C2.3.3 Load Combinations Including Flood Load

The nominal flood load, F_a, is based on the 100-year flood (Section 5.1). The recommended flood load factor of 2.0 in V Zones and Coastal A Zones is based on a statistical analysis of flood loads associated with hydrostatic pressures, pressures due to steady overland flow, and hydrodynamic pressures due to waves, as specified in Section 5.4.

The flood load criteria were derived from an analysis of hurricane-generated storm tides produced along the United States East and Gulf coasts (Mehta et al. 1998), where storm tide is defined as the water level above mean sea level resulting from wind-generated storm surge added to randomly phased astronomical tides. Hurricane wind speeds and storm tides were simulated at 11 coastal sites based on historical storm climatology and on accepted wind speed and storm surge models. The resulting wind speed and storm tide data were then used to define probability distributions of wind loads and flood loads using wind and flood load equations specified in Sections 5.3 and 5.4. Load factors for these loads were then obtained using established reliability methods (Ellingwood et al. 1982 and Galambos et al. 1982) and achieve approximately the same level of reliability as do combinations involving wind loads acting without floods. The relatively high flood load factor stems from the high variability in floods relative to other environmental loads. The presence of $2.0F_a$ in both combinations (4) and (6) in V Zones and Coastal A Zones is the result of high stochastic dependence between extreme wind and flood in hurricane-prone coastal zones. The $2.0F_a$ also applies in coastal areas subject to northeasters, extratropical storms, or coastal storms other than hurricanes, where a high correlation exists between extreme wind and flood.

Flood loads are unique in that they are initiated only after the water level exceeds the local ground elevation. As a result, the statistical characteristics of flood loads vary with ground elevation. The load factor 2.0 is based on calculations (including hydrostatic, steady flow, and wave forces) with still-water flood depths ranging from approximately 4 to 9 ft (average still-water flood depth of approximately 6 ft), and applies to a wide variety of flood conditions. For lesser flood depths, load factors exceed 2.0 because of the wide dispersion in flood loads relative to the nominal flood load. As an example, load factors appropriate to water depths slightly less than 4 ft equal 2.8 (Mehta et al. 1998). However, in such circumstances, the flood load generally is small. Thus, the load factor 2.0 is based on the recognition that flood loads of most importance to structural design occur in situations where the depth of flooding is greatest.

C2.3.4 Load Combinations Including Atmospheric Ice Loads

Load combinations 1 and 2 in Sections 2.3.4 and 2.4.3 include the simultaneous effects of snow loads as defined in Chapter 7 and Atmospheric Ice Loads as defined in Chapter 10. Load combinations 2 and 3 in Sections 2.3.4 and 2.4.3 introduce the simultaneous effect of wind on the atmospheric ice. The wind load on the atmospheric ice, W_i, corresponds to an event with approximately a 500-year Mean Recurrence Interval (MRI). Accordingly, the load factors on W_i and D_i are set equal to 1.0 and 0.7 in Sections 2.3.4 and 2.4.3, respectively. The rationale is exactly the same as that used to specify the earthquake force as $0.7E$ in the load combinations applied in working stress design. The snow loads defined in Chapter 7 are based on measurements of frozen precipitation accumulated on the ground, which includes snow, ice due to freezing rain, and rain that falls onto snow and later freezes. Thus the effects of freezing rain are included in the snow loads for roofs, catwalks, and other surfaces to which snow loads are normally applied. The atmospheric ice loads defined in Chapter 10 are applied simultaneously to those portions of the structure on which ice due to freezing rain, in-cloud icing, or snow accrete that are not subject to the snow loads in Chapter 7. A trussed tower installed on the roof of a building is one example. The snow loads from Chapter 7 would be applied to the roof with the atmospheric ice loads from Chapter 10 applied to the trussed tower. If a trussed tower has working platforms, the snow loads would be applied to the surface of the platforms with the atmospheric ice loads applied to the tower. If a sign is mounted on a roof, the snow loads would be applied to the roof and the atmospheric ice loads to the sign.

C2.3.5 Load Combinations Including Self-Straining Loads

Self-straining load effects should be calculated based on a realistic assessment of the most probable values rather than the upper bound values of the variables. The most probable value is the value that can be expected at any arbitrary point in time.

When self-straining loads are combined with dead loads as the principal action, a load factor of 1.2 may be used. However, when more than one variable load is considered and self-straining loads are considered as a companion load, the load factor may be reduced