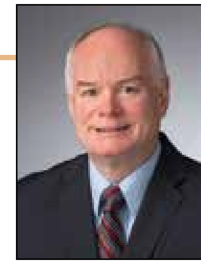

Keeping the Public Safe – How Far Must We Go?

By Richard C. Boggs, P.E., SECB, LEED AP

We live in a society that tends to react to the latest threats found in the most recent news cycle. A terrorist boards a plane in Paris in 2001 with an explosive in his shoe, and passengers must remove their shoes before boarding planes for decades. A sociopath enters an elementary school in Connecticut in 2012 and shoots whoever crosses his path. As a result, school design is forever changed to incorporate security features that were not imagined decades earlier. Did we not know this could happen?

As structural engineers, we are in the business of managing risk. The states that grant us licensure entrust us to make decisions that result in a built environment that is safe for its occupants. But how is safety defined? Most engineers would answer that safe design equals conformance with the building code. But the building code is a minimum standard only, and is the result of a series of compromises between various stakeholders whose objectives can be in conflict. This results in documents that aspire to the public's protection but recognize economic realities that can defy the certainty of that result. The risks addressed by the code can only reflect past experience. But what about future risks? How can those be determined and incorporated into building codes? Should design professionals be responsible for failure to anticipate conditions not previously experienced and, therefore, not prescribed by building codes?

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One extreme example of this was the twin towers of the World Trade Center, destroyed in 2001. The towers' design actually did consider the impact of an airplane, but not a fully loaded jet operating at full speed, bent on destruction. Following this disaster, much was written about the performance of the structures and fire protection systems, resilience of egress paths, etc. Building codes were modified to apply the lessons learned. Similarly, the bombing of the Alfred P. Murrah Federal Building in Oklahoma City in 1995 led to changes in codes and prescriptive design procedures for government-funded projects intended to prevent progressive collapse. But progressive collapse was not an unknown phenomenon before the destruction of the Murrah Building. Should this have been a design consideration, even though it was not mandated by code when the building was constructed? Hindsight is always 20/20, but the potential scenarios one can imagine are limitless.

I was a young structural engineer in the late 1980s when seismic loads first became a design consideration in the northeastern US states. In Connecticut, the 1987 Building Officials and Code Administrators (BOCA) Code, with the 1988 Supplement, was adopted in October of 1989, and henceforth earthquakes became a design consideration for new buildings and renovations designed in my state. In preparation for these changes, seismologists and structural dynamics experts were dispatched to educate the structural engineers in the northeast about these provisions, why they were appropriate in our region, and how to apply them effectively. At that time, I recall hearing a virtual guarantee that the northeast would experience a significant seismic event in the subsequent twenty years, and the alarm was sounded to be ready. Of course, thirty years later, this has still not happened for most of our region, but the majority of engineers in the northeast accept that the risk was real and remains so.

One of the first buildings I designed under the new 1989 code was a single-story school addition. The adjacent main wing of the existing school was a four-story unreinforced concrete masonry bearing wall structure built in the 1940s. There was no *International Existing Building Code* (IEBC) at that time, but the BOCA Code did contain a chapter that addressed renovations of existing buildings. The renovations contemplated in this area were clearly not sufficient to mandate seismic retrofit. With my knowledge of the poor performance of unreinforced masonry bearing wall structures in earthquakes, I presented what I felt was a sound argument to the project manager (a co-worker in my A/E firm) to take steps to introduce ductility to the existing structure. When he asked whether the building code mandated such a retrofit, I gave the honest response that it did not, and he elected not to bring the issue to the School Building Committee for consideration.

The Code of Ethics in the Connecticut P.E. Regulations states, "The engineer… shall at all times recognize his or her primary obligation to protect the safety, health, and welfare of the public in the performance of his or her professional duties." In that context, I look back on this experience and others like it and wonder if this was an appropriate response. How would I feel if that old portion of the school collapsed in a moderate earthquake? How would I respond to the parents of children lost in the collapse if they asked why a structure known to perform poorly in an earthquake was permitted to be used as a school? As structural engineers, do we demand the application of logic (and cost) beyond what the building code requires? I have always felt that I had a sound legal argument by meeting the standard of care in this case, but is that really enough?

On the west coast, there have been efforts to be more proactive in addressing pre-existing conditions that pose significant seismic hazards. Still, even there, such efforts face opposition due to costs and a perception that such actions may be discriminatory. These types of discussions are lacking in the northeastern states. Unfortunately, this debate will probably have to wait until an actual earthquake, and its resulting death and destruction, makes the case on the nightly news for a more proactive response.▪

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