Chapter 7
SNOW LOADS

7.1 SYMBOLS

\( C_e \) = exposure factor as determined from Table 7-2
\( C_s \) = slope factor as determined from Fig. 7-2
\( C_t \) = thermal factor as determined from Table 7-3
\( h \) = vertical separation distance in feet (m) between the edge of a higher roof including any parapet and the edge of a lower adjacent roof excluding any parapet
\( h_b \) = height of balanced snow load determined by dividing \( p_s \) by \( \gamma \), in ft (m)
\( h_c \) = clear height from top of balanced snow load to (1) closest point on adjacent upper roof, (2) top of parapet, or (3) top of a projection on the roof, in ft (m)
\( h_d \) = height of snow drift, in ft (m)
\( h_o \) = height of obstruction above the surface of the roof, in ft (m)
\( I \) = importance factor as prescribed in Section 7.3.3
\( I_s \) = importance factor as prescribed in Section 7.3.3
\( l_u \) = length of the roof upwind of the drift, in ft (m)
\( p_d \) = maximum intensity of drift surcharge load, in lb/ft\(^2\) (kN/m\(^2\))
\( p_f \) = snow load on flat roofs (“flat” = roof slope \( \leq 5^\circ \)), in lb/ft\(^2\) (kN/m\(^2\))
\( p_g \) = ground snow load as determined from Fig. 7-1 and Table 7-1; or a site-specific analysis, in lb/ft\(^2\) (kN/m\(^2\))
\( p_m \) = minimum snow load for low-slope roofs, in lb/ft\(^2\) (kN/m\(^2\))
\( p_s \) = sloped roof (balanced) snow load, in lb/ft\(^2\) (kN/m\(^2\))
\( s \) = horizontal separation distance in feet (m) between the edges of two adjacent buildings
\( S \) = roof slope run for a rise of one
\( \theta \) = roof slope on the leeward side, in degrees
\( w \) = width of snow drift, in ft (m)
\( W \) = horizontal distance from eave to ridge, in ft (m)
\( \gamma \) = snow density, in lb/ft\(^3\) (kN/m\(^3\)) as determined from Eq. 7.7-1

7.2 GROUND SNOW LOADS, \( p_g \)

Ground snow loads, \( p_g \), to be used in the determination of design snow loads for roofs shall be as set forth in Fig. 7-1 for the contiguous United States and Table 7-1 for Alaska. Site-specific case studies shall be made to determine ground snow loads in areas designated CS in Fig. 7-1. Ground snow loads for sites at elevations above the limits indicated in Fig. 7-1 and for all sites within the CS areas shall be approved by the authority having jurisdiction. Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2 percent annual probability of being exceeded (50-year mean recurrence interval).

Snow loads are zero for Hawaii, except in mountainous regions as determined by the authority having jurisdiction.

7.3 FLAT ROOF SNOW LOADS, \( p_f \)

The flat roof snow load, \( p_f \), shall be calculated in lb/ft\(^2\) (kN/m\(^2\)) using the following formula:

\[
p_f = 0.7 C_e C_t I_s p_g \quad (7.3-1)
\]

7.3.1 Exposure Factor, \( C_e \)

The value for \( C_e \) shall be determined from Table 7-2.

7.3.2 Thermal Factor, \( C_t \)

The value for \( C_t \) shall be determined from Table 7-3.

7.3.3 Importance Factor, \( I_s \)

The value for \( I_s \) shall be determined from Table 1.5-2 based on the Risk Category from Table 1.5-1.

