

Editorial | Structural Collapse

An Ounce of Prevention is Better than a Pound of Cure



By Barry Arnold, P.E., S.E., SECB

The collapse of a structure and/or other consequences that result from errors, omissions, or negligence by an engineer are sobering reminders of the serious nature of our business and our ethical obligation to the public. Mohammad Ayub's article in the December 2010 issue of STRUCTURE magazine, titled *Structural Collapses During Construction*, was both enlightening and disheartening. It was enlightening because it put numbers and facts to a problem within the profession that many structural engineers know exists, but whose magnitude they do not fully comprehend. It was disheartening because it did not go far enough in exploring the root cause(s) of the problem and what we, as a profession, can do to prevent it in the future.

As I read Mr. Ayub's article, I was curious whether any of the failures was a result of error, omission, ignorance, arrogance, naiveté, or indifference on the part of the engineer. Perhaps the exact cause will never be determined because it is buried in a file at an insurance company or attorney's office, or hidden in the engineer's heart and head. After a collapse, the consequences of a particular course of action – or, in some cases, inaction – are all that remain, and our response is often a deep sigh of relief that we were not involved and, if we are the least bit reflective, the nagging questions: Why did it happen, and could it have been prevented?

Mr. Ayub's article offered advice such as: "Designer... must indicate in their detail rebar development lengths, including rebar splice lengths.", "...outlookers must be designed to resist all anticipated forces.", "Final design should be based on the anticipated final loads.", "Compression members must be checked [and designed] against buckling.", "Proper design must evaluate the unbraced compression flange length.", and two of the best, "The engineer must consider realistic and verifiable loads while designing structural framing systems," and "Lateral-load-resting systems must be provided in both directions."

Using a common phrase, I would ask: Really? Are you serious? Those things are all fundamental to structural engineering – rudimentary – basic – right? Do we need to be reminded that reading and understanding the current code, using correct loads, following a load path, considering member and material performance, providing proper detailing, and carrying out construction administration services are precisely the duties that the structural engineer is responsible for performing? How could any engineers consider themselves competent to practice structural engineering and fail in their responsibility to the public at such a fundamental level?

Additional questions that need to be explored and answered include: How did the engineer's background, education, experience, and examination contribute to the collapse? Was the engineer truly competent to practice structural design? How was this competence assessed? What discipline, if any, was taken against the engineer? Was the discipline adequate to act as a deterrent? And what was the engineer's interpretation of the phrases, "Practice within the area of your competence and expertise," and "Hold paramount the health, safety and welfare of the public"?

More uncomfortable questions include: Is this just the tip of the iceberg? What about the near misses where the flawed design was caught, but not reported, before a failure occurred? What about the structures that have been modified by an incompetent engineer and weakened, but will not collapse until a significant lateral event occurs? Is there a way to determine the real magnitude of the problem? Is there a way to prevent the problem?

Is part of the problem that we, as individuals, are not the best judges of our own abilities, competence, and limitations? Jon Schmidt's recent articles in ENR (January 24, 2011) and STRUCTURE (March 2011) clearly reveal the flaw in our perception of our own competence. In fact, the Dunning-Kruger effect reveals that the more incompetent people are, the more competent they believe they are! This is alarming, to say the least.

The depth and breadth of the current problem may never be known or completely understood because the system serves to obscure, rather than expose and enlighten. There are those who would rather hold rigidly to the dogma of the past, and continue putting the public at risk, rather than focus on the problem and initiate a healthy dialogue about what we can do to correct it.

I have had the opportunity to meet many structural engineers from around the country. I have been surprised and, in some cases, saddened by what I have heard about their experiences – no plan reviews of a structure at all, no peer review of significant structures, inadequate enforcement, lack of effective deterrents, and general indifference on the part of the local governing authority and engineering groups.

Many structural engineers, owners, and architects have seen the problems that exist in the structural engineering profession as long-standing and egregious. They also see proper peer reviews, thorough plan reviews, and structural licensing and practice restrictions as possible solutions.

I am well aware of the pressures that structural engineers face daily; but to overlook or be ignorant of fundamental design requirements for a structure, and yet still be allowed to practice structural engineering, indicates that a serious flaw exists within our profession. Permitting engineers – regardless of their education, experience, and examination – to practice freely and decide for themselves what work they are competent to perform is seriously flawed and dangerous.

Reading about and understanding the consequences of the problems in our current system is insightful; working together to correct the problem is essential. So I ask you: What are you going to do about it?■

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