



# Safer, Stronger, Smarter: A Guide to Improving School Natural Hazard Safety

FEMA P-1000 / June 2017



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# **Safer, Stronger, Smarter: A Guide to Improving School Natural Hazard Safety**

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**FEMA**

June 2017



## **Notice**

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# Foreword

Our nation's elementary and secondary school buildings contain the future of our country. Over 50 million students attend approximately 99,000 public elementary and secondary schools with an additional 5.2 million students attending close to 34,000 private schools (NCES, 2016). Parents send their children off to school every day with the belief and expectation that their children will be safe from natural hazards. Children not only have the right to an education; they also have the right to an education in a safe environment. However, in many parts of our country, school buildings are vulnerable to severe damage or collapse in the next earthquake, tornado, hurricane, flood, tsunami, windstorm, or other natural hazard and are therefore putting our children at risk. In particular, many of our nation's school buildings are older unreinforced masonry (URM) structures that are vulnerable to severe damage and collapse in the next earthquake, or are of lighter frame construction that is vulnerable to other types of natural hazards such as a tornado, hurricane, high winds, or flash flooding. Some schools are located in tsunami hazard zones without access to safe ground that can be reached within the expected tsunami warning time.

Schools are far more than a place for teaching children; they often serve as community centers. They are the places where the public votes for their future leaders and they often serve as a focal point for a community's social and cultural life, be it the Friday night football game or the location for evening community meetings. The loss of a school building can severely disrupt the fabric of a community.

School buildings also serve other critical functions within the communities where they are located. For example, they often serve as designated shelters for displaced families after a natural or manmade disaster. Even when they may not be a designated shelter, school policy across the country is that if children cannot be returned home safely, they must be sheltered in place in the school until parents can pick them up. So even if a school is not officially designated as a shelter, school policies have made them into de facto shelters.

The 1933 Long Beach magnitude-6.4 earthquake in southern California is best known for damaging thousands of URM buildings, including over 230

school buildings. Fortunately, school had ended for the day at the time of the earthquake. Had that not been the case, thousands of children would have been injured or killed. The outcry from seeing collapsed school buildings directly led to the State of California passing the Field Act, which mandated earthquake-resistant construction requirements and inspection for all future school buildings.

While the January 1994 magnitude-6.7 Northridge earthquake in southern California did not collapse any school buildings, the amount of damage, including collapsed suspended ceilings and light fixtures, would have injured children had the earthquake occurred during school hours. Fortunately, the earthquake occurred early in the morning on a national holiday. Even so, FEMA funded a major seismic retrofitting program to seismically brace all suspended ceilings and light fixtures in every Los Angeles County school building.

While there have been notable efforts by some states, particularly Oregon and Utah, to identify at-risk school buildings and to begin the process of addressing the seismic risk they present, they have all been severely limited by budget issues and the day-to-day problems local governments face to just to keep their schools operating.

However, this is not just an earthquake problem. In May 2013, an EF5 tornado struck Moore, Oklahoma and resulted in 24 fatalities, including seven children at the Plaza Towers Elementary School. In April 2014, an EF4 tornado leveled a brand-new school still under construction in Vilonia, a suburb of Little Rock, Arkansas. While schools generally have some short-term notification of a tornado warning, and tornado safe rooms are becoming an accepted standard of care, and are now a requirement for new schools in certain locations under the *2015 International Building Code*, many schools remain vulnerable to tornadoes with no safe haven for students or staff.

The risk from flooding is generally well known and mapped, and sufficient warning time usually exists that the risk from this hazard is well controlled. However, the risk from flash flooding in mountainous terrain or from storm surge flooding in coastal areas can still be a significant hazard for schools located in harm's way. Severe flooding, as with other natural hazard events, can also lead to school closures and long-term negative impacts on students.

Despite the critical role that schools play in people's lives, many obstacles exist in attempting to improve school safety from natural hazards. These include competing public needs and demands, scarce resources in an increasingly difficult economic and political environment, and lack of

understanding of the risk of natural hazards. We believe that a comprehensive document for school administrators and staff, as well as concerned parents that provides advice on both successful operational policies and practices, as well as recommendations on how to improve the physical protection of the school facility to resist applicable natural hazards would help improve overall school safety.