7.3.4 Minimum Snow Load for Low-Slope Roofs, \( p_m \)

A minimum roof snow load, \( p_m \), shall only apply to monoslope, hip and gable roofs with slopes less than 15\(^\circ\), and to curved roofs where the vertical angle from the eaves to the crown is less than 10\(^\circ\). The minimum roof snow load for low-slope roofs shall be obtained using the following formula:

Where \( p_s \) is 20 lb/ft\(^2\) (0.96 kN/m\(^2\)) or less:

\[
p_m = I_s p_s \quad \text{(Importance Factor times } p_s)\]

Where \( p_s \) exceeds 20 lb/ft\(^2\) (0.96 kN/m\(^2\)):

\[
p_m = 20 \times (I_s) \times (20 \text{ lb/ft}^2 \times \text{times Importance Factor})
\]

This minimum roof snow load is a separate uniform load case. It need not be used in determining
Table 7-1 Ground Snow Loads, $p_g$, for Alaskan Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>$p_g$</th>
<th>$p_g$</th>
<th>Location</th>
<th>$p_g$</th>
<th>$p_g$</th>
<th>Location</th>
<th>$p_g$</th>
<th>$p_g$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adak</td>
<td>30</td>
<td>1.4</td>
<td>Galena</td>
<td>60</td>
<td>2.9</td>
<td>Petersburg</td>
<td>150</td>
<td>7.2</td>
</tr>
<tr>
<td>Anchorage</td>
<td>50</td>
<td>2.4</td>
<td>Gulkana</td>
<td>70</td>
<td>3.4</td>
<td>St. Paul</td>
<td>40</td>
<td>1.9</td>
</tr>
<tr>
<td>Angoon</td>
<td>70</td>
<td>3.4</td>
<td>Homer</td>
<td>40</td>
<td>1.9</td>
<td>Seward</td>
<td>50</td>
<td>2.4</td>
</tr>
<tr>
<td>Barrow</td>
<td>25</td>
<td>1.2</td>
<td>Juneau</td>
<td>60</td>
<td>2.9</td>
<td>Shemya</td>
<td>25</td>
<td>1.2</td>
</tr>
<tr>
<td>Barter</td>
<td>35</td>
<td>1.7</td>
<td>Kenai</td>
<td>70</td>
<td>3.4</td>
<td>Sitka</td>
<td>50</td>
<td>2.4</td>
</tr>
<tr>
<td>Bethel</td>
<td>40</td>
<td>1.9</td>
<td>Kodiak</td>
<td>30</td>
<td>1.4</td>
<td>Talkeetna</td>
<td>120</td>
<td>5.8</td>
</tr>
<tr>
<td>Big Delta</td>
<td>50</td>
<td>2.4</td>
<td>Kotzebue</td>
<td>60</td>
<td>2.9</td>
<td>Unalakleet</td>
<td>50</td>
<td>2.4</td>
</tr>
<tr>
<td>Cold Bay</td>
<td>25</td>
<td>1.2</td>
<td>McGrath</td>
<td>70</td>
<td>3.4</td>
<td>Valdez</td>
<td>160</td>
<td>7.7</td>
</tr>
<tr>
<td>Cordova</td>
<td>100</td>
<td>4.8</td>
<td>Nome</td>
<td>70</td>
<td>3.4</td>
<td>Whittier</td>
<td>300</td>
<td>14.4</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>60</td>
<td>2.9</td>
<td>Palmer</td>
<td>50</td>
<td>2.4</td>
<td>Wrangell</td>
<td>60</td>
<td>2.9</td>
</tr>
<tr>
<td>Fort Yukon</td>
<td>60</td>
<td>2.9</td>
<td></td>
<td></td>
<td></td>
<td>Yakutat</td>
<td>150</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Table 7-2 Exposure Factor, $C_e$

<table>
<thead>
<tr>
<th>Terrain Category</th>
<th>Fully Exposed</th>
<th>Partially Exposed</th>
<th>Sheltered</th>
</tr>
</thead>
<tbody>
<tr>
<td>B (see Section 26.7)</td>
<td>0.9</td>
<td>1.0</td>
<td>1.2</td>
</tr>
<tr>
<td>C (see Section 26.7)</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>D (see Section 26.7)</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Above the treeline in windswept mountainous areas.</td>
<td>0.7</td>
<td>0.8</td>
<td>N/A</td>
</tr>
<tr>
<td>In Alaska, in areas where trees do not exist within a 2-mile (3-km) radius of the site.</td>
<td>0.7</td>
<td>0.8</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 7-3 Thermal Factor, $C_t$

