CODE

5.3.5 If wind load ***W*** is provided at service-level loads, **1.6*W*** shall be used in place of **1.0*W*** in Eq. (5.3.1d) and (5.3.1f), and **0.8*W*** shall be used in place of **0.5*W*** in Eq. (5.3.1c).

5.3.6 The structural effects of forces due to restraint of volume change and differential settlement ***T*** shall be considered in combination with other loads if the effects of ***T*** can adversely affect structural safety or performance. The load factor for ***T*** shall be established considering the uncertainty associated with the likely magnitude of ***T***, the probability that the maximum effect of ***T*** will occur simultaneously with other applied loads, and the potential adverse consequences if the effect of ***T*** is greater than assumed. The load factor on ***T*** shall not have a value less than 1.0.

5.3.7 If fluid load ***F*** is present, it shall be included in the load combination equations of 5.3.1 in accordance with (a), (b), (c), or (d):

(a) If ***F*** acts alone or adds to the effects of ***D***, it shall be included with a load factor of 1.4 in Eq. (5.3.1a).
(b) If ***F*** adds to the primary load, it shall be included with a load factor of 1.2 in Eq. (5.3.1b) through (5.3.1e).
(c) If the effect of ***F*** is permanent and counteracts the primary load, it shall be included with a load factor of 0.9 in Eq. (5.3.1g).

COMMENTARY

R5.3.5 In ASCE/SEI 7-05, wind loads are consistent with service-level design; a wind load factor of 1.6 is appropriate for use in Eq. (5.3.1d) and (5.3.1f) and a wind load factor of 0.8 is appropriate for use in Eq. (5.3.1c). ASCE/SEI 7-16 prescribes wind loads for strength-level design and the wind load factor is 1.0. Design wind speeds for strength-level design are based on storms with mean recurrence intervals of 300, 700, and 1700 years depending on the risk category of the structure. The higher load factors in 5.3.5 apply where service-level wind loads corresponding to a 50-year mean recurrence interval are used for design.

R5.3.6 Several strategies can be used to accommodate movements due to volume change and differential settlement. Restraint of such movements can cause significant member forces and moments, such as tension in slabs and shear forces and moments in vertical members. Forces due to ***T*** effects are not commonly calculated and combined with other load effects. Rather, designs rely on successful past practices using compliant structural members and ductile connections to accommodate differential settlement and volume change movement while providing the needed resistance to gravity and lateral loads. Expansion joints and construction closure strips are used to limit volume change movements based on the performance of similar structures. Shrinkage and temperature reinforcement, which may exceed the required flexural reinforcement, is commonly proportioned based on gross concrete area rather than calculated force.

Where structural movements can lead to damage of nonductile elements, calculation of the predicted force should consider the inherent variability of the expected movement and structural response.

A long-term study of the volume change behavior of precast concrete buildings (Klein and Lindenberg 2009) recommends procedures to account for connection stiffness, thermal exposure, member softening due to creep, and other factors that influence ***T*** forces.

Fintel et al. (1986) provides information on the magnitudes of volume change effects in tall structures and recommends procedures for including the forces resulting from these effects in design.