Technical Q & A

Snow Load Provisions of the International Residential Code

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Two methods of designing snow loads are explored.

The design snow load is not the result of a single storm but rather the result of snow accumulation from many winter storms.

Even when it is still warm outside, some people just can't help but talk about snow! Although it is not currently snowing in most areas, as we all know trusses still need to be designed to resist snow loads. Within the last month, SBCA has received a number of inquiries about how to apply snow loads to trusses.

Question

I am a component manufacturer salesman involved in a residential project and the local building official says the trusses must be designed with a roof snow load equal to the ground snow load in our area. He says that the building code does not have any provisions that allow for a reduction in the ground snow load. Is this true? Our building code is based on the International Residential Code (IRC).

Answer

The question revolves around whether the ground snow loads shown in the IRC need to be applied directly to a building as the design roof snow load or if it is appropriate for various factors to be applied to the ground snow load to arrive at the correct design roof snow load. Another question is if the ground snow load can be factored to obtain the design roof snow load, what other issues need to be addressed?

Let's look at what the IRC has to say. This discussion is based on the 2009 IRC, but note that the 2003 and 2006 versions are very similar. The prescriptive method and engineered method are the two methods that the IRC allows to achieve compliance with the snow load provisions.

Prescriptive Method

The prescriptive method provisions are provided in IRC Section R301. The overall goal of building design is to support all applied loads and safely transfer them from the point of origin through the load resisting elements (i.e., the roof, walls, floors, and connections) to the foundation. IRC Section R301.2 defines how much snow load should be applied to the building:

> **R301.2 Climatic and geographic design criteria.** Buildings shall be constructed in accordance with the provisions of this code as limited by the provisions of this section. Additional criteria shall be established by the local *jurisdiction* and set forth in Table R301.2(1).

IRC Table R301.2(1) contains a field for the ground snow load as well as other climatic and geographic design criteria while IRC Figure R301.2(5) (see facing page) maps the ground snow loads that should be used.

When using the prescriptive method, the ground snow load is used in the building design. The IRC provides no other direction on how to apply the ground snow load, so you can assume that the full value is used; it is applied in its entirety to the building as the design roof live load. There is no need to run unbalanced load cases for drifting across the ridge of the building, because snow drifting has already been considered in the development of the ground snow load value. However, you should also consider other situations such as drifting at high-low roofs or sliding snow from an upper roof onto a lower one.

The prescriptive method is more conservative than the engineered method. This conservatism is necessary to achieve the simplicity of the prescriptive method.

at a glance

- The prescriptive method for designing snow load is more conservative than the engineered method.
- The IRC prescriptive method allows the ground snow load to be reduced to 0.7Pg as long as the conditions of this section are met for all truss types.
- The IBC engineered method allows certain reductions to the ground snow load per ASCE 7.

Essentially, the logic is that any building falling within the scope of the IRC can be designed using the full ground snow load value and the resulting building design will be adequate to transfer the applied loads to the foundation without considering such things as the building's exposure to wind, its thermal efficiency, and its intended use. It is a worst case scenario where one simplified answer covers all building sites within the scope of the IRC. So if the trusses are designed to the prescriptive method (i.e., IRC), the building official is correct that the design roof snow load is equal to the ground snow load and no reductions are allowed.

There is one exception to this in IRC Section R802.10.2.1

> **R802.10.2.1 Applicability limits.** The provisions of this section shall control the design of truss roof framing when snow controls for buildings not greater than 60 feet in length perpendicular to the joist, rafter or truss span, not greater than 36 feet in width parallel to the joist, rafter or truss span, not greater than two stories in height with each story not greater than 10 feet high, and roof slopes not smaller than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Truss roof framing constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour, Exposure A, B or C, and a maximum ground snow load of 70 psf. For consistent loading of all truss types, roof snow load is to be computed as: 0.7 P_g.

Here, the prescriptive method of the IRC allows the ground snow load to be reduced to 0.7P_g as long as the conditions of this section are met for ALL truss types, methods and materials of construction (wood, wood/steel, steel, etc).

Engineered Method

The engineered method is more exact in determining the roof design load because it considers a number of different conditions that may occur, like the building's wind exposure the thermal resistance of the ceiling assembly, and snow drifting.

