The unbalanced snow load in the valley is $2p_f/C_e$ to create a total unbalanced load that does not exceed a uniformly distributed ground snow load in most situations.

Sawtooth roofs and other "up-and-down" roofs with significant slopes tend to be vulnerable in areas of heavy snowfall for the following reasons:

1. They accumulate heavy snow loads and are therefore expensive to build.
2. Windows and ventilation features on the steeply sloped faces of such roofs may become blocked with drifting snow and be rendered useless.
3. Meltwater infiltration is likely through gaps in the steeply sloped faces if they are built as walls, because slush may accumulate in the valley during warm weather. This can promote progressive deterioration of the structure.
4. Lateral pressure from snow drifted against clerestory windows may break the glass.
5. The requirement that snow above the valley not be at an elevation higher than the snow above the ridge may limit the unbalanced load to less than $2p_f/C_e$.

C7.6.4 Unbalanced Snow Loads for Dome Roofs

This provision is based on a similar provision in the 1990 National Building Code of Canada.

C7.7 DRIFTS ON LOWER ROOFS (AERODYNAMIC SHADE)

When a rash of snow-load failures occurs during a particularly severe winter, there is a natural tendency for concerned parties to initiate across-the-board increases in design snow loads. This is generally a technically ineffective and expensive way of attempting to solve such problems because most failures associated with snow loads on roofs are caused not by moderate overloads on every square foot (square meter) of the roof, but rather by localized significant overloads caused by drifted snow.

Drifts will accumulate on roofs (even on sloped roofs) in the wind shadow of higher roofs or terrain features. Parapets have the same effect. The affected roof may be influenced by a higher portion of the same structure or by another structure or terrain feature nearby if the separation is 20 ft (6.1 m) or less. When a new structure is built within 20 ft (6.1 m) of an existing structure, drifting possibilities should also be investigated for the existing structure (see Sections C7.7.2 and C7.12). The snow that forms drifts may come from the roof on which the drift forms, from higher or lower roofs, or, on occasion, from the ground.

The leeward drift load provisions are based on studies of snow drifts on roofs (Speck 1984, Taylor 1984, and O'Rourke et al. 1985 and 1986). Drift size is related to the amount of driftable snow as quantified by the upwind roof length and the ground snow load. Drift loads are considered for ground snow loads as low as 5 lb/ft^2 (0.24 kN/m^2). Case studies show that, in regions with low ground snow loads, drifts 3 to 4 ft (0.9 to 1.2 m) high can be caused by a single storm accompanied by high winds.

A change from a prior (1988) edition of this standard involves the width w when the drift height h_d from Fig. 7-9 exceeds the clear height h_c. In this situation the width of the drift is taken as $4h_d^2/h_c$ with a maximum value of $8h_c$. This drift width relation is based upon equating the cross-sectional area of this drift (i.e., $1/2h_c \times w$) with the cross-sectional area of a triangular drift where the drift height is not limited by h_c (i.e., $1/2h_d \times 4h_d$) as suggested by Zallen (1988). The upper limit of drift width is based on studies by Finney (1939) and Tabler (1975) that suggest that a "full" drift has a rise-to-run of about 1:6.5, and case studies (Zallen 1988) that show observed drifts with a rise-to-run greater than 1:10.

The drift height relationship in Fig. 7-9 is based on snow blowing off a high roof upwind of a lower roof. The change in elevation where the drift forms is called a "leeward step." Drifts can also form at "windward steps." An example is the drift that forms at the downwind end of a roof that abuts a higher structure there. Fig. 7-7 shows "windward step" and "leeward step" drifts.

For situations having the same amount of available snow (i.e., upper and lower roofs of the same length) the drifts that form in leeward steps are larger than those that form in windward steps. In previous versions of the standard, the windward drifts height was given as $1/2h_d$ from Fig. 7-9 using the length of the lower roof for l_u. Based upon an analysis of case histories in O'Rourke and DeAngelis (2002), a value of 3/4 is now prescribed.

Depending on wind direction, any change in elevation between roofs can be either a windward or leeward step. Thus the height of a drift is determined for each wind direction as shown in Example 3, and the larger of the two heights is used as the design drift.

The drift load provisions cover most, but not all, situations. Finney (1939) and O'Rourke (1989) document a larger drift than would have been expected based on the length of the upper roof. The