Another Fine Mess We Have Gotten Ourselves Into!

By John Dal Pino, S.E.

I had a conversation with a colleague recently while developing a fee proposal for a seismic project which was to use a national structural engineering seismic standard. Our discussion eventually got around to that often repeated question, "why are these provisions so constraining, rigid and detailed, leaving me no flexibility to make engineering judgments?" My colleague told me that the answer was that the writers of codes and standards are trying to force engineers to do the "right thing" in all situations, via the technical provisions. His point got the attention of the libertarian gnome that usually sits on my shoulder, who spoke up and asked "Is this the best and most efficient way for society to gain a safe result?" I thought about it for a second and answered, NO! The longer my colleague and I talked, the higher my fee went as I realized how much I was *required* to do, even when my experience told me otherwise!

The purpose of a building code or building standard should be to regulate a market that has gone astray by prohibiting (or at least discouraging through penalties) designs that are detrimental to the public interest or safety. Certainly there have been building failures from which engineers have learned a great deal, and the resulting research into building performance has helped advance the state of our knowledge. But I am not sure that we have learned enough with requisite certainty to justify the extent and breadth of the building codes and standards that currently regulate the engineering profession. At times, well-meaning engineers rush to incorporate research into the code before it is settled science, having then to backtrack and change the code again when better data is discovered. A good example of this is the 1988 UBC change requiring welded moment frame connections in ductile frames that the 1994 Northridge earthquake showed to be a bad idea. I believe that we have lost our way through unnecessary bureaucracy and rigidity that stifles engineering creativity, increases costs and may not actually make the public safer. A change is needed.

When I was a young engineer, a favorite topic around the lunchroom table, particularly on Friday afternoons, was whether we needed building codes at all. The fun position for the older engineers to take, particularly those that wanted to stir it up a bit, was to advocate for the "no codes at all", i.e. the laissez faire approach, as being the most efficient way to provide safe buildings for society. The argument went that if codes didn't exist at all, the best designers would be recognized as such, the lesser designers would fall by the way side since their lack of skills would be exposed and they wouldn't have clients, and the world would be a safe and happy place. Shocked to hear such heresy, the young engineers countered with the question, "aren't you concerned about public safety?" To the young engineers, the lack of a code would result in the design of many poorly conceived structures, some that might collapse in an earthquake due to shoddy design or construction, or both. The old guys countered that this might need to happen from time to time to keep the profession honest (this really got the young guys going!) and by the way, they reminded us, there are lots of perfectly safe buildings that were designed before modern codes were developed. The young guys, who really didn't want to have their lives shortened dramatically in an unnecessary building collapse, argued that the lack of codes was just too scary to comprehend and something that the public would never accept anyway. After a while of this back and forth, a stalemate ensued, so we finished our drinks and went home, to resume the argument another day.

The young guys were clearly on the "winning side" in the court of public opinion as evidenced by not only the expansion of both the size and complexity of codes and standards, but also in the number of codes and standards and the variety of building types they are written to address. Now that I can safely put myself in the "old guy" category, I often ask myself, is this detailed and constraining regulatory approach the best way to ensure public safety and to do so in an efficient manner and at a reasonable cost? I think not.

It seems extremely futile and wasteful for a large number of code writers, who are arguably the best engineering minds the profession has, to spend their energies year after year, code cycle after code cycle, writing more and more detailed code provisions and standards to catch fewer and fewer "bad" buildings from being designed, those that heretofore have somehow slipped through their grasp, while at the same time making the design and evaluation of all of the other "good" buildings more and more complicated and more opaque. Have they created a code that in my opinion unnecessarily applies to almost all buildings uniformly whether they are, to use an auto analogy, a basic compact or a Tesla Model S? Have they also unwittingly created a "safety net" which bails out engineers, with lets say less than average skills who are heavily reliant on computer models and technology to design buildings, at a cost to everyone else?

In addition to the safety net aspect, could the bureaucracy and rigidity of the codes be making the situation less safe? To save time and fee for the important creative design process, engineers have turned to technology to design almost all of the major components in a building in order to stay competitive and charge fees that can be accepted in the marketplace. The technology, which was supposed to help engineers, has the opposite effect of intellectually distancing engineers from the design process and the end result can suffer. Has your staff engineer ever told you that he or she feels certain about the design because "everything was green" in the computer model?

