masonry structures substantially increases the allowable stress in tension reinforcement.

C2.4.2 Load Combinations Including Flood Load

See Section C2.3.4. The multiplier on F_a aligns allowable stress design for flood load with strength design.

C2.4.3 Load Combinations Including Atmospheric Ice Loads

See Section C2.3.4.

C2.4.4 Load Combinations Including Self-Straining Loads

When using allowable stress design, determination of how self-straining loads should be considered together with other loads should be based on the considerations discussed in Section C2.3.5. For typical situations, the following load combinations should be considered for evaluating the effects of self-straining loads together with dead and live loads.

$$1.0D + 1.0T$$
$$1.0D + 0.75(L + T)$$

These combinations are not all-inclusive, and judgment will be necessary in some situations. For example, where roof live loads or snow loads are significant and could conceivably occur simultaneously with self-straining loads, their effect should be included.The design should be based on the load combination causing the most unfavorable effect.

C2.5 LOAD COMBINATIONS FOR EXTRAORDINARY EVENTS

Section 2.5 advises the structural engineer that certain circumstances might require structures to be checked for low-probability events such as fire, explosions, and vehicular impact. Since the 1995 edition of ASCE Standard 7, Commentary C2.5 has provided a set of load combinations that were derived using a probabilistic basis similar to that used to develop the load combination requirements for ordinary loads in Section 2.3. In recent years, social and political events have led to an increasing desire on the part of architects, structural engineers, project developers, and regulatory authorities to enhance design and construction practices for certain buildings to provide additional structural robustness and to lessen the likelihood of disproportionate collapse if an abnormal event were to occur. Several federal, state, and local agencies have adopted policies that require new buildings and structures to be constructed with such enhancements of structural robustness (GSA 2003 and DOD 2009). Robustness typically is assessed by notional removal of key load-bearing structural elements, followed by a structural analysis to assess the ability of the structure to bridge over the damage (often denoted alternative path analysis). Concurrently, advances in structural engineering for fire conditions (e.g., AISC 2010, Appendix 4) raise the prospect that new structural design requirements for fire safety will supplement the existing deemed-to-satisfy provisions in the next several years. To meet these needs, the load combinations for extraordinary events have been moved to Section 2.5 of *ASCE Standard 7* from Commentary C2.5, where they appeared in previous editions.

These provisions are not intended to supplant traditional approaches to ensure fire endurance based on standardized time–temperature curves and code-specified endurance times. Current code-specified endurance times are based on the ASTM E119 time–temperature curve under full allowable design load.

Extraordinary events arise from service or environmental conditions that traditionally are not considered explicitly in design of ordinary buildings and other structures. Such events are characterized by a low probability of occurrence and usually a short duration. Few buildings are ever exposed to such events, and statistical data to describe their magnitude and structural effects are rarely available. Included in the category of extraordinary events would be fire, explosions of volatile liquids or natural gas in building service systems, sabotage, vehicular impact, misuse by building occupants, subsidence (not settlement) of subsoil, and tornadoes. The occurrence of any of these events is likely to lead to structural damage or failure. If the structure is not properly designed and detailed, this local failure may initiate a chain reaction of failures that propagates throughout a major portion of the structure and leads to a potentially catastrophic partial or total collapse. Although all buildings are susceptible to such collapses in varying degrees, construction that lacks inherent continuity and ductility is particularly vulnerable (Taylor 1975, Breen and Siess 1979, Carper and Smilowitz 2006, Nair 2006, and NIST 2007).

Good design practice requires that structures be robust and that their safety and performance not be sensitive to uncertainties in loads, environmental influences, and other situations not explicitly considered in design. The structural system should be designed in such a way that if an extraordinary event occurs, the probability of damage disproportionate to