<table>
<thead>
<tr>
<th>Thermal Conditiona</th>
<th>$C_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>All structures except as indicated below</td>
<td>1.0</td>
</tr>
<tr>
<td>Structures kept just above freezing and others with cold, ventilated roofs in which the thermal resistance (R-value) between the ventilated space and the heated space exceeds 25 °F × h × ft²/Btu (4.4 K × m²/W)</td>
<td>1.1</td>
</tr>
<tr>
<td>Unheated and open air structures</td>
<td>1.2</td>
</tr>
<tr>
<td>Structures intentionally kept below freezing</td>
<td>1.3</td>
</tr>
<tr>
<td>Continuously heated greenhousesb with a roof having a thermal resistance (R-value) less than 2.0 °F × h × ft²/Btu (0.4 K × m²/W)</td>
<td>0.85</td>
</tr>
</tbody>
</table>

---

*a These conditions shall be representative of the anticipated conditions during winters for the life of the structure.

*b Greenhouses with a constantly maintained interior temperature of 50 °F (10 °C) or more at any point 3 ft above the floor level during winters and having either a maintenance attendant on duty at all times or a temperature alarm system to provide warning in the event of a heating failure.
7.4 SLOPED ROOF SNOW LOADS, $p_s$

Snow loads acting on a sloping surface shall be assumed to act on the horizontal projection of that surface. The sloped roof (balanced) snow load, $p_s$, shall be obtained by multiplying the flat roof snow load, $p_f$, by the roof slope factor, $C_s$:

$$p_s = C_s p_f$$

(7.4-1)

Values of $C_s$ for warm roofs, cold roofs, curved roofs, and multiple roofs are determined from Sections 7.4.1 through 7.4.4. The thermal factor, $C_t$, from Table 7-3 determines if a roof is “cold” or “warm.” “Slippery surface” values shall be used only where the roof’s surface is unobstructed and sufficient space is available below the eaves to accept all the sliding snow. A roof shall be considered unobstructed if no objects exist on it that prevent snow on it from sliding. Slippery surfaces shall include metal, slate, glass, and bituminous, rubber, and plastic membranes with a smooth surface. Membranes with an imbedded aggregate or mineral granule surface shall not be considered smooth. Asphalt shingles, wood shingles, and shakes shall not be considered slippery.

7.4.1 Warm Roof Slope Factor, $C_s$

For warm roofs ($C_t \leq 1.0$ as determined from Table 7-3) with an unobstructed slippery surface that will allow snow to slide off the eaves, the roof slope factor $C_s$ shall be determined using the dashed line in Fig. 7-2a, provided that for nonventilated warm roofs, their thermal resistance (R-value) equals or exceeds 30 ft² °F/Btu (5.3 °C m²/W) and for warm ventilated roofs, their R-value equals or exceeds 20 ft² °F/Btu (3.5 °C m²/W). Exterior air shall be able to circulate freely under a ventilated roof from its eaves to its ridge. For warm roofs that do not meet the aforementioned conditions, the solid line in Fig. 7-2a shall be used to determine the roof slope factor $C_s$.

7.4.2 Cold Roof Slope Factor, $C_s$

Cold roofs are those with $C_t > 1.0$ as determined from Table 7-3. For cold roofs with $C_t = 1.1$ and an unobstructed slippery surface that will allow snow to slide off the eaves, the roof slope factor $C_s$ shall be determined using the dashed line in Fig. 7-2b. For all other cold roofs with $C_t = 1.1$, the solid line in Fig. 7-2b shall be used to determine the roof slope factor $C_s$. For cold roofs with $C_t = 1.2$ and an unobstructed slippery surface that will allow snow to slide off the eaves, the roof slope factor $C_s$ shall be determined using the dashed line on Fig. 7-2c. For all other cold roofs with $C_t = 1.2$, the solid line in Fig. 7-2c shall be used to determine the roof slope factor $C_s$.

