

Learning from Failures

By Jon A. Schmidt, P.E., SECB



In October 1993, I was in the second year of a master's degree program at The George Washington University in Washington, DC. I was ready to put classes and research behind me and start practicing what I had spent the last several years learning. Having grown up in the central part of the country, I was eager to return there after graduation, so I was pleased to discover that the ASCE Annual Convention in Dallas, Texas, would include a job fair for students. I made arrangements to attend this event and then proceed to my adopted hometown, Kansas City, for interviews with several firms (including Burns & McDonnell, which worked out quite well).

As is always the case, ASCE Publications set up a bookstore at the Annual Convention. Between sessions, I took some time to examine what it had for sale and came upon a volume that I had already been thinking about purchasing: *To Engineer Is Human*, by Henry Petroski. I bought it, read it, and enjoyed it immensely. In the years since, I have devoured all of the other books that Mr. Petroski has written, and I consider him to be my favorite engineering author. One of the perks of chairing the Editorial Board for STRUCTURE® magazine is the ability to influence the selection of individuals to be profiled in the Great Achievements department, and I was delighted when Richard Weingardt agreed to write about Mr. Petroski for this issue (see page 56).

A recurring theme in Mr. Petroski's writings is also the subtitle for *To Engineer Is Human*: the role of failure in successful design. Whether subtle or spectacular, failures always offer the engineering profession an opportunity to discover and discuss the "lessons learned" – what could have, and perhaps should have, been done differently in the days, weeks, months, or even years preceding an unfortunate event. The demise of the Tacoma Narrows Bridge led to careful study of the effects of wind on suspended roadways. The collapse of the walkways in the Kansas City Hyatt Regency Hotel – a vivid memory of my childhood – led to renewed emphasis on the role of the designer during construction and the importance of even the smallest details.

The thesis that failure drives design actually extends well beyond engineering. Mr. Petroski's works include such titles as *The Pencil*, *The Evolution of Useful Things*, *The Book on the Bookshelf*, and *Small Things Considered*. He convincingly demonstrates that new inventions, even ones as seemingly mundane as the Gem paper clip and the zipper, almost always come into being because their creators detect a flaw in existing technology and are subsequently able to devise "a better mousetrap".

The challenge posed by the educational value of failures is the fact that, all too often, those involved would prefer not to discuss what went

wrong. It is not exactly a career-building exercise to tell the world all about the mistakes that we have made in the process of practicing our profession. This makes it all the more critical that we be sure to learn everything that we can from the one set of failures with which we are guaranteed to be intimately familiar: our own. Hopefully, they will never take the form of structural failures; instead, they may be process failures like rerunning an analysis because of a modeling error or issuing a change order because of an incorrect dimension.

As I have written in this space previously, much of engineering relies on subjective judgment that is obtained only through experience and is fundamentally fallible. Failures provide an opportunity to bound and refine the heuristics that we use to carry out our primary responsibility: holding paramount the safety, health, and welfare of the public.

Mr. Petroski believes that writing poetry and doing engineering are similar activities. With that in mind, I want to close with a poem that I was inspired to compose shortly after finishing my first reading of *To Engineer Is Human* so many years ago:

The Engineer's Task

*The Engineer's task is with less to do more,
Extending the boundaries established before.
The gaps being spanned must widen with time,
Approaching, not crossing, the critical line.
But lighter, and cheaper, and longer, they say.
The pressure is great to find a better way,
To establish new methods, to update the old,
To top all the others, innovate, and be bold.
But like pioneers who find the frontier's end,
Engineers, disappointed, see their structures bend.
Beams start to crack, and bridges crash down –
Lifetimes of effort become piles on the ground.
Still, all is not lost, there's a lesson at hand,
For by knowing what falls, we can know what will stand.
We set new limits for our successors to come –
And they, in turn, stretch them, just as we have done.
Wisdom is accepting what mistakes can teach;
Our hands must be slapped when we overreach.
So the ultimate error, of real concern,
Is when the Engineer fails from failure to learn. ■*

Jon A. Schmidt, P.E., SECB, is a senior structural engineer at Burns & McDonnell in Kansas City, Missouri, and chairs the Editorial Board for STRUCTURE magazine. If you have a failure story that you believe would benefit our readers, see the "Success from Failures" contest announcement on page 58 of this issue.

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