inspection responsibilities. Some, it was found, held second jobs while they were supposed to be conducting inspections. Likewise, building inspections were often recorded despite very brief, or sometimes no, visits to construction sites.

Other Disasters and the Same Lessons

A 1988 study by Philip Berke and Suzanne Wilhite found that among communities with relatively high earthquake risks (zones 3 and 4), 97.6% of California communities and 81.7% of other U.S. communities had adopted building codes. However, while 69.4% of the California communities had special seismic-resistant building standards, only 9.2% of the high risk communities outside of California had special standards (p. 10). The differences may, in part, be explained by the

relative infrequency of earthquakes in the Midwest and eastern U.S., hence the low salience of earthquake mitigation efforts. Another explanation may be the comparatively fewer contacts between local officials in the communities outside of California and representatives of federal agencies (i.e., the U.S. Geological Survey, the Federal Emergency Management Agency, and the U.S. Army Corps of Engineers); professional engineering/construction associations; and private consultants interested in earthquake hazards. Communities outside California also had fewer contacts with state and regional agencies (p. 26). The latter finding may be more critical in determining local attention to building codes and other mitigation tools.

The interagency hazard mitigation team report from the Hurricane Hugo disaster noted that the state of South Carolina had no statewide code and that local code adoption was optional. State legislation in 1972 permitted counties, cities, and towns to mandate conformity with the current Standard Building Code and National Fire Protection Association standards. Those jurisdictions that adopted the standards were also required to create building departments with at least one administrator. However, when Hurricane Hugo made landfall in 1989, only about half of the cities and a third of the counties had adopted the Standard Building Code. Moreover, while the 1972 legislation also created a state agency to oversee and facilitate the adoption of local codes, approve modifications, and hear appeals, the agency was given no enforcement authority over local codes. The agency's primary role was in designating responsible building officials for state buildings and schools (FEMA, 1989: 25-26).

The mitigation report recommended mandating statewide adoption of building codes, regulating qualifications of building officials, and requiring all jurisdictions to have enough certified officials to enforce codes. The report also expressed concerns about nonconformity with seismic design standards, poor coastal construction techniques, noncompliance with coastal wind standards, and poor design standards for manufactured housing. The hazard mitigation team recommended

workshops for contractors and building officials and more stringent standards.

Indeed, Elliot Mittler's study of the public policy response to Hurricane Hugo in South Carolina found there was strong political opposition to mandatory state building codes in the 1980s, and the experience of Hurricane Hugo did not overcome funding concerns of local officials (1993). A state-mandated building code, without state funding for code enforcement, failed to survive legislative action. Nonetheless, Mittler's study did suggest that city officials in Charleston had some defined views on the adequacy of building codes for hurricanes because of their direct experience with Hugo, but little notion of the adequacy of the codes for earthquake hazard reduction. That uncertainty, however, led most of the officials surveyed to indicate support for retrofitting buildings to better withstand earthquakes, although most felt that such an ordinance would not pass in the near future (1993: 53-54).

By contrast, the mitigation reports for hurricane disasters in Massachusetts, Maine, and New Hampshire in 1991 suggested assistance to building inspectors relative to unusual damage, such as information on the effects of storm surge on patios built between seawalls and homes, as well as strengthened requirements for rebuilding to assure conformity with newer building standards.

It is perhaps unfortunate that initial reports on the Hurricane Andrew disaster stated that building codes were weak in Florida. In fact, the building code in south Florida is "one of the toughest in the country" (Levy and Toulmin, 1993: 21). Problems were caused by poor construction, poor building code enforcement, and windspeeds in excess of the maximum design speed of 120 m.p.h. Manufactured housing did not meet federal construction standards, often failing in winds as low as 80 m.p.h., despite a construction design standard of 110 m.p.h. (Levy and Toulmin, 1993). In addition, Levy and Toulmin recommended retrofitting, better siting, and other mitigation actions to reduce vulnerability to future disasters.

Indeed, the patterns of destruction caused by Hurricane Andrew are being evaluated. There is

evidence the damage to buildings followed the circular patterns of the thunderstorms that preceded and accompanied the eye's landfall. That is, rather than damage that suggests a "wall" of wind moving inland from the eye, the damage pattern seems to be caused by windsheers and other downdrafts from thunderstorms flowing around the hurricane's eye, which ripped roofs off buildings. If research determines the circular pattern occurred, building codes need to reflect levels of risk different from those currently in use.

