

Door Security + Safety

DHI'S PUBLICATION FOR DOOR SECURITY + SAFETY PROFESSIONALS

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Schools

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When a tornado struck the southern Missouri city of Joplin in May 2011, it killed 161 people and caused \$2 billion in damage. This storm was just one in a series of natural disasters that regularly tear through America's "Tornado Alley," a broad swath of the nation's heartland, encompassing all or parts of 22 states.

Four years before the Joplin disaster, a powerful tornado struck the town of Enterprise, Ala. While the death toll and damage were not as severe as in Joplin, it was especially sobering in one regard: the storm made a direct hit on the local high school, killing eight students and one other person.

The Enterprise tornado sparked considerable discussion and subsequent

action among those responsible for assuring the safety of students at school. In 2010, the governor of Alabama signed into law legislation mandating the construction of tornado shelters in all new schools built in the state. Since that time, the model building code of the United States has adopted mandatory requirements bringing similar standards to a broad portion of the country.

The International Building Code® (IBC) is a model code developed by the International Code Council® (ICC) and revised every three years. The IBC 2015 edition required that all newly-built schools housing 50 or more kindergarten through 12th grade students in the most tornado-prone part of the country be constructed with shelters that can accommodate all occupants of the building. These

were the first mandatory shelter construction requirements in the IBC, and have since been followed by similar requirements in the 2018 *International Existing Building Code*®.

Experience in Shelters

There are two main concepts on how to design a school that includes a tornado shelter. One approach is to take a large space, such as a gymnasium or an auditorium, and design the entire structure so it can withstand a tornado. Such spaces can be suitable to serve as shelters for several reasons: they can hold many people, they usually don't have exterior windows, and they lend themselves to hardening with concrete walls, roof structures and highly engineered doors. However, gyms and auditoriums also have a drawback: they may be located far from classrooms, possibly on a different floor, and since tornadoes arrive with little warning, there may not be enough time to get students into the shelter before the storm hits.

Rather than try to direct a couple of hundred third graders to the gym and subsequently account for each one, some shelter designers asked, why not let the classroom serve as a shelter space? The key to this approach is to install specialized doors, or shutters, which normally stand open against the wall next to a window, but can quickly be swung 180 degrees to cover the window and protect the classroom in the event of a tornado. The face of the shutter can hold a whiteboard or displays of artwork, so the teacher doesn't lose wall space.

FEMA and the International Code Council

When it comes to hurricane, tornado and flood preparation for structures, as well as for shelter construction, the Federal Emergency Management Agency (FEMA) has become a bit of a catch-all phrase in the industry. This is because they have such a wide range of information available and often provide financial assistance for

project funding. FEMA has produced and made available guidelines for residential and commercial structures and FEMA materials range from enforceable documents to best-practices.

As best illustrated on their website, FEMA guidelines and standards are organized in a hierarchy. Standards are mandatory FEMA policy. They are divided into two categories: Program Standards and Working Standards.

- **Program Standards** are mandatory FEMA policy.
- **Working Standards** are applied by specialists (engineers, planners, technicians, scientists, etc.).
- **Guidance documents** provide a recommended approach to meet the Risk MAP standards.
- **Best Practices/Lessons Learned** comprise any method that helps meet or exceed Risk MAP standards and are shared by FEMA Regions and Mapping Partners following successful approaches to program activities.

A couple of important documents stand out for our focus:

The *FEMA P-361* document provides guidance for community and residential safe rooms for tornadoes and hurricanes, and presents important information about the design and construction of safe rooms that will provide protection during tornado and hurricane events. FEMA P-361 presents criteria for safe rooms as well as guidance and commentary reflecting several years of post-damage assessments and lessons learned, including those based on many safe rooms directly impacted by tornadoes.

ICC 500-2014, from the International Code Council (ICC) is referenced in the 2015 *International Building Code*® (IBC) and the 2015 *International Residential Code*® (IRC) for buildings or spaces designated for use as a shelter from tornadoes and/or hurricanes. *ICC 500-2014* covers Administration and Oversight;

Structural Design Criteria; Occupancy, Means of Egress, and Access; Fire Protection, Essential Features, and Accessories; and Test Methods.

An experienced structural engineer should be able to design an adequate safe room, but the IBC 2015 requirements will have some new considerations for designers. Buildings in Tornado Alley need to be designed to withstand a wind speed of 250 miles per hour, while those in less vulnerable areas might only need to hold up under a 130-mile-per-hour wind load. Tornado shelter designers need to specify products that are third-party listed for *ICC 500 - 2014* applications to ensure the performance of their shelter.

With the introduction of mandatory tornado shelter requirements in the 2015 IBC, and the subsequent release of the 2018 IBC and IEBC, we have witnessed the evolution of new life safety requirements. Coupling the science of engineering and design with the legislative process of code development, we have added a level of safety to the occupants of our educational facilities.

Partner in Safety

For integrators working in tornado-prone areas, or for facility managers and building owners looking to add a layer of life safety to their structures, the first step is to find a manufacturing partner that is invested in your success and safety.

Strong partnerships mean you will always have a team on your side to help meet standards, make alterations, repair parts, and continuously offer the highest level of life safety in your facility. +



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