# When the Code Requires You to Design a Tornado Shelter

*Excerpt from Communiqué—a monthly practice management newsletter for XL Catlin insureds.*

**The International Building Code has a new requirement for the construction of tornado shelters for new construction and additions in 23 states, for schools and first response centers. To learn more, *Communiqué* spoke with Benchmark (Ben) Harris, PE, SE, LEED AP, vice president of engineering at Huckabee, an A/E firm that exclusively designs learning environments. Harris chairs the National Storm Shelter Association's design practices committee, a group that will be contributing to the developing standard of care for design professionals as it relates to the new requirements.**

**Communiqué (C): What does the International Building Code mandate regarding tornado shelters?**

**Ben Harris (BH):** The *2015 International Building Code* [IBC] is the first edition of that code that requires all new schools, and new additions to existing schools, to have tornado shelters. This applies to any construction classified as Educational (Group E) if the occupant load is at least 50 people and the construction is located within a certain zone, which is roughly a third of the continental U.S. [see the map on page 3]. The code also requires tornado shelters for first response centers, such as fire stations and 911 call centers, in that same zone.

**C: What have been the concerns of designers involved in these types of projects since the 2015 IBC was released?**

**BH:** One concern is that in the United States, Federal Emergency Management Agency [FEMA] issued its P-361 guideline on safe rooms prior to this change to the IBC. The IBC references a minimum standard document, ICC 500, which covers all types of storm shelters. If the code requires you to build a tornado shelter, the design of the shelter has to comply with ICC 500, which is different from FEMA's P-361 guideline in significant ways. Many designers are unaware of some of the ICC 500 requirements that are different than the FEMA recommendations.

**C: Has FEMA made any changes to its P-361 based on the IBC change?**

**BH:** The *Third Edition* of P-361 was recently published and it's more compatible with ICC 500 than the previous editions. However, the ICC 500 is not related to the FEMA document, as the P-361 guidelines are more associated with a higher standard of "near absolute" protection rather than the "minimum code" requirements of ICC 500.

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**C: How have you been involved with responding to these changes to the International Building Code?**

**BH:** The National Storm Shelter Association [NSSA] was the original authoring organization of the document that became ICC 500, *ICC/NSSA Standard for the Design and Construction of Storm Shelters*. NSSA has created a design practices committee, which I chair. Our goal is to create guidelines and make code recommendations for consideration for inclusion in the developing standard of care, to help design professionals who have to apply the ICC 500 provisions to projects.

**C: Which professionals are affected by the ICC 500 requirements?**

**BH:** They're the same professionals you have on any other building, including architects, structural, civil, and mechanical engineers, communications and technology designers, and others.

**C: How clear are the ICC 500 requirements?**

**BH:** At this point, quite a few of the ICC 500 provisions are more performance requirements than explicit prescriptive requirements. These require professional judgment that will vary among design professionals. Our committee is working to define the guidelines so there's less variation of interpretation among both design professionals and building officials. They need clarity and that's what our committee is working to provide.

One example of what the ICC 500 doesn't address in either code or commentary is whether a shelter's doors, when shut after activation of the shelter, are required to be considered a wall in a fire egress analysis of the host building.

**The shaded region on the map is the area affected by the 2015 IBC requirement for ICC 500 tornado shelters. Image courtesy of Huckabee**

**C: Why is that significant?**

**BH:** Let's say the shelter doors are shut while some school occupants are in other parts of the school, but, for whatever reason, are not in the shelter when it's activated. Once activated, opening up a shelter door is not like opening up a regular door, because shelter doors are bolted and locked shut. If a fire were to start in the school, and the closed shelter doors weren't considered a wall for fire egress analysis during the design, then those who didn't make it into the shelter before activation might have to travel farther to find an exit.

If the shelter doors, when shut, were considered a wall, then the egress calculations would be different and those occupants would have a much shorter distance to travel to an exit. However, this more conservative interpretation could require an additional set of stairs in some instances.

**C: What's another example of a requirement that needs professional judgment?**

**BH:** One provision states, "Lay down, rollover and collapse hazards shall be considered by the design professional..." This could apply, for example, to the possibility of a nearby structure rolling over onto the shelter, and leaves it to one's imagination as to how to "consider" that. Within the industry, designers are asking if they're permitted to do nothing, because the document doesn't clearly prescribe any specific action, or if they should plan for the possibility that a tornado picks up a 10-story building half a mile away and hurls it into the shelter.

These are examples of two extreme ways the new code could be interpreted. Many structural engineers are interpreting the requirement to address structures that will be nearby at the time the shelter is completed, but theoretically, future nearby construction could fall onto a shelter after the shelter is built and it's unclear what's expected of the design community in considering future construction. If new structures are built near existing shelters, does a designer need to consider whether reinforcement of the shelter is necessary?

**C: The possibilities a designer must consider seem virtually endless.**

**BH:** Exactly. Since the code is not explicit, one could theoretically argue that you have to design for an infinite load in some of these scenarios. Obviously, that's impossible, but the failure to do so could be a liability. So I believe our committee's work in publishing guidelines that reflect the current dialogue within the design community will not only result in successful storm shelter projects that protect the occupants, but will also help protect designers who want to make sure they can prove they're meeting the code's intent.

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**C: How can a design professional join NSSA's design practices committee?**

**BH:** Anyone interested in being considered for membership on the committee should contact me [see info below]. Design professionals who regularly design school building projects or first response centers within the geographic zone covered by the new code may want to join to have a say in what others may come to expect of their roles.

Right now, we're aiming to have an informal draft of the NSSA guidelines ready for an interactive session at the NSSA's annual meeting in Dallas this November. Professional development opportunities will be available at that event, before the committee meetings, for any architects, engineers, building officials, contractors, owners or others interested in learning more about the ICC 500 standard.

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