One of the more obvious arenas in which building codes are evaluated is earthquake hazard reduction. A number of major actors involved in the National Earthquake Hazards Reduction Program (NEHRP), which was created in 1977 to reduce exposure to earthquake losses, have focused their recommendations on the adequacy of state and local regulation of building standards. The Federal Emergency Management Agency's (FEMA) advisory committee noted the problem of local action when code compliance is voluntary rather than mandated, both in terms of state and local government action and in terms of mitigation efforts by building owners. FEMA's advisory committee stated that "unless NEHRP legislation incorporates a programmatic implementation mechanism that creates strong incentives for the adoption of risk-reduction measures, the loss mitigation goals of the Program will not be achieved in the foreseeable future" (FEMA, 1993: 1).

The report also noted that state adoptions of building codes have been improving, but many local governments delete the seismic-safety provisions, while many others simply lack the expertise to enforce them. Retrofitting of buildings is seldom required. The committee recommended that conformity with adequate seismic-safety standards be instituted. Conformity, according to the report, could be required for all federal buildings and construction funded or guaranteed directly or indirectly by the federal government or through loans insured by the FDIC or any government agency. For other construction, additional mechanisms could include tax credits; tax-free bonds; matching grants; requirements for receiving disaster aid; and/or a federal disaster insurance program with stringent

risk-reduction requirements (FEMA, 1993: 13).

In terms of requiring retrofitting of older, particularly unreinforced masonry, buildings, the city of Los Angeles found that mandated retrofitting places a greater burden on older housing stock, with costs transferred to lower-income tenants. In light of these cost transfers, a retrofitting program might begin with an inventory of older buildings, including classification of risk levels to human life (e.g., occupancy loads) to permit prioritization of compliance efforts, and standard setting for retrofitting. Such a program should recognize the costs to owners and tenants; financing issues (i.e., the long-term costs and where such resources may come from); and timing of expenditures for retrofitting, city financing, and city administration (Comerio, 1991).

An illustration of the financial aspects of building code enforcement and retrofitting is provided by Richard Stuart Olson and Robert A. Olson in their study of community reactions to an earthquake in Oroville, California, in 1975. The principal local issues were paying for retrofitting old buildings and keeping downtown businesses competitive despite the added expense of more stringent building codes. Because there was little or no federal and state financial disaster assistance, Oroville was bearing virtually all the expense of recovery (Olson and Olson, 1993). This case is interesting because it focuses on local concerns, much like Mittler's (1993) description of the debate in South Carolina over state-mandated building codes.

The report of FEMA's Task Force on Urban Wildfire (1992) focuses on the financial burden of compliance, as well. Although the task force emphasizes the importance of identifying high risk areas and adding wildfire provisions to building codes to reduce structural and property vulnerability, the group also underscores the need to pay for such efforts. The report summarizes recommendations from several panels, which include offering monetary incentives to use fire-resistant materials for rebuilding, amortizing the costs of compliance, offering tax credits, levying special assessments, using lending standards to force code compliance, employing the National Flood Insurance Program model

to require compliance in return for insurance, and proposing model legislation. The United Fire Code is a companion to the Uniform Building Code, and provisions of the fire code can easily be added to building codes—if local officials are willing or able to do so.

Conclusions

Like much of emergency management, the problem is how to provide local officials with state and federal resources and, at the same time, encourage local action to reduce hazards. In some measure it is a question of administrative and fiscal capacity; but, it may also be a question of political capacity. As in the Oroville and South Carolina cases, there are strong state and local interests that oppose codes and regulations and plans that might raise the costs of doing business, increase taxes, or limit private use of property. Thus, state action to mandate building codes appears easier than local action. With some fiscal support from federal and state governments, at least some of the objections to adequate building codes could be answered.

The insurance industry also has considerable interest in more effective building codes and enforcement. There has been some debate over the impacts of recent disasters on the insurance industry and the adequacy of reinsurance programs, but there have also been clear indications that insurers are interested in reducing exposure, or at least in defining them accurately. In fact, some companies stopped issuing residential insurance in south Florida following Hurricane Andrew, indicating considerable concern about future losses. In short, insurance companies want to improve the adequacy of building codes and their enforcement, and may choose to not provide insurance, rather than substantially increase premiums (Roth, 1993: 4-5).

Hurricane Andrew provided a painful lesson concerning manufactured housing. As many as 18,000 mobile homes were damaged or destroyed in south Florida and Louisiana during the hurricane. Clearly, one of the problems was that mobile homes were only required to hold up under

80 m.p.h. winds, while Andrew's winds hit 160 m.p.h. As a result, new federal standards for mobile homes went into effect in July 1994 that require mobile homes sold in Hawaii and 25 counties on the coasts of Alaska, Louisiana, Florida, and North Carolina be able to withstand 110 m.p.h. winds. Mobile homes sold in another 91 counties in Alaska, Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, Virginia, Massachusetts, and Maine must be able to withstand 100 m.p.h. winds. Nevertheless, the costs of compliance are uncertain. The Department of Housing and Urban Development (HUD) estimates that the 110 m.p.h. standard will increase mobile home manufacturing costs from $1,200 to $1,500 and that the 100 m.p.h. standard will increase costs $800 to $1,000. If these costs are passed on to consumers, the 110 m.p.h. standard may raise prices $5,500 to $6,000 and the 100 m.p.h. standard may raise prices $3,600 to $4,500 (McConnaughey, 1994).

