

## Snow Loads on Roofs

### Unit Weight of Snow on Roofs

7. To calculate loads due to snow on roofs, a measurement or good estimate of the unit weight is necessary. The unit weight of snow on roofs,  $\gamma$ , obtained from measurements at a number of stations across Canada varied from about 1.0 to 4.5 kN/m<sup>3</sup>. An average value for use in design in lieu of better local data is  $\gamma = 3.0$  kN/m<sup>3</sup>.<sup>[5]</sup> The unit weight of snow may be considerably greater than 3.0 kN/m<sup>3</sup> in some locations such as regions where the maximum roof load is reached only after contributions from many snowstorms, coastal regions, and regions where winter rains are considerable; in such locations, a unit weight as high as 4.0 kN/m<sup>3</sup> may be appropriate.

### Solar Radiation and Heat Loss

8. Some factors that modify snow loads occur only under special conditions. For example, solar radiation has little effect in reducing loads in cold weather. Similarly, during cold weather, heat loss from roofs is not very effective in melting the snow, particularly on well insulated and well ventilated roofs. These two factors cannot, therefore, be relied upon to significantly reduce the snow load during colder periods. During thaws and toward the end of winter, however, when air temperatures approach the freezing point, solar radiation and heat loss do cause melting.

### Roof Snow Load Factors

9. The factors  $C_b$ ,  $C_w$ ,  $C_s$  and  $C_a$  were not obtained by rigorous statistical analyses due to the lack of data, but they have been found to give acceptable and conservative designs.
10. **Basic roof snow load factor,  $C_b$ .** The basic roof snow load has been set at 80% of the ground load (i.e.  $C_b = 0.8$ ). This percentage is based on the results of a countrywide survey of snow loads on roofs carried out by the Institute for Research in Construction and a number of volunteers. The wind is less effective in removing snow from large roofs due to the greater quantities involved and because snow may drift from one area to another.<sup>[17]</sup> Increased values of  $C_b$  are therefore specified in NBC Clauses 4.1.6.2.(2)(a) and (b) to account for this effect in the case of large roofs.
11. **Wind exposure factor,  $C_w$ .** Observations in many areas of Canada have shown that where a roof or a part of it is fully exposed to wind, some of the snow is blown off or prevented from accumulating, thus reducing the average snow load.
12. Therefore, for roofs fully exposed to the wind, the wind exposure factor,  $C_w$ , may be taken as equal to 0.75 rather than 1.0 (or 0.5 rather than 1.0 for exposed sites north of the treeline). This substitution applies under the following conditions:
  - (a) the building is on open level terrain containing only scattered buildings, trees or other such obstructions, open water or shorelines thereof, and is expected to remain so during its service life;
  - (b) the area of roof under consideration is exposed to the wind on all sides and does not have any significant obstructions, such as parapet walls, within a distance of at least 10 times the difference between the height of the obstruction and  $C_b C_w S_s / \gamma$  metres, where the applicable value of  $C_w$  is either 0.75 or 0.5, as provided in NBC Sentence 4.1.6.2.(4);
  - (c) the loading case under consideration does not involve the accumulation of snow due to drifting from adjacent surfaces such as, for example, the other side of a gable roof; and
  - (d) the buildings are not in the High or Post-disaster Importance Categories described in NBC Table 4.1.2.1.

A value of 1.0 for  $C_w$  must be applied to other loadings than the ones marked Case I in Figures G-1 to G-4.

13. The value  $C_b C_w S_s / \gamma$  is the height of uniformly distributed snow on a roof without any obstructions, including parapets. Any obstructions lower than this do not generate additional snow loading.
14. In practice it is sometimes difficult to make a clear distinction between roofs that will be fully exposed to winds and those that will not. The designer should, in consultation with the owner, weigh the probability of the roof becoming sheltered by an addition to the building or by adjacent higher buildings or trees. Such changes could cause either drift loads or higher average loads. In considering drift loads—which are the more serious—a minimum distance of at least 5 m should be