Chapter 2
COMBINATIONS OF LOADS

2.1 GENERAL
Buildings and other structures shall be designed using the provi-
sions of either Section 2.3 or 2.4. Either Section 2.3 or 2.4 shall
be used exclusively for proportioning elements of a particular
construction material throughout the structure.

2.2 SYMBOLS AND NOTATION
\[ D = \text{dead load} \]
\[ D_i = \text{weight of ice} \]
\[ E = \text{earthquake load} \]
\[ F = \text{load due to fluids with well-defined pressures and} \]
\[ \text{maximum heights} \]
\[ F_a = \text{flood load} \]
\[ H = \text{load due to lateral earth pressure, ground water pressure,} \]
\[ \text{or pressure of bulk materials} \]
\[ L = \text{live load} \]
\[ L_r = \text{roof live load} \]
\[ R = \text{rain load} \]
\[ S = \text{snow load} \]
\[ T = \text{self-straining force} \]
\[ W = \text{wind load} \]
\[ W_i = \text{wind-on-ice determined in accordance with Chapter} \]
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2.3 COMBINING FACTORED LOADS
USING STRENGTH DESIGN

2.3.1 Applicability. The load combinations and load factors
given in Section 2.3.2 shall be used only in those cases in which
they are specifically authorized by the applicable material design
standard.

2.3.2 Basic Combinations. Structures, components, and foun-
dations shall be designed so that their design strength equals
or exceeds the effects of the factored loads in the following
combinations:
1. \[ 1.4(D + F) \]
2. \[ 1.2(D + F + T) + 1.6(L + H) + 0.5(L_r \text{ or } S \text{ or } R) \]
3. \[ 1.2D + 1.6(L_r \text{ or } S \text{ or } R) + (L \text{ or } 0.8W) \]
4. \[ 1.2D + 1.6W + L + 0.5(L_r \text{ or } S \text{ or } R) \]
5. \[ 1.2D + 1.0E + L + 0.2S \]
6. \[ 0.9D + 1.6W + 1.6H \]
7. \[ 0.9D + 1.0E + 1.6H \]

EXCEPTIONS:
1. The load factor on \( L \) in combinations (3), (4), and (5) is permitted to
   equal 0.5 for all occupancies in which \( L_o \) in Table 4-1 is less than or
equal to 100 psf, with the exception of garages or areas occupied as
   places of public assembly.
2. The load factor on \( H \) shall be set equal to zero in combinations (6) and
   (7) if the structural action due to \( H \) counteracts that due to \( W \) or \( E \).

Where lateral earth pressure provides resistance to structural actions
from other forces, it shall not be included in \( H \) but shall be included in
the design resistance.
3. In combinations (2), (4), and (5), the companion load \( S \) shall be taken
   as either the flat roof snow load \( p_f \) or the sloped roof snow load \( p_s \).

Each relevant strength limit state shall be investigated. Effects
of one or more loads not acting shall be investigated. The most
unfavorable effects from both wind and earthquake loads shall be
investigated, where appropriate, but they need not be considered
to act simultaneously. Refer to Section 12.4 for specific definition
of the earthquake load effect \( E \). \[ \text{1} \]

2.3.3 Load Combinations Including Flood Load. When a
structure is located in a flood zone (Section 5.3.1), the follow-
ing load combinations shall be considered:
1. In V-Zones or Coastal A-Zones, 1.6W in combinations (4)
   and (6) shall be replaced by 1.6W + 2.0F_a.
2. In noncoastal A-Zones, 1.6W in combinations (4) and (6)
   shall be replaced by 0.8W + 1.0F_a.

2.3.4 Load Combinations Including Atmospheric Ice Loads.
When a structure is subjected to atmospheric ice and wind-on-ice
loads, the following load combinations shall be considered:
1. \[ 0.5(L_r \text{ or } S \text{ or } R) \text{ in combination (2) shall be replaced by} \]
   \[ 0.2D_i + 0.5S. \]
2. \[ 1.6W + 0.5(L_r \text{ or } S \text{ or } R) \text{ in combination (4) shall be re-
   placed by } D_i + W_i + 0.5S. \]
3. \[ 1.6W \text{ in combination (6) shall be replaced by } D_i + W_i. \]

2.4 COMBINING NOMINAL LOADS USING
ALLOWABLE STRESS DESIGN

2.4.1 Basic Combinations. Loads listed herein shall be consid-
ered to act in the following combinations; whichever produces the
most unfavorable effect in the building, foundation, or structural
member being considered. Effects of one or more loads not acting
shall be considered.
1. \[ D + F \]
2. \[ D + H + F + L + T \]
3. \[ D + H + F + (L_r \text{ or } S \text{ or } R) \]
4. \[ D + H + F + 0.75(L + T) + 0.75(L_r \text{ or } S \text{ or } R) \]
5. \[ D + H + F + (W \text{ or } 0.7E) \]
6. \[ D + H + F + 0.75(W \text{ or } 0.7E) + 0.75L \]
   \[ + 0.75(L_r \text{ or } S \text{ or } R) \]
7. \[ 0.6D + W + H \]
8. \[ 0.6D + 0.7E + H \]

\[ \text{1 The same } E \text{ from Section 12.4 is used for both Sections 2.3.2 and 2.4.1.} \]
\[ \text{Refer to the Chapter 11 Commentary for the Seismic Provisions.} \]