7.4.3 Roof Slope Factor for Curved Roofs

Portions of curved roofs having a slope exceeding 70° shall be considered free of snow load (i.e., $C_s = 0$). Balanced loads shall be determined from the balanced load diagrams in Fig. 7-3 with $C_s$ determined from the appropriate curve in Fig. 7-2.

7.4.4 Roof Slope Factor for Multiple Folded Plate, Sawtooth, and Barrel Vault Roofs

Multiple folded plate, sawtooth, or barrel vault roofs shall have a $C_s = 1.0$, with no reduction in snow load because of slope (i.e., $p_s = p_f$).

7.4.5 Ice Dams and Icicles Along Eaves

Two types of warm roofs that drain water over their eaves shall be capable of sustaining a uniformly distributed load of $2p_f$ on all overhanging portions: those that are unventilated and have an R-value less than 30 ft² °F/Btu (5.3 °C m²/W) and those that are ventilated and have an R-value less than 20 ft² °F/Btu (3.5 °C m²/W). The load on the overhang shall be based upon the flat roof snow load for the heated portion of the roof up-slope of the exterior wall. No other loads except dead loads shall be present on the roof when this uniformly distributed load is applied.

7.5 PARTIAL LOADING

The effect of having selected spans loaded with the balanced snow load and remaining spans loaded with half the balanced snow load shall be investigated as follows:

7.5.1 Continuous Beam Systems

Continuous beam systems shall be investigated for the effects of the three loadings shown in Fig. 7-4:

Case 1: Full balanced snow load on either exterior span and half the balanced snow load on all other spans.

Case 2: Half the balanced snow load on either exterior span and full balanced snow load on all other spans.

Case 3: All possible combinations of full balanced snow load on any two adjacent spans and half the balanced snow load on all other spans. For this case there will be $(n-1)$ possible combinations where $n$ equals the number of spans in the continuous beam system.
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If a cantilever is present in any of the above cases, it shall be considered to be a span.

Partial load provisions need not be applied to structural members that span perpendicular to the ridgeline in gable roofs with slopes of 2.38° (½ on 12) and greater.

7.5.2 Other Structural Systems
Areas sustaining only half the balanced snow load shall be chosen so as to produce the greatest effects on members being analyzed.

7.6 UNBALANCED ROOF SNOW LOADS

Balanced and unbalanced loads shall be analyzed separately. Winds from all directions shall be accounted for when establishing unbalanced loads.

7.6.1 Unbalanced Snow Loads for Hip and Gable Roofs

For hip and gable roofs with a slope exceeding 7 on 12 (30.2°) or with a slope less than 2.38° (½ on 12) unbalanced snow loads are not required to be applied. Roofs with an eave to ridge distance, \( W \), of 20 ft (6.1 m) or less, having simply supported prismatic members spanning from ridge to eave shall be designed to resist an unbalanced uniform snow load on the leeward side equal to \( Ip_s \). For these roofs the windward side shall be unloaded. For all other gable roofs, the unbalanced load shall consist of 0.3\( p_s \), on the windward side, \( p_s \), on the leeward side plus a rectangular surcharge with magnitude \( h_{d/(S)} \) and horizontal extent from the ridge 8\( \sqrt{Sh_{d/(S)}} \) where \( h_d \) is the drift height from Fig. 7-9 with \( l_e \) equal to the eave to ridge distance for the windward portion of the roof, \( W \). For \( W \) less than 20 ft (6.1 m), use \( W = l_e = 20 \) ft in Fig 7-9. Balanced and unbalanced loading diagrams are presented in Fig. 7-5.

7.6.2 Unbalanced Snow Loads for Curved Roofs

Portions of curved roofs having a slope exceeding 70° shall be considered free of snow load. If the slope of a straight line from the eaves (or the 70° point, if present) to the crown is less than 10° or greater than 60°, unbalanced snow loads shall not be taken into account.

