The 'Art' of Structural Engineering

By John Mercer, Jr., P.E.

Finally, common sense has been incorporated in a key reference document that the structural engineering community has relied upon for the past two decades. I am referring to ASCE 7 and the ASCE 7-05 Reformat Project, taken on by the joint ASCE 7's Seismic Task Force Committee and the Building Seismic Safety Council's (BSSC) Code Resource Support Committee. I want to thank the committees for their efforts to assist practicing structural engineers to correctly interpret and apply the standard's minimum seismic load requirements.

Early in my career, I was exposed to a unique definition of a structural engineer, penned by one of my colleagues and a highly respected structural engineers in the upper Midwest, Mr. Doug Loos, P.E. "*Structural Engineering is the art of molding material we do not wholly understand into shapes we cannot precisely analyze so as to withstand forces we cannot totally assess; in such a way that others have no reason to suspect the extent of our ignorance.*"

Doug calligraphied this for my mentor and supervising engineer, Mr. Jim Glick, PE in 1994. My first job out of the Halls of Ivy was working for a prestressed concrete company where Mr. Glick oversaw my work as an E.I.T. Although tongue in cheek, Doug's definition of structural engineering is right to the point and about as accurate as our designs were during those pre-computer days. That was an era of structural engineers cultured in practicing the art.

Today, with computers and appropriate software, structural engineers can develop numeric solutions to an astonishing number of decimal points with a degree of precision that takes ones breath away. It makes me wonder if the *art* of being able to smell or feel a reasonable solution will continue to exist for the structural engineer. Perhaps "ignorance" will continue to escalate if we become solely dependent on computers for our design solutions.

In 1982, I departed the precast company and launched my consulting career in structural engineering. Reference materials soon populated my bookshelves. One reference was the ANSI A58.1, later to be claimed by ASCE and evolve into ASCE 7 *Minimum Design Loads for Buildings and Other Structures*. Several revisions were made to ANSI A58.1/ASCE 7 over the years. The latest version, partially discussed in this issue, is the ASCE 7-05.

Susan M. Dowty, S.E. reported on the ASCE/CRSC Subcommittee's decision to not only upgrade the content of the document with technical criteria, but to reorganize the format of the information into a logical sequence and flow for the new provisions. I encourage you to download Ms. Dowty's full white paper from STRUCTURE® magazine's website (**www.structuremag.org**). I also recommend that you read Ms. Dowty's article on page 53 in this issue.

The ASCE/CRSC Subcommittee is to be congratulated on its vision and their efforts to accomplish the following:

"**GOAL**: Make ASCE 7-05 a good, user-friendly set of seismic provisions which can be understood and interpreted correctly and easily by an average engineer designing an average structure."

To accomplish their task, the Subcommittee created a set of 19 ground rules dealing with punctuation, paragraph numbering schemes, use of tables and graphs, and the use of unambiguous words and language. Does this remind you a bit of English 101? Fortunately, the structural engineering community will reap many benefits.

Standard of Care, a pre-cursor to Risk Management, requires the structural engineer to be globally familiar with project information and design process in order to produce design documents that comply with local building authorities' adopted code requirements.

The International Building Code (IBC) is used by a majority of jurisdictions. The IBC is gravitating toward incorporating, by reference, existing standards and material codes to minimize document bloat, and to avoid introduction of errors and misinterpretation of each standard's intent. Specifically, the forthcoming IBC 2006 will defer to the ASCE 7-05 for minimum building and other structure loading requirements.

Structural engineers may experience additional workload in their basic scope of work with the evolution of each new code or code/standard version. Ms. Dowty has done a superb job of comparing the differences between two versions of the ASCE 7 standard to alert the structural engineer to the changes and/or necessity of applying the standard's requirements.

Chapters in the latest version of the standard were organized to minimize the design effort on the part of the practicing structural engineer. This was accomplished by placing the lowest level seismic requirements first, subject to the structure meeting a predetermined set of criteria. More stringent requirements for complex structures exceeding the criteria occur in later chapters of the document.

Looking forward, a lesson can be learned by all code and standard writing bodies from the Reformat Project subcommittee. Hopefully, one day, all structural engineers may be able to understand and correctly interpret all standards' and material codes' provisions for loads to buildings and other structures without confusion and faulty or conflicting interpretations of the past.■

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