

May 2024

Determining Snow Loads Key to Cost-Effective Building

Snow loading on a building is largely affected by how the ground snow and roof snow loads are determined. Subsequently, the price of a building can be impacted by how the ground and roof snow loads are determined. Therefore, making sure both ground and roof snow loads are obtained as accurately as possible can be key to a cost-effective building. Some of the most common methods for determining the ground and snow loads are:

- Utilize building code (such as Figure 1 shown below) to select the proper ground snow and calculate the roof snow using code equations (see Equation 1 below).
- Obtain the ground snow and/or roof snow from building officials.
 - If obtaining only ground snow from a building official, roof snow can be calculated like using the building code to determine the ground snow.
 - If obtaining only roof snow from a building official, ground snow can be back calculated using the same equation.

$$p_f = 0.7C_eC_tI_s p_g$$

p_f is the roof snow in psf
 C_e is the exposure factor
 C_t is the thermal factor
 I_s is the importance factor
 p_g is the ground snow in psf

Equation 1:

ASCE 7-16 Equation 7.3-1 for Calculating Roof Snow



Figure 1: Ground Snow Loads for Risk Category II (from ASCE 7-22)

The ground load determined and used in the contract will be used to determine the code-calculated roof snow load. The code-calculated roof snow load is used for partial snow, unbalanced snow, and snow drift (see Figure 2 below for diagram of types of snow accumulation).

If a building official specifies a roof snow load lower than the code-calculated roof snow, the code-calculated roof snow will still be used. However, if a building official specifies a roof snow load higher than the code-calculated roof snow load, the specified roof snow load will be used for a minimum roof snow load case, while the code-calculated roof snow load will still be used for the other previously mentioned snow cases.

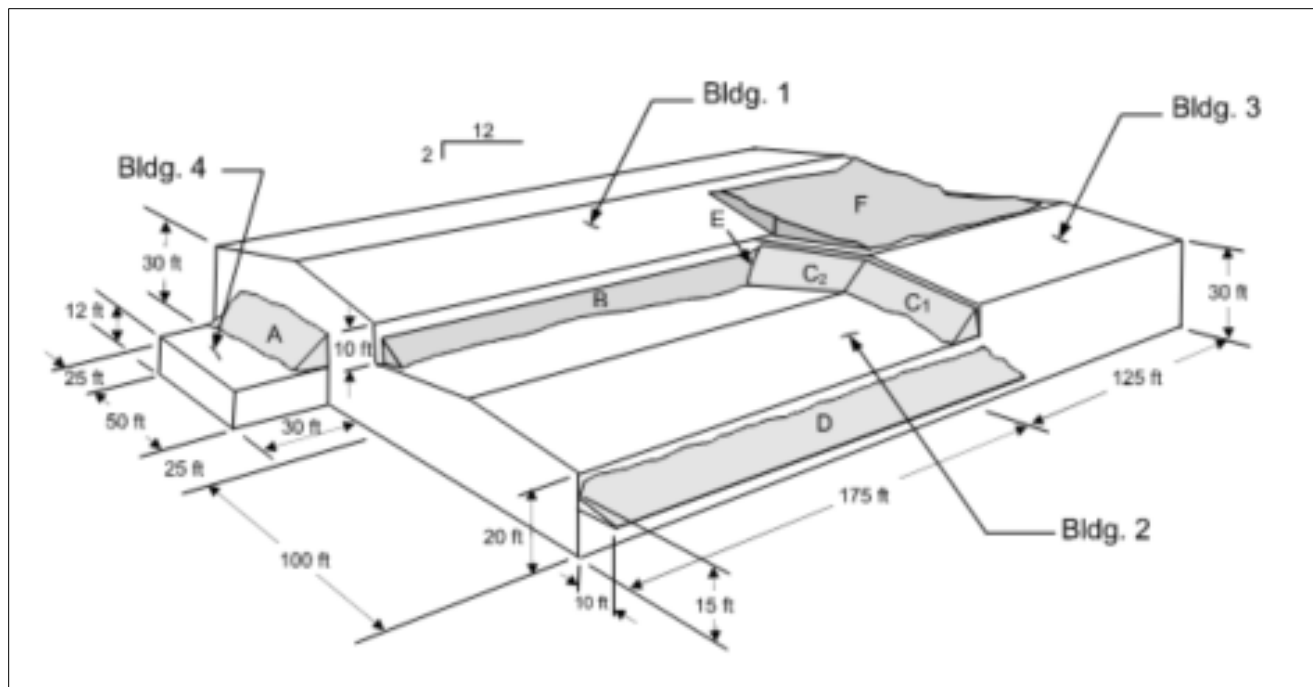


Figure 2: Diagram from MBMA 2018 Representing Examples of Snow Loading: A, B, and D are examples of snow drift; C1 and C2 are examples of unbalanced snow and snow drift, and F is an example of valley snow which is a form of unbalanced snow.