In researching legal matters for a paper I recently wrote on the engineering Standard of Care, I came across the argument that the most efficient way for the court system to decide alleged negligence and breach of duty-to-protect cases (and in fact the way our courts do it today), is for the courts to rely on "custom" as defined by expert witnesses using the common law. Negligence is therefore behavior that falls outside of what engineers should have done or should not have been expected to do in specific cases as established by engineers as a group. The alternative to "custom" would be for the courts to decide cases based on a "code" or a set of rules the courts established for themselves from a thorough understanding of the engineering profession, its technical nature, the economics of its business model, etc. or legislative actions that eventually result in code provisions that regulate how engineers do their work in addition to what they can and can't design. Clearly the courts don't have time to do this for engineering, let alone multiplying this effort by thousands of times to cover all of the cases from other industries, professions and occupations that find their way before the courts. So the courts rely on custom to the extent permissible by law. Most engineering projects don't end up in court, so the majority of engineers must be doing the right thing for their clients a vast majority of the time.

Getting back to the code issue, my "old guy" argument is – why don't we take the same approach as the courts to our building codes? The code could be a fairly simple document (like the *Uniform Building Code* still was back in the mid-1980s, when I was "young") that covered most buildings and laid out a general philosophy for proper building design. Required loadings (floor, roof, wind, seismic, etc.) and load conditions would be easy to understand and straightforward to implement, with little waste. Organizations such as the Structural Engineers of California (SEAOC) would write commentary documents (as they did in the past and continue to do) that would help engineers understand code intent and to provide guidance on how to incorporate best practices and current research into building designs. Equally important, the code would clearly state for the public what the structure was intended to provide in terms of safety, longevity and durability, and it would be up to the engineer to provide these through design. The engineering effort would be balanced against the risk in terms of loads and historic building performance. In terms of economic impact, it would be an efficient system because engineers and their clients would not be burdened by excessively restrictive and burdensome code regulations for buildings and legislative edicts which simply don't justify the

extra effort required based on their size, use or construction type. Engineers could always incorporate whatever technical advances that seemed justified to them and the building owner, given the intended age and use of the building. Let's face it, not every building needs to be designed to last 150-200 years or survive every natural event without some damage!

For larger, more complicated or unique buildings that fall outside the limits of a building code for "basic" buildings, rather than rely on overly detailed and restrictive codes like we do now, why not rely on the peer review process to decide if the building design is appropriate? If it works for the courts in terms of expert witness testimony and the establishment of custom, it should work for building design too. Besides, despite the efforts of code writers and legislators, the code provisions can never stay ahead of the creativity of engineers and architects working at the cutting edge. So why try? The building designer would develop a basis of design and the peer review panel (i.e. the experts) would either approve the project or require changes before final approval. This would be the purest form, and in my opinion the ideal result, of performance-based design. For those that aspire to engineering legend, what could be better?

The code currently has a similar system known as "alternative means of compliance"

for buildings that don't strictly comply with some aspects of the building code but that can be shown by test or calculation to provide the required measure of safety under expected loadings. The City of San Francisco already uses this process on buildings that are pushing the envelope, and there is no shortage of engineers eager to get involved on the review side. In theory, it should speed the review process because major projects won't be funneled through the normal building department review process that is not equipped to deal with such buildings. My argument is that this type of approach isn't used nearly often enough.

So as you can see, I am not advocating an entirely new approach to the building code, but just one that involves a sliding of the "complexity needle" considerably to the "left" (say from 910 toward 560 on the AM radio dial) so that many more buildings end up in the peer review process. Common, nothing-out-of-the-ordinary, buildings can be designed in accordance with a streamlined building code. This change would also have the added benefit of placing the burden of good design on skilled design professionals, and might even weed out the less skilled. I think that engineers and owners will be happier, money will be saved, and the public will be better off. What do you think?

I am not sure the change will ever happen. Tectonic changes like this are akin to changing the tax code from a graduated progressive tax to a flat tax. Most people can see the overall benefit from the simplicity of a flat tax and the obvious incentives for economic growth, but people generally lack the courage to try something new because they either don't see the immediate need (although it may exist), are worried about the disparate impacts on taxpayers, or for other reasons. Others who would be against a significant code change are those that have vested interests in managing and propagating the current system, and selling services to help their clients navigate the minefields that have been created (by them).

There will always be a role for the true expert in design and consulting, so those engineers have nothing to fear and I suspect they would thrive in a freer environment. I am advocating for a reform that will establish a healthier and more sustainable platform for everyone going forward.▪

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