Unbalanced loads shall be determined according to the loading diagrams in Fig. 7-3. In all cases the windward side shall be considered free of snow. If the ground or another roof abuts a Case II or Case III (see Fig. 7-3) curved roof at or within 3 ft (0.91 m) of its eaves, the snow load shall not be decreased between the 30° point and the eaves, but shall remain constant at the 30° point value. This distribution is shown as a dashed line in Fig. 7-3.

7.6.3 Unbalanced Snow Loads for Multiple Folded Plate, Sawtooth, and Barrel Vault Roofs

Unbalanced loads shall be applied to folded plate, sawtooth, and barrel-vaulted multiple roofs with a slope exceeding 3/8 in./ft (1.79°). According to Section 7.4.4, \( C_e \) = 1.0 for such roofs, and the balanced snow load equals \( p_s \). The unbalanced snow load shall increase from one-half the balanced load at the ridge or crown (i.e., 0.5\( p_s \)) to two times the balanced load given in Section 7.4.4 divided by \( C_e \) at the valley (i.e., 2\( p_s/C_e \)). Balanced and unbalanced loading diagrams for a sawtooth roof are presented in Fig. 7-6. However, the snow surface above the valley shall not be at an elevation higher than the snow above the ridge. Snow depths shall be determined by dividing the snow load by the density of that snow from Eq. 7.7-1, which is in Section 7.7.1.

7.6.4 Unbalanced Snow Loads for Dome Roofs

Unbalanced snow loads shall be applied to domes and similar rounded structures. Snow loads, determined in the same manner as for curved roofs in Section 7.6.2, shall be applied to the downwind 90° sector in plan view. At both edges of this sector, the load shall decrease linearly to zero over sectors of 22.5° each. There shall be no snow load on the remaining 225° upwind sector.

7.7 DRIFTS ON LOWER ROOFS
(AERODYNAMIC SHADE)

Roofs shall be designed to sustain localized loads from snowdrifts that form in the wind shadow of (1) higher portions of the same structure and (2) adjacent structures and terrain features.

7.7.1 Lower Roof of a Structure

Snow that forms drifts comes from a higher roof or, with the wind from the opposite direction, from the roof on which the drift is located. These two kinds of drifts (“leeward” and “windward” respectively) are shown in Fig. 7-7. The geometry of the surcharge load due to snow drifting shall be approximated by a triangle as shown in Fig. 7-8. Drift loads shall be superimposed on the balanced snow load. If \( h_d/h_b \) is less than 0.2, drift loads are not required to be applied. For leeward drifts, the drift height \( h_d \) shall be determined directly from Fig. 7-9 using the length of the upper roof. For windward drifts, the drift height shall be determined by substituting the length of the
lower roof for $l_u$ in Fig. 7-9 and using three-quarters of
$h_d$, as determined from Fig. 7-9 as the drift height. The
larger of these two heights shall be used in design. If
this height is equal to or less than $h_u$, the drift width,
$w$, shall equal $4h_d$ and the drift height shall equal $h_d$. If
this height exceeds $h_u$, the drift width, $w$, shall equal
$4h_u^2/h_d$ and the drift height shall equal $h_u$. However,
the drift width, $w$, shall not be greater than $8h_u$. If the
drift width, $w$, exceeds the width of the lower roof, the
drift shall be truncated at the far edge of the roof, not
reduced to zero there. The maximum intensity of the
drift surcharge load, $p_s$, equals $h_u \gamma$ where snow
density, $\gamma$, is defined in Eq. 7.7-1:

$$\gamma = 0.13p_s + 14 \text{ but not more than 30 pcf} \quad (7.7-1)$$

This density shall also be used to determine $h_d$ by
dividing $p_s$ by $\gamma$ (in SI: also multiply by 102 to get the
depth in m).

