**Snow Loads**
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**References:**

American Society of Civil Engineers (2010). *ASCE 7-10 Minimum Design Loads for Buildings and Other Structures.*

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Determine ground snow load, $p_g$, from map. (See ASCE 7 or [http://www.lib.uidaho.edu/digital/idahosnow/index.html](http://www.lib.uidaho.edu/digital/idahosnow/index.html)).

Determine importance factor for snow loads, $I_s$, from *IBC Table 1604.5*

Determine exposure factor, $C_e$, from *ASCE 7 Table 7-2*

Determine thermal factor, $C_t$, from *ASCE 7 Table 7-3*

Calculate flat roof snow load

$$p_f = 0.7 C_e C_t I_s p_g$$

Is roof flat?

- **no**
  - 1

- **yes**
  - If slope $\leq \frac{1}{2}$" in 12", add rain-on-snow surcharge (Section 7.10 *ASCE 7*)
    - 2
If slope $\leq \frac{1}{4}''$ in 12'', design to prevent ponding.  
(Section 7.11, ASCE 7)

Go to partial loading

If slope $> 5^\circ$, calculate sloped roof snow load.

Check roof thermal factor

$C_t = 1.0$ (warm roof)

$C_s$ from Fig 7.2a

Slippery, unobstructed roof: use dashed line

Obstructed roof: use solid line

$C_t = 1.1$ (intermediate roof)

$C_s$ from Fig 7.2b

Slippery, unobstructed roof: use dashed line

Obstructed roof: use solid line

$C_t = 1.2$ (cold roof)

$C_s$ from Fig 7.2c

Slippery, unobstructed roof: use dashed line

Obstructed roof: use solid line
**ASCE 7.4:**

“Slippery surface” values [Slippery, unobstructed roof 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 granular surface shall not be considered smooth. Asphalt shingles, wood shingles, and shakes shall not be considered slippery.

Calculate sloped roof snow load:

\[ p_s = p_f C_s \]

where \( p_s \) is in pounds per square foot of horizontally projected roof area

Check for unbalanced snow load assuming wind can blow from any direction

- **Hip and gable roofs**
  - \( 2.38^\circ \leq \text{slope} < 30.2^\circ \)
  - \( 1/2 \) on 12 or \( 7 \) on 12
  - yes
  - Unbalanced snow load from Fig. 7.5
  - no

- Curved roofs, multiple folded plate roofs, sawtooth roofs, barrel vault roofs and dome roofs, see Section 7.6 of *ASCE 7.*

Calculate partial loading:

1. Full balanced snow load on any one portion of the structure and half the balanced snow load everywhere else, *and*
2. Half the balanced snow load on any one portion of the structure and the full balanced snow load everywhere else.
Other Structural Systems

Select areas to carry half the balanced snow load to produce the greatest effect on the member being analyzed. (Influence lines are very helpful).

Check drift loads

Is roof in the wind shadow of (1) higher portions of the structure or (2) adjacent structures or terrain features?

- Yes
  - Go to sliding loads

- No
  - No drift loads
Calculate the density of the drift:
\[
\gamma = 0.13 p_g + 14
\]
but \(\gamma \leq 30\) pcf

Calculate the depth of the base snow

For flat roofs:
\[
h_b = \frac{p_f}{\gamma}
\]
For sloped roofs:
\[
h_b = \frac{p_s}{\gamma}
\]

Referring to Fig 7.8, is \(h_c/h_b < 0.2\)? I.e., does the base snow depth \(h_b\) “bury” the cornice \(h_c\)?

Calculate height of drift \(h_d\).

Higher portion of structure or adjacent structures

Leeward drift: Calculate height of drift \(h_d\) from Fig. 7.9.

Windward drift: Let \(l_u\) = length of lower roof then \(h_d = \frac{3}{4}\) of the drift height from Fig. 7.9

Use the larger of the windward and leeward drifts

Parapet wall or roof projection

Is the length of the roof projection or parapet < 15 ft?

Any direction:
\(l_u = \) length of roof upwind of parapet or projection,
\(h_d = \frac{3}{4}\) of the drift height from Fig. 7.9

Go to sliding loads
Calculate drift surcharge load: $p_d = h_d \gamma$

Is $h_d > h_c$? I.e., does the drift “bury” the cornice?

- **yes**
  - $w = 4h_d^2 / h_c$
  - but, $w \leq 8h_c$
  - and then $h_d = h_c$

- **no**
  - Calculate drift width $w = 4h_d$

Is the width of the drift $w$ greater than the width of the lower roof?

- **yes**
  - Truncate the drift at the far edge of the roof

- **no**
  - If the drift is due to an adjacent structure or terrain within 20 ft of the roof, multiply the drift load by the factor: $(20 - s)/20$
    - where $s$ is the spacing in feet.

  Superpose the drift load on the base snow load.

  Check for loads due to snow sliding from an upper roof.
  - See Section 7.9, *ASCE 7*.

  Check for ice dams and icicle loads.
  - See Section 7.4.5, *ASCE 7*.

Done