A Personal Call to Regain Seismic Design Code Simplicity

By David W. Anderson, P.E., SECB

The March 2016 edition of STRUCTURE magazine just happened to contain a pair of articles which, when considered together, seem to indicate that our structural engineering profession is facing a sort of dichotomy in our seismic design methodologies. In this column, I examine certain statements from those two articles and relate them to my experience as a structural engineer. I also reflect on how our seismic design methodologies have become exponentially more complex over the years. From that realization, I entreat structural engineers nationwide to acknowledge that there is a real need for a much-simplified method of designing the vast majority of our seismic force resisting systems.

In his article, *Seismic Design Value Maps*, Ronald O. Hamburger states that "… the [seismic design values] maps portray precision in the design values that is inappropriate, given the substantial uncertainty in the values portrayed." He then goes on to say that the USGS/BSSC Project 17 group will address this issue (among others) by providing "… mapped value stability", and addressing the "… portrayal of inappropriate levels of precision." I want to speak to those Project 17 goals, and relate them to the companion article in that very same STRUCTURE magazine issue, *Alternative Diaphragm Seismic Design Force Level of ASCE 7-16*, by S. K. Ghosh.

As an every day practicing structural engineer, I have watched, as have many, as the seismic design procedures for buildings and structures have grown ever more complex (and to my purposes, ever more confusing). As the implied precision of the seismic design maps attests, all of this growing design complexity appears to be based on a house-of-cards foundation constructed from the idea that ever-increasing precision of calculations and modeling equals better built, and safer structures. I, for one, applaud the efforts of the Project 17 group to try and add some simplicity back into the mix, and maybe begin reversing the complicating trend of the past 25 years.

To gain some perspective on the subject of simplicity, the ASCE 7-10 seismic provisions now run to something like 180 pages. I do acknowledge that these provisions cover a multitude of specific design subjects. Compare that, however, with the ASCE 7-88 (only 28 years ago!). The earthquake design section then was only 9 pages long! Moreover, it, too, covered multiple subjects.

Following immediately after Mr. Hamburger's article, Dr. Ghosh's article on diaphragm design forces indicates that an additional, alternative procedure for calculating these forces will be included in Section 12.10 of the soon to be released edition of ASCE 7-16. In that section, the calculation of seismic forces will once again be taken to a more complex, and precise, level of scrutiny. For designs of extraordinary, complex, or critical structures located in high-seismic areas, this type of additional complexity might well be justified. Though, for the remainder of the structures located in the rest of the US, that level of precision seems to me like overkill. The author himself appears to imply as much with his statement "… [the] empirical approach has been generally satisfactory".

Given the overall, decent, historical seismic performance of the majority of the structures located in much of the U.S., I believe that it is now time to simplify life a bit (at least, the life of the ordinary structural design engineer). I think that the time has come for a much-simplified, complete seismic design methodology to be included in the ASCE 7 Code, based on aspects of empirical designs of yore which still serve us well – though informed by a more modern, applicable, physical understanding. This alternative, simplified methodology would apply to much of the country, and be usable within its stated restrictive assumptions, in a similar fashion to the simplified wind provisions which were introduced into recent ASCE 7 editions. Maybe a target of 8 to 10 total code pages might be a good goal?

I have become increasingly aware, as have many of my colleagues with whom I have discussed this subject, that our design codes have been trending toward a much more academically-driven level of precision and complexity that doesn't necessarily help the majority of us to design buildings that are intrinsically any safer. The outcome of good research and good academe should be to take complex phenomena and make them simple, and understandable – and in our case, more usable. As R. Buckminster Fuller once said, "… if the solution is not beautiful, I know it is wrong." Beautiful answers are quite often the simplest. In the case of seismic design codes, I believe the simplest answers are, reflectively, the beautiful ones – and the most useful.

As Tenet 1 of the ASCE Code of Ethics proclaims, let's continue to "…hold paramount the safety, health and welfare of the public…" by simplifying life where we can, and especially where it counts: for us engineers, and by extension, for our clients and their wallets.▪

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