7.7.2 Adjacent Structures

If the horizontal separation distance between
adjacent structures, $s$, is less than 20 ft (6.1 m) and less
than six times the vertical separation distance ($s < 6h_u$),
then the requirements for the leeward drift of Section
7.7.1 shall be used to determine the drift load on the
lower structure. The height of the snow drift shall be
the smaller of $h_d$, based upon the length of the adjacent
higher structure, and $(6h_u - s)/6$. The horizontal extent
of the drift shall be the smaller of $6h_u$ or $(6h_u - s)$.

For windward drifts, the requirements of Section
7.7.1 shall be used. The resulting drift is permitted to
be truncated.

7.8 ROOF PROJECTIONS AND PARAPETS

The method in Section 7.7.1 shall be used to calculate
drift loads on all sides of roof projections and at parapet
walls. The height of such drifts shall be taken as
three-quarters the drift height from Fig. 7-9 (i.e.,
$0.75h_u$). For parapet walls, $l_u$ shall be taken equal to the
length of the roof upwind of the wall. For roof projec-
tions, $l_u$ shall be taken equal to the greater of the length
of the roof upwind or downwind of the projection. If the
side of a roof projection is less than 15 ft (4.6 m) long, a
drift load is not required to be applied to that side.

7.9 SLIDING SNOW

The load caused by snow sliding off a sloped roof
onto a lower roof shall be determined for slippery
upper roofs with slopes greater than $\frac{1}{4}$ on 12, and for
other (i.e., nonslippery) upper roofs with slopes
greater than $\frac{2}{12}$ on 12. The total sliding load per unit
length of eave shall be $0.4p_sW$, where $W$ is the
horizontal distance from the eave to ridge for the
sloped upper roof. The sliding load shall be distrib-
uted uniformly on the lower roof over a distance of
15 ft (4.6 m) from the upper roof eave. If the width of
the lower roof is less than 15 ft (4.6 m), the sliding
load shall be reduced proportionally.

The sliding snow load shall not be further
reduced unless a portion of the snow on the upper
roof is blocked from sliding onto the lower roof by
snow already on the lower roof.

For separated structures, sliding loads shall be
considered when $h/s > 1$ and $s < 15$ ft (4.6 m). The
horizontal extent of the sliding load on the lower roof
shall be $15 - s$ with $s$ in feet ($4.6 - s$ with $s$ in meters),
and the load per unit length shall be $0.4p_sW(15 - s)/15$
with $s$ in feet ($0.4p_sW(4.6 - s)/4.6$ with $s$ in meters).

Sliding loads shall be superimposed on the
balanced snow load and need not be used in combina-
tion with drift, unbalanced, partial, or rain-on-snow
loads.

7.10 RAIN-ON-SNOW SURCHARGE LOAD

For locations where $p_s$ is 20 lb/ft$^2$ ($0.96$ kN/m$^2$) or
less, but not zero, all roofs with slopes (in degrees)
less than $W/50$ with $W$ in ft (in SI: $W/15.2$ with $W$ in
m) shall include a 5 lb/ft$^2$ ($0.24$ kN/m$^2$) rain-on-snow
surcharge load. This additional load applies only to
the sloped roof (balanced) load case and need not be
used in combination with drift, sliding, unbalanced,
minimum, or partial loads.

7.11 PONDING INSTABILITY

Roofs shall be designed to preclude ponding instabil-
ity. For roofs with a slope less than $\frac{1}{4}$ in./ft (1.19˚)
and roofs where water can be impounded, roof
deflections caused by full snow loads shall be evalu-
ated when determining the likelihood of ponding
instability (see Section 8.4).

7.12 EXISTING ROOFS

Existing roofs shall be evaluated for increased snow
loads caused by additions or alterations. Owners or
agents for owners of an existing lower roof shall be
advised of the potential for increased snow loads
where a higher roof is constructed within 20 ft
(6.1 m). See footnote to Table 7-2 and Section 7.7.2.
In CS areas, site-specific Case Studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

Numbers in parentheses represent the upper elevation limits in feet for the ground snow load values presented below. Site-specific case studies are required to establish ground snow loads at elevations not covered.

