CHAPTER

2

LEARNING ABOUT SEISMIC SAFETY OF SCHOOLS FROM COMMUNITY EXPERIENCE IN BERKELEY, CALIFORNIA

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Abstract: Following the 1989 Loma Prieta earthquake in California, the Berkeley community has worked diligently to reduce seismic hazards in its schools. This paper describes the efforts of the Berkeley community and local leaders to address the serious risk to students in its 16 public schools through persistent legislative efforts and development of multi-sectoral partnerships. The catalyst for action to improve school safety was not the discovery of improved technical standards or the financial means to correct building deficiencies; it was the fact that a small group of people decided to take action for a safer community for their children.

Introduction

Seismically safe schools must be recognised as a basic human right. Because we require young children to attend school, it is incumbent upon the responsible government agency to provide structurally sound facilities. This statement is easy to make but difficult to accomplish. Government officials and community stakeholders are accountable and morally responsible for acknowledging the necessity to improve seismic safety in schools and to act upon that knowledge. Forging alliances between the many groups involved in school administration and government can be an initial step towards significant safety improvements. These alliances can provide a multi-disciplinary approach to problem-solving, and bring added capacity and energy to accomplishing the daunting tasks of seismic assessment and reconstruction.

Communities rarely have a systematic approach to improving school seismic safety. Facility infrastructure is not often a primary consideration when other, more immediate, issues call for attention and scarce resources. Despite the fact that many countries have seismic engineering codes, it is not common practice for schools, or their governing bodies, to embark on a safety programme to reduce seismic hazards. Typically, newly constructed buildings in countries with effective regulatory oversight have improved levels of earthquake resistance, but experience demonstrates that school districts and school administrators do not undertake unbidden seismic evaluations of existing school facilities.

One critical issue is to link legislative mandates with everyday practice and implementation. Though a state, provincial or federal law may require implementing certain safety measures or precautions, often the local government agency responsible for implementation may not be able to fulfil its obligation. Educational and social service programmes are always at the forefront for administrators, and mandates that detract from those initiatives are not given equivalent attention. California has developed a series of safety requirements for local school facilities that include earthquake-resistant construction. These state mandates are adhered to in new construction projects, but many California school buildings were not recently built. A significant safety problem exists in school buildings constructed before contemporary standards were enacted. Some school districts, including those in California and Seattle, Washington, have developed systems for incorporating seismic analysis into routine checks of all building systems in order to determine baseline facility health.

A case study

Local authorities are reluctant to thoroughly review the structural integrity of schools for fear they will find unsolvable safety problems. Such was the case in Berkeley, California, after the 1989 Loma Prieta earthquake. Since 1989, the Berkeley community of 103 000 residents has worked diligently to reduce seismic hazards in its schools. The effort took time to develop as local leaders realised that there were no simple solutions to address the serious risk to students in its 16 public schools. The schools were threatened by the significant seismic and wildland fire risk in the region, especially in the densely populated hills in the eastern part of Berkeley where the Hayward fault lies. The Hayward/Rogers Creek fault system has a 32% likelihood that a M6.7 or greater event will occur in the next 30 years. In addition, the region is at risk of conflagration. The October 1991 East Bay hills fire is the latest example of such an incident; 25 lives were lost and over 3 000 residential units in the area were destroyed.

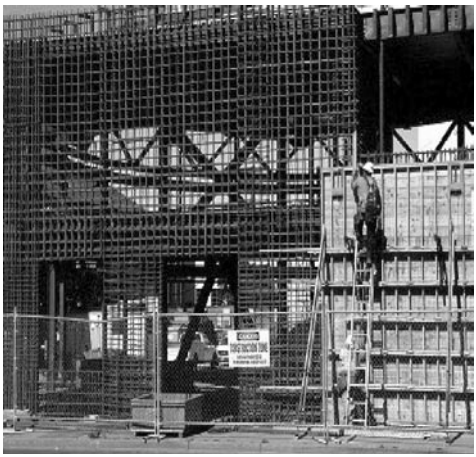
The 1989 disaster prompted a group of parents to approach officials with their concerns about the safety of the local schools constructed in the 1950s and 1960s using concrete. The buildings appeared to be suspiciously like the collapsed Cypress freeway overpass structure in nearby Oakland, where many fatalities occurred. Local officials appointed parent advocates to serve as an advisory body to the school district, and they worked together to evaluate the facilities and to develop a plan for reducing seismic risk. Group members discovered engineering reports issued ten years earlier that confirmed that at least one of the schools, still in use, was unsafe and was to have been closed. The materials had been misplaced by school officials and had never been acted upon. The parent advisory group informed the district, and supported by another parent who was a structural engineer, convinced authorities to review all the schools again. The district architect and engineers conferred with the parent group over the next year as the schools were evaluated using current technical information. Eventually, the community learned that seven of the 16 district schools posed serious life threats to students.

