The 1/3 Stress Increase

I enjoyed reading the correspondence from Duane Ellifrit regarding the history of the "Mysterious 1/3 Stress Increase for Wind." I dug up a faded xerox copy of Mr. Ellifrit's article published in AISC *Engineering Journal* (circa 1977). I use it periodically when asked by colleagues about the mysterious increase. It provides a great snapshot of the history of the stress increase (dating back to 1896 construction).

Perhaps you could consider reprinting few excerpts from the original article for their historical significance.

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Editor's note: The following is an excerpt from Mr. Ellifrit's Engineering Journal *article, "The Mysterious 1/3 Stress Increase," published in the Fourth Quarter, 1977. The full article is available from AISC's ePubs web site, (www.aisc.org/epubs). Members and ePubs subscribers can download it for free, and all others can order it for $10.*

"It has been customary throughout three or four generations of structural engineers to use a higher allowable stress when considering the stresses produced by wind in a structure. Much later, the same provision was allowed for earthquake related stresses. Recently...there has been some confusion as to what was the rationale for permitting this increase in the first place. Just what physical phenomenon is it supposed to account for? When was it first introduced and why? If it was valid at the time of its origin, is it still valid today?"

"…This controversy motivated me to conduct my own informal, unfunded research project to see what I could uncover on the subject."

"The oldest reference I could find to using an increased allowable stress for wind was in Cooper's railway bridge specifications of 1896. This permitted a ¼ increase, but gave no reason. A. J. DuBois recommended, also in 1896, an allowable stress for beams of 10,000 psi and an allowable for lateral bracing of 15,000 psi. Although no statement is made regarding the reason for a higher allowable stress for bracing, it could be interpreted as a 50% increase because of wind forces."

Credit Due

The triangulated egg-shaped structure discussed and pictured in "Steel Showcase," December 2003, was designed and manufactured by TEMCOR of Gardena, CA. It is made using only aluminum struts and gussets and is not "an innovative steel strut and gusset system" as stated in the article. TEMCOR also provided the aluminum frame used for the 2001 APEC conference center, as part of this same facility.

For 40 years, TEMCOR has provided clear span aluminum structures for architectural, bulk storage, petroleum, water and wastewater applications. Another notable installation is the aluminum dome at the South Pole and our largest is a 415'-diameter dome located adjacent to the Queen Mary in Long Beach, CA.

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Editor's Note: TEMCOR correctly should be credited with the design of the triangulated egg-shaped structure in the Shanghai Museum of Science and Technology. It is constructed of aluminum, not steel struts and gussets. We regret any confusion caused by the error.

Do you have an opinion?

Modern Steel Construction would like to hear from you! Please send your comments to Scott Melnick, melnick@aisc.org.