Chapter C7
SNOW LOADS

C7.0 SNOW LOADS

Methodology. The procedure established for determining design snow loads is as follows:

1. Determine the ground snow load for the geographic location (Sections 7.2 and C7.2).
2. Generate a flat roof snow load from the ground load with consideration given to (1) roof exposure (Sections 7.3.1, C7.3, and C7.3.1), (2) roof thermal condition (Sections 7.3.2, C7.3, and C7.3.2), (3) occupancy and function of structure (Sections 7.3.3 and C7.3.3).
3. Consider roof slope (Sections 7.4 through 7.4.5 and C7.4).
4. Consider partial loading (Sections 7.5 and C7.5).
5. Consider unbalanced loads (Sections 7.6 through 7.6.4 and C7.6).
6. Consider snow drifts: (1) on lower roofs (Sections 7.7 through 7.7.2 and C7.7) and (2) from projections (Sections 7.8 and C7.8).
7. Consider sliding snow (Sections 7.9 and C7.9).
8. Consider extra loads from rain on snow (Sections 7.10 and C7.10).
9. Consider ponding loads (Section 7.11 and C7.11).
10. Consider existing roofs (Sections 7.12 and C7.12).
11. Consider other roofs and sites (Section C7.13).
12. Consider the consequences of loads in excess of the design value (see the following text).

Loads in Excess of the Design Value. The philosophy of the probabilistic approach used in this standard is to establish a design value that reduces the risk of a snow load induced failure to an acceptably low level. Because snow loads in excess of the design value may occur, the implications of such “excess” loads should be considered. For example, if a roof is deflected at the design snow load so that slope to drain is eliminated, “excess” snow load might cause ponding (Section C7.11) and perhaps progressive failure.

The snow load/dead load ratio of a roof structure is an important consideration when assessing the implications of “excess” loads. If the design snow load is exceeded, the percentage increase in total load would be greater for a lightweight structure (i.e., one with a high snow load/dead load ratio) than for a heavy structure (i.e., one with a low snow load/dead load ratio). For example, if a 40 lb/ft^2 (1.92 kN/m^2) roof snow load is exceeded by 20 lb/ft^2 (0.96 kN/m^2) for a roof having a 25 lb/ft^2 (1.19 kN/m^2) dead load, the total load increases by 31 percent from 65 to 85 lb/ft^2 (3.11 to 4.07 kN/m^2). If the roof had a 60-lb/ft^2 (2.87 kN/m^2) dead load, the total load would increase only by 20 percent from 100 to 120 lb/ft^2 (4.79 to 5.75 kN/m^2).

C7.2 GROUND SNOW LOADS, p_g

The snow load provisions were developed from an extreme-value statistical analysis of weather records of snow on the ground (Ellingwood and Redfield 1983). The log normal distribution was selected to estimate ground snow loads, which have a 2 percent annual probability of being exceeded (50-yr mean recurrence interval).

Maximum measured ground snow loads and ground snow loads with a 2 percent annual probability of being exceeded are presented in Table C7-1 for 204 National Weather Service (NWS) “first-order” stations at which ground snow loads have been measured for at least 11 years during the period 1952–1992.

Concurrent records of the depth and load of snow on the ground at the 204 locations in Table C7-1 were used to estimate the ground snow load and the ground snow depth having a 2 percent annual probability of being exceeded for each of these locations. The period of record for these 204 locations, where both snow depth and snow load have been measured, averages 33 years up through the winter of 1991–1992. A mathematical relationship was developed between the 2 percent depths and the 2 percent loads. The nonlinear best-fit relationship between these extreme values was used to estimate 2 percent (50-yr mean recurrence interval) ground snow loads at about 9,200 other locations at which only snow depths were measured. These loads, as well as the extreme-value loads developed directly from snow load measurements at 204 first-order locations, were used to construct the maps.

In general, loads from these two sources were in agreement. In areas where there were differences, loads from the 204 first-order locations were considered to be more valuable when the map was