More information is also needed on specific structural problems during earthquakes and the need for more focused building codes and land use regulations (see, e.g., U.S. Geological Survey, 1989). General statewide building codes may not address risks in particular localities. In fact, an International City Management Association study in the early 1980s found that few cities developed their building codes specifically to address the hazards common to their areas, except in flood areas (May and Williams, 1986: 52). Also, there needs to be more recognition of the need for federal and state assistance in financing building code enforcement and other disaster mitigation programs (National Research Council, 1991: 25). Fiscal incentives may overcome the lack of interest among some communities in disaster mitigation and fuel the interest in others. Local budgetary limitations make it difficult for officials to spend scarce dollars on uncertain purposes.

As well as focusing building standards on specific known hazards and improving code enforcement, some means of dealing with the decay of standards over time is needed. Building code enforcement is generally outside the jurisdiction of emergency managers, although the

promotion of standards may be an important component of a disaster mitigation program (Perry, 1985: 122; Pickett and Block, 1991: 285-286).

REFERENCES

Comerio, Mary C.
1991 "Financing the Seismic Retrofit of URM Residential Buildings: The Los Angeles Experience and Its Implications for Other Cities." Paper presented at the UCLA International Conference on the Impact of Natural Disasters: Agenda for Future Action, Los Angeles, California, July 10-12.

Federal Emergency Management Agency (FEMA)
1993 *Report of the Advisory Committee of the National Earthquake Hazards Reduction Program (NEHRP).* Washington, D.C.: FEMA, Office of Earthquakes and Natural Hazards.

1992 *Inter-Agency Hazard Mitigation Team Report: The October 30-November 2, 1991 Disaster Declarations for the States of Massachusetts, Maine, and New Hampshire.* FEMA 920-DR-MA, FEMA 921-DR-ME, FEMA 923-DR-NH, April.

1992 *Report of the Operation Urban Wildfire Task Force*, Washington, D.C.: FEMA, U.S. Fire Administration, February 5-7.

1989 *Inter-Agency Hazard Mitigation Team Report: Hurricane Hugo*. FEMA 843-DR-SC, October.

Hy, Ronald John
1990 "Structural Failures," in *Handbook of Emergency Management: Policies and Programs Dealing with Major Hazards and Disasters*. William L. Waugh, Jr. and Ronald John Hy, Editors. Westport, Connecticut: Greenwood Press.

May, Peter J., and Walter Williams
1986 *Disaster Policy Implementation: Managing Programs Under Shared Governance.* New York: Plenum Books.

McConnaughey, Janet
1994 "Opening the Door to Hurricane-Proof Homes," *The Atlanta Journal/The Atlanta Constitution*, July 13, p. A4.

Mittler, Elliot
1993 *The Public Policy Response to Hurricane Hugo in South Carolina*. Working Paper #84. Boulder, Colorado: Natural Hazards Research and Applications Information Center, University of Colorado.

National Research Council
1991 *A Safer Future: Reducing the Impacts of Natural Disasters*. Washington, D.C.: National Academy Press.

Olson, Richard Stuart, and Robert A. Olson
1993 "'The Rubble's Standing Up' in Oroville, California: The Politics of Building Safety," *International Journal of Mass Emergencies and Disasters* 11 (August):163-188.

Perry, Ronald W.
1985 *Comprehensive Emergency Management: Evacuating Threatened Populations*. Greenwich, Connecticut: JAI Press.

Pickett, John H., and Barbara A. Block
1991 "Day-to-Day Management." In *Emergency Management: Principles and Practice for Local Government*. Gerard J. Hoetmer and Thomas E. Drabek, Editors. pp. 263-288. Washington, D.C.: International City Management Association.

Roth, Richard J., Jr.
1993 "Comments on Howard Kunreuther's Article 'Combining Insurance with Hazard Mitigation to Reduce Disaster Losses,'" *Natural Hazards Observer* XVII (July):4-5.

U.S. Geological Survey (USGS)
1989 *Lessons Learned from the Loma Prieta, California, Earthquake of October 17, 1989*. Washington, D.C.: USGS Circular 1045.

Waugh, William L., Jr.
1988 "The Hyatt Skywalk Disaster." In *Crisis Management*. Michael T. Charles and John Choon K. Kim, Editors. pp. 115-129. Springfield, Illinois: Charles C. Thomas.