To convert lb/sq ft to kN/m$^2$, multiply by 0.0479.

To convert feet to meters, multiply by 0.3048.

FIGURE 7-1 Ground Snow Loads, $P_g$, for the United States (Lb/Ft$^2$).
FIGURE 7-1. (Continued)
FIGURE 7-2 Graphs for Determining Roof Slope Factor $C_s$, for Warm and Cold Roofs (See Table 7-3 for $C_s$ Definitions).
FIGURE 7-3 Balanced and Unbalanced Loads for Curved Roofs.

- **Case 1** – Slope at eaves < 30°
  - Balanced Load
  - Unbalanced Load

- **Case 2** – Slope at eaves 30° to 70°
  - Balanced Load
  - Unbalanced Load

- **Case 3** – Slope at eaves > 70°
  - Balanced Load
  - Unbalanced Load

* Use the slope at the eaves to determine $C_s$ here.
** Use 30° slope to determine $C_s$ here.
♦ Alternate distribution if another roof abuts.
* The left supports are dashed since they would not exist when a cantilever is present.

FIGURE 7-4 Partial Loading Diagrams for Continuous Beams.
Unbalanced loads need not be considered for $\theta > 30.2^\circ$ (7 on 12) or for $\theta \leq 2.38^\circ$ (1/2 on 12).

FIGURE 7-5 Balanced and Unbalanced Snow Loads for Hip and Gable Roofs.
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* May be somewhat less; see Section 7.6.3

FIGURE 7-6 Balanced and Unbalanced Snow Loads for a Sawtooth Roof.

FIGURE 7-7 Drifts Formed at Windward and Leeward Steps.
FIGURE 7-8 Configuration of Snow Drifts on Lower Roofs.

FIGURE 7-9 Graph and Equation for Determining Drift Height, $h_d$.

If $l_u > 600$ ft, use equation

$$l_u = 600 \text{ ft}$$

If $l_u < 20$ ft, use $l_u = 20$ ft

$$h_d = 0.43 \sqrt[3]{l_u} \sqrt[4]{p_g + 10} - 1.5$$

To convert lb/ft$^2$ to kN/m$^2$, multiply by 0.0479.
To convert ft to m, multiply by 0.3048.
Chapter 8
RAIN LOADS

8.1 SYMBOLS

\[ R = \text{rain load on the undeflected roof, in lb/ft}^2 \quad (\text{kN/m}^2) \]. When the phrase “undeflected roof” is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

\[ d_s = \text{depth of water on the undeflected roof up to the inlet of the secondary drainage system when the primary drainage system is blocked (i.e., the static head), in in. (mm).} \]

\[ d_h = \text{additional depth of water on the undeflected roof above the inlet of the secondary drainage system at its design flow (i.e., the hydraulic head), in in. (mm).} \]

If the secondary drainage systems contain drain lines, such lines and their point of discharge shall be separate from the primary drain lines.

8.4 PONDING INSTABILITY

“Ponding” refers to the retention of water due solely to the deflection of relatively flat roofs. Susceptible bays shall be investigated by structural analysis to assure that they possess adequate stiffness to preclude progressive deflection (i.e., instability) as rain falls on them or meltwater is created from snow on them. Bays with a roof slope less than 1/4 in./ft., or on which water is impounded upon them (in whole or in part) when the primary drain system is blocked, but the secondary drain system is functional, shall be designated as susceptible bays. Roof surfaces with a slope of at least 1/4 in. per ft (1.19º) towards points of free drainage need not be considered a susceptible bay. The larger of the snow load or the rain load equal to the design condition for a blocked primary drain system shall be used in this analysis.

8.5 CONTROLLED DRAINAGE

Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of all rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow (determined from Section 8.3).

Such roofs shall also be checked for ponding instability (determined from Section 8.4).