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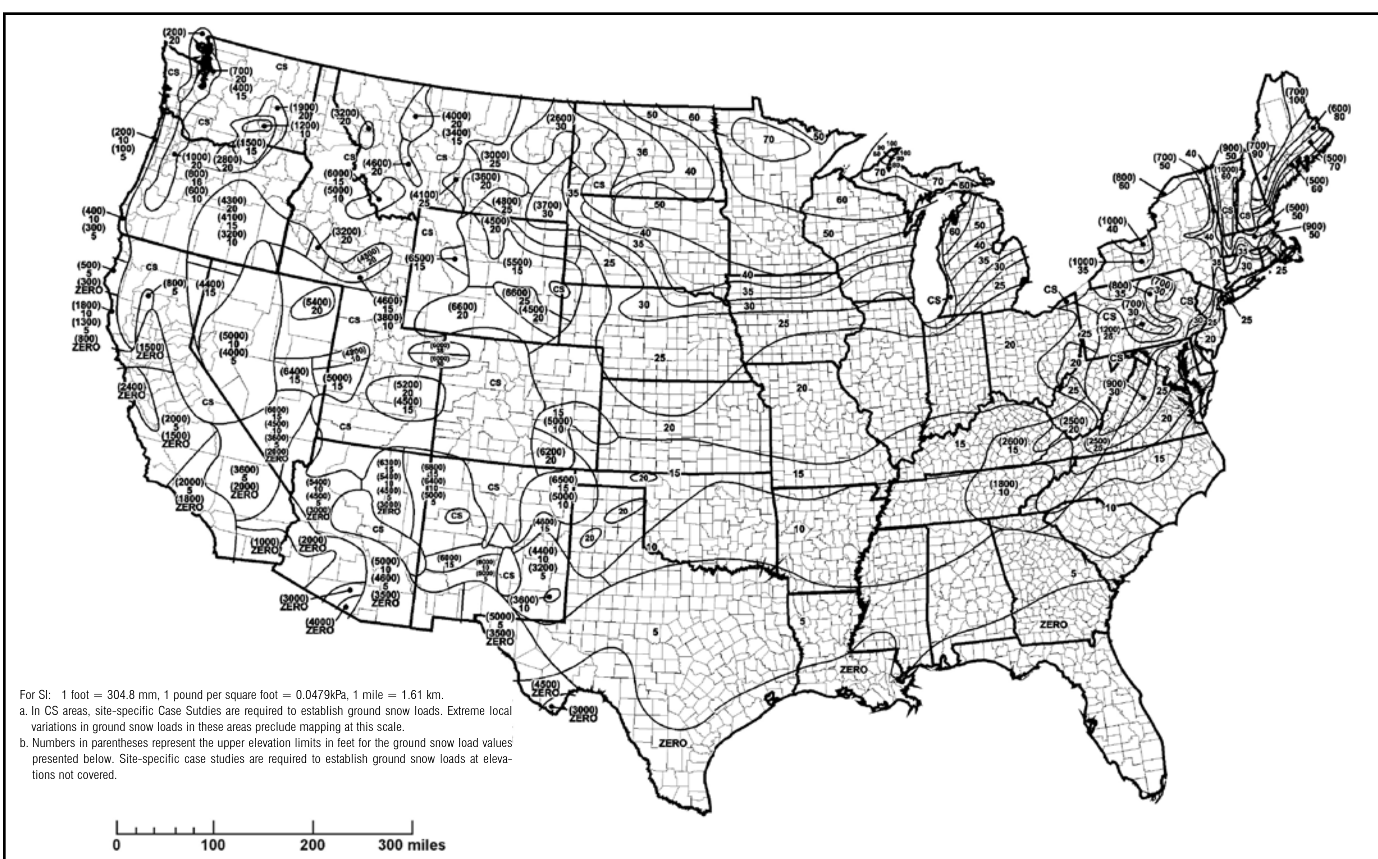

FIGURE R301.2(5)
GROUND SNOW LOADS, P_g, FOR THE UNITED STATES (lb/ft^2)

Technical Q&A

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Because each of these factors is considered, the building can be designed to more accurately reflect the localized conditions' affect on snow loads. By eliminating the "one size fits all" approach of the IRC prescriptive method, engineered roof systems can use a more precise design to make efficient use of materials. IRC Section R301.1.3 describes these alternate (engineered) provisions:

> **R301.1.3 Engineered design.** When a building of otherwise conventional construction contains structural elements exceeding the limits of Section R301 or otherwise not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. ... Engineered design in accordance with the International Building Code is permitted for all buildings and structures, and parts thereof, included in the scope of this code.

Therefore, the engineered method is covered in the provisions of the International Building Code (IBC). IBC Section 1608.1 provides the following on design snow loads:

> **1608.1 General.** Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall not be less than that determined by Section 1607.

The use of ASCE 7 snow load provisions is mandated when using the engineered method per the IBC.

With regard to design snow loads, the prescriptive method is much easier to apply due to the conservative nature of applying the ground snow load onto the building as the roof live load. The engineered method provides a more accurate analysis of the required snow loading because it takes into account the unique characteristics of each building site. For the engineered method, it is clear that ASCE 7 is the appropriate standard to use to determine how the ground snow loads from IRC Table R301.2(1) are to be applied. According to ASCE 7, all of the snow load provisions must be followed, not just the balanced load condition. Unbalanced loads for drifting across the ridge, drifting from high to low roofs, sliding snow, rain on snow surcharges, etc. must all be considered.

As to whether or not the structure should be designed to the prescriptive method or the engineered method is up to the building designer. Trusses designed to the IRC prescriptive method would be designed with a roof snow load equal to 0.7 times the ground snow load or the ground snow load depending on the specific building parameters, whereas trusses designed to the IBC engineered method would allow certain reductions to the ground snow load per ASCE 7 (as long as it was above the IBC mandated minimum). For information on how to calculate design roof snow loads, see the **SBCA Load Guide** at www.sbcindustry.com/loads.php. SBC

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