FEMA recently worked with the Department of Education and other federal partners to develop the *Guide on Developing High Quality School Emergency Operations Plans* (U.S. Department of Education, 2013), a school safety planning guide that covers a wide range of possible hazards and threats. The goal of FEMA P-1000 was to develop a companion guide that provides additional information specific to natural hazards to help schools be better prepared and better able to respond, recover, and mitigate future natural hazards. This *Guide* focuses on operational guidance (what to do before, during and after an event) as well as physical protection (what can be done to the structure and facility to improve safety). It was developed with input from design professionals, emergency managers, school administrators, teachers, representatives of concerned parent groups, and other relevant entities.

FEMA wishes to express its gratitude to the Project Management Committee (PMC) of Barry H. Welliver (Chair), Suzanne Frew, William T. Holmes, Christopher P. Jones, Lori Peek, John Schelling, Thomas L. Smith, and Edward Wolf. The PMC managed the development efforts and also served as principal authors. We also wish to thank Laura Dwelley-Samant, who was the Report Development Consultant, as well as Lucy Carter, Shawna Bendeck, Scott Kaiser, Jacob Moore, Meghan Mordy, Katherine Murphy, and Jennifer Tobin, who provided assistance in the literature search and focus group work.

FEMA also wishes to thank the Project Review Panel, which consisted of Ines Pearce (Chair), Jill Barnes, Victor Hellman, Andrew Kennedy (ATC Board Contact), Rebekah Paci-Green, and Cindy Swearingen. They provided review, advice, and consultation at key stages of the work. The names and affiliations of all who contributed to this report are provided in the list of Project Participants.

Without the dedication and hard work of all of these people, this project would not have been possible.

Federal Emergency Management Agency



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# Preface

In 2014, the Applied Technology Council (ATC), with funding from FEMA under Task Order Contract HSFE60-12-D-0242, commenced a two-year project (ATC-122) to develop a document that would provide school safety guidance to use before, during, and after a natural hazard event by updating existing documents and providing new information on improved knowledge about natural hazard-resistant design and policies and procedures recommended by other federal agencies. In particular, this project would build upon the *Guide for Developing High-Quality School Emergency Operations Plans* (U.S. Department of Education, 2013), which was developed as a multi-agency effort involving the Department of Education, the Department of Health and Human Services, the Department of Homeland Security and its Federal Emergency Management Agency, and the Department of Justice and its Federal Bureau of Investigation. To help inform the development of the document under the ATC-122 Project, the project team conducted a literature review of over 250 existing relevant resources and held videoconference calls with focus groups made up of representatives of the intended audience.

The resulting *Guide* provides up-to-date, authoritative information that schools can use to develop a comprehensive strategy for addressing natural hazards.

ATC is thankful for the leadership of Barry H. Welliver, Project Technical Director, and to the members of the ATC-122 Project Team for their efforts in developing this *Guide*. The Project Management Committee, consisting of Suzanne Frew, William T. Holmes, Christopher P. Jones, Lori Peek, John Schelling, Thomas L. Smith, and Edward Wolf, managed the development efforts and served as principal authors. Laura Dwelley-Samant served as the Report Development Consultant and Lucy Carter, Shawna Bendeck, Scott Kaiser, Jacob Moore, Meghan Mordy, Katherine Murphy, and Jennifer Tobin provided assistance in the literature search and focus group work as members of the Project Working Group. The Project Review Panel, consisting of Ines Pearce (Chair), Jill Barnes, Victor Hellman, Andrew Kennedy (ATC Board Contact), Rebekah Paci-Green, and Cindy Swearingen, provided review, advice, and consultation at key stages of the work. Focus group members, consisting of Debbie Carter-Bowhay, Cathy Coy, Susan Graves, Julie

Mahoney, Bob Roberts, Kerry Sachetta, Shawn Streeter, and Randy Trani, provided valuable feedback as representatives of the target audience. The names and affiliations of all who contributed to this report are provided in the list of Project Participants.

ATC is indebted to the leadership of Mike Mahoney (FEMA Project Officer) who conceived the project, contributed to development efforts, and provided guidance at critical stages. ATC also gratefully acknowledges Drew Herseth (FEMA Task Monitor) whose input and guidance made this document possible. ATC is thankful to John Westcott (FEMA) and Madeline Sullivan (U.S. Department of Education) for their review of this document. Veronica Cedillos and Ayse Hortacsu served as the ATC Project Managers and Carrie Perna provided report production services.

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