The parents also turned to regional and state officials for guidance on how best to advise the local officials. The Bay Area Earthquake Preparedness Project, the California Seismic Safety Commission (CSSC) and the Office of the State Architect gave crucial technical assistance to parents. Seismic and policy experts from the agencies also attended school board meetings to advise policy-makers about seismic risk and best practices to evaluate structural systems. Berkeley community members became conversant in state laws governing seismic safety in school buildings – the Field Act, the Riley Act and the Katz Act – all aimed to enhance earthquake safety in school buildings.

Once the school district determined the extent of the risk in so many of its buildings, the city's state legislators also joined the safety improvement efforts. Berkeley's state assemblyman and state senator worked with district officials to change the distribution of state funds to partially fund upgrades for Berkeley schools. Further, they sponsored state legislation that enabled local districts to tap into state emergency funds for school facilities deemed life safety hazards. Engineers at the Office of the State Architect co-ordinated with the

Figure 2.1. Cragmont School, Berkeley

Figure 2.2. Berkeley High School, California



involved officials and community leaders to ensure that state regulatory and funding agency staff understood the severity of the safety problems and would act responsibly to assist Berkeley. Federal agencies were also contacted for funding assistance. The state and federal programmes only funded a small portion of the costs to rebuild the unsafe schools, but this seed funding provided a vital catalyst for action; local leaders knew that they would have to raise a considerable part of the reconstruction costs.

In December 1991, a larger community advisory group proposed that school district officials embark on a comprehensive safety programme, totalling USD 158 million, to rebuild the Berkeley schools. Improvements would include seismic upgrades for all facilities and modernisation of all building systems. After many community meetings and public hearings, the school board voted to place a tax measure on the June 1992 ballot to request approval for a special tax to fund the programme. The tax measure was approved by over 70% of Berkeley voters in the 1992 election, and the measure was the first of six special hazard mitigation taxes that the Berkeley voters would approve over the next ten years. In the meantime, state and federal officials granted over USD 20 million in matching funds to the seismic safety projects. The State Allocation Board, the California Office of Emergency Services and the Federal Emergency Management Agency all contributed significant funds to several school projects, including the reconstruction of Cragmont Elementary School (Figure 2.1) and Berkeley High School (Figure 2.2). Since 1992, all of the Berkeley schools have been rebuilt. Some – Thousand Oaks and Rosa Parks schools – were replaced with new buildings, as upgrading the old facilities proved too costly. In the period from 1992 to 2004, all the local schools were vastly improved using the proceeds from the original 1992 bond measure, which was supplemented by funds from two other special tax measures approved in 2000. Few if any other school districts in California have accomplished so much in order to reduce seismic risk.

Partnership leads to successful change

Through persistent legislative efforts and development of multi-sector partnerships, a grassroots parents' group convinced decision-makers that the risk in local schools was more than they were willing to accept for their children. The tipping point in this quest for safer schools was not the discovery of improved technical standards or the financial means to correct building deficiencies. It was the fact that a small group of people decided to take action for a safer community for their children. The group faced many obstacles as they attempted, over time, to first convince local officials that a genuine problem existed. Persistence in pursuing the issue and making sure that district officials would address the safety problems were twin challenges for the parents' group.

Prominent community members questioned the parents' right to ask certain questions about seismic safety and to challenge the decisions made by the school board. Not until the engineering reports from the previous decade were found and the findings of these reports substantiated by a practicing engineer did the broader community start to understand the extent of the problem. Scepticism encountered at the state level was even more pronounced. State legislators and agency officials responsible for allocation of school facility funds were reluctant to recognise the seriousness of the seismic safety issue. Many felt that opening public discussion about the safety of California schools, and especially performing a detailed examination of the large number of older buildings in the state inventory, was like opening Pandora's box. It was only after district officials attended numerous state hearings and provided repeated, unsolicited testimony that the state regulators finally took up the issue of pre-disaster hazard mitigation for schools. Ironically, in a subsequent state election, the very same state officials used safety information presented by Berkeley officials as ballot arguments to convince the state electorate to approve special funding for California school buildings.

In retrospect, the group learned that achieving improved seismic safety is not solely a technical problem, but rather a challenge to prompt community engagement, accountability and action. In Berkeley, a curious situation developed as the technical experts followed the lead established by community advocates. Even though public officials and engineering professionals monitored school safety, they did not sound the alarm when the 1989 Loma Prieta earthquake revealed the vulnerability of inadequately reinforced-concrete structures. It took the deep, heartfelt concern of involved parents to initiate the much-needed, thorough evaluation of the buildings. Even then, community leaders took two years to negotiate the labyrinth of state bureaucracy before the need for action was acknowledged and improved seismic safety laws were enacted for local district funding.