Roof snow loads may also be used in consideration for seismic loads. In ASCE 7-10 (IBC 2012 and IBC 2015) and ASCE 7-16 (IBC 2018 and IBC 2021), 20% of the code-calculated roof snow load is applied to the seismic dead weight of the building if roof snow load is 30psf or greater. In ASCE7-22 (IBC 2024), 15% of the code-calculated roof snow load is applied to the seismic dead weight of the building if roof snow load is 45psf or greater.

EXAMPLE:

Cost impact due to ground snow or roof snow being provided by building code or building official (100'x300'x25' building):

Scenario 1: A roof snow of 35 psf is given; the ground snow is then back calculated to be 50 psf (see Figure 3 below for an example of how the contract would appear).

Scenario 2: A ground snow and roof snow of 35 psf is given; the 35 psf roof snow is taken as the minimum roof snow case and the code calculated roof snow is determined to be 24.5 psf (used for partial loading, unbalanced snow, and seismic considerations).

| <p>3) PROJECT LOAD REQUIREMENTS</p> <p>Building Code: IBC 2021 Design to be in accordance with Common Industry Practices as described by the current MBMA Metal Building Systems Manual. Information on this order overrides that on plans or specifications.</p> <p>UL90 Rated: No</p> <p>Occupancy Classification: II - Standard Buildings Live Load: 20 psf Reducible per Code Ground Snow Load: 50 psf Snow Exposure Coefficient (Ce): 1.0 - Partially Exposed Wind Speed: 105 mph Wind Exposure: C Seismic Information: Ss: 0.200 S1: 0.100 Site Class: D Assumed Rainfall intensity: 6.00 in/hr</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-----------------|----------------|----------------|------------------------|--------------------|----------------------|------------------------|---|--|---------------|----------------|----------------|----------------|---------------------|--------------------|----------------------|------------------------|---|--------|-----------------|----------|----------|------------------------|----------|----------|---------------------|-----|
| <p>4) BUILDING LOAD REQUIREMENTS</p> <p>LOAD REQUIREMENTS</p> <table border="1"> <thead> <tr> <th>Building Name</th> <th>Roof Dead Load</th> <th>Roof Snow Load</th> <th>Wind Enclosure</th> <th>Thermal Coeff. (Ct)</th> <th>Primary Collateral</th> <th>Secondary Collateral</th> <th>Collateral Load Due To</th> <th>Roof Insulation R<30 and/or Roof Obstruction Exists</th> </tr> </thead> <tbody> <tr> <td>50 PSF</td> <td>Per Seller Std.</td> <td>35.0 psf</td> <td>Enclosed</td> <td>Heated Structure (1.0)</td> <td>10.0 psf</td> <td>10.0 psf</td> <td>Mech/Elec/Sprinkler</td> <td>Yes</td> </tr> </tbody> </table> | | | | | | | | | | Building Name | Roof Dead Load | Roof Snow Load | Wind Enclosure | Thermal Coeff. (Ct) | Primary Collateral | Secondary Collateral | Collateral Load Due To | Roof Insulation R<30 and/or Roof Obstruction Exists | 50 PSF | Per Seller Std. | 35.0 psf | Enclosed | Heated Structure (1.0) | 10.0 psf | 10.0 psf | Mech/Elec/Sprinkler | Yes |
| Building Name | Roof Dead Load | Roof Snow Load | Wind Enclosure | Thermal Coeff. (Ct) | Primary Collateral | Secondary Collateral | Collateral Load Due To | Roof Insulation R<30 and/or Roof Obstruction Exists | | | | | | | | | | | | | | | | | | | |
| 50 PSF | Per Seller Std. | 35.0 psf | Enclosed | Heated Structure (1.0) | 10.0 psf | 10.0 psf | Mech/Elec/Sprinkler | Yes | | | | | | | | | | | | | | | | | | | |

Figure 3: Example Contract Showing 50 psf Ground Snow Load and 35 psf Roof Snow Load.

Note: Loading information in boxes 3 and 4 of contracts are related to variables in Equation 1 previously referenced; ground snow load is p_g , roof snow load is p_f (unless otherwise specified by building official), snow exposure coefficient is C_e , thermal coefficient is C_t , and occupancy classification determines I_s .

The result is that scenario 2 is approximately \$8,000 less than scenario 1. The key takeaway from this example is that obtaining more accurate information from the building code or a building official opens the opportunity for a more cost-effective building.