Another element that added to the mitigation success was the identification of "champions" at each level of the endeavour. The grassroots effort began with a few parents, who in turn found sympathetic allies in key settings such as City Hall, school site meetings, state agencies like the Seismic Safety Commission and the state legislature. At each juncture, every obstacle encountered was swiftly bypassed as the resourceful

advocates sought out other, more likely supporters. Over time, a network of interested people was established with the professional capacity and personal interest to sustain the long-term investment in a worthy cause: improved seismic safety for schools.

In Berkeley, however, the work did not end with the school safety programme. The seismic safety programme established in schools set the stage for a community-wide mitigation programme (Table 2.1).

After the school district successfully passed its USD 158 million bond measure, the municipal government followed suit and asked the voters in 1992, 1996 and 2000 for approval of special tax measures to further the hazard mitigation work. All Berkeley fire stations and many major city buildings have been seismically reconstructed. The community also built a new public safety building and emergency operations centre, and are making plans to provide a contingency water supply system.

The local investment in community safety is significant; Berkeley has one of the highest local tax rates in California, largely attributable to the hazard mitigation taxes. The community has approved over USD 362 million in taxes for these safety improvements over the last 12 years. The City Council has established fiscal incentive programmes for homeowners, which has prompted residents to make safety improvements in nearly 60% of single-family homes. Grants and loan programmes assist senior, low-income and disabled residents to retrofit their homes. These governmental efforts, totalling over USD 1 million annually, spurred private sector owners of large public assembly buildings to upgrade their facilities. The neighbouring campus at the University of California, Berkeley launched a USD 1 billion seismic retrofit programme for its instructional and administrative buildings. What began as a simple inquiry about school safety blossomed into a community renaissance.

Table 2.1. Timeline of Berkeley mitigation activities and key events

Date	Event	Results
1868	Hayward earthquake	Impact on Berkeley not known
1870	South Hall constructed at the University of California, Berkeley with steel straps to resist earthquakes	An early example of seismic-resistant design
1878	Founding of the City of Berkeley	
1898	Mare Island earthquake	Impact on Berkeley not known
1906	San Francisco razed by major earthquake	Damage in Berkeley is significantly smaller than damage in San Francisco
1911	Damaging earthquake near San José	Impact on Berkeley not known
1923	Major wild fire	Affects large area of current downtown Berkeley; hundreds of residences burn
1927	City of Berkeley adopts Uniform Building Code	Community conforms to building regulations and safety codes
1962	Flood in Berkeley environs	Damage builds awareness about need for damage prevention

Date	Event	Results
1978	Enactment of floodplain ordinance	Flood Insurance Rate Maps are developed for the community
1980	Grass fire in hills consumes some Berkeley houses	City develops hazardous hills zones and regulates building materials in hills
July 1989	Establishment of Disaster Council	Establishment of monitoring and advocacy
Oct. 1989	Loma Prieta earthquake	Berkeley sustains minimal damage; event prompts local preparedness action
Dec. 1989	Establishment of unreinforced masonry (URM) building inventory, identification of risks and notification of owners	
Aug. 1990	Meeting of the Board of Education to review school engineering analysis	Life safety hazards found in seven out of 16 district schools
July 1991	Adoption of transfer tax rebate ordinance	Rebate is allowed for one-third of the real estate transfer tax up to USD 1 500 for seismic safety improvements to dwellings, retroactive to 17 October 1989
Mid-1991	Establishment of fee waiver programme	Permit fees are waived on residential seismic safety projects
Oct. 1991	East Bay Hills Fire	Over 3 200 residences destroyed in area; 67 in Berkeley. Community mobilises mitigation response
Oct. 1991	Creation of Special Assessment District for Berkeley Hills	Assessed USD 50/parcel/year for fire safety programmes
Oct. 1991	Adoption of strengthened requirements for hazards hill fire zones	Stricter standards for roofing and other building materials
Dec. 1991	Establishment of mandatory URM retrofit programme	To date nearly 600 out of 700 URMs have improved seismic resistance
June 1992	Approval of State bill for school funding	Berkeley and urban districts eligible for state money
June 1992	Approval of Measure A	USD 158 million made available for school safety programmes
Nov. 1992	Approval of Measure G	USD 55 million made available for municipal safety improvements
Mar. 1995	Meeting of the Seismic Technical Advisory Group	Expert panel of advisors provides technical guidance to city on seismic issues
July 1996	Development of soft-storey and tilt-up building inventories	A ballot measure was defeated in 2002 aiming to raise funds to reduce risk in soft-storey structures
Nov. 1996	Approval of Measure S	USD 45 million made available for seismic retrofit of city buildings
Aug. 1997	Establishment of the University of California's SAFER Programme	Ten-point action plan for the university's USD 1.2 billion reconstruction programme
Dec. 1999	Awarding of FEMA Community of the Year for mitigation work	Recognised nationally as model for mitigation efforts
Nov. 2000	Approval of Measures AA and Q	USD 116.5 million for school safety programme; tax measure for safety efforts
Feb. 2003	Completion of CGS hazard maps	New buildings are required to meet strict design and construction standards if they are located in potential liquefaction or landslide areas