



## Roof Collapse and Tips to Help Prevent It

The partial or total collapse of a roof due to the weight of snow or water is a serious concern and presents significant property and life safety dangers. The primary cause of roof collapse is the accumulation of snow or water causing overloading on the roof surface which exceeds the structural support capabilities. Overloading and collapse is also caused by inadequate drains, clogged drainage devices and backed-up roof drainage systems.

### PREVENTION

Preventing roof collapse due to the above condition involves several steps that a building owner should take – before winter and during winter.

#### Before Winter

- Periodically inspect roof framework for obvious signs of weaknesses and damage.
- Have an architect or a structural engineer determine your building's safe maximum snow depth.
- Upgrade roofs that do not meet guidelines for your area.
- Inspect and clean drains of debris, leaves and silt. Make sure exterior downspouts are clear of snow and ice at outlets.

#### During Winter

- Monitor snow depths on roofs.
- Verify drains are clear of ice and snow to allow winter run-off.
- Be particularly watchful of situations that involve snow drifting potential such as:
  - changes in roof elevations or heights.
  - winds over moderately- or low-sloped single-gable roofs.
  - valleys formed by multiple-gable roofs.
  - roofs with multiple projections (parapets, penthouses, etc.).
  - adjacent, unattached structures or nearby terrain features.

#### How Winter Precipitation Can Affect Your Roof

A series of roof collapses and reports of extensive interior water damage prompted engineers to develop guidelines about risk factors posed by ice and snow, and steps to take to reduce those risks. Here's how winter precipitation can affect your roof:

#### The age of the building can be a major factor in the snow load risk.

- Newer building codes provide much better guidance for estimating snow loads, particularly increased loads near changes in roof elevations where snow drifts and falling snow from the upper roof can build up on the lower roof near the step.
- Older roofs can suffer from corrosion of members and connection, which can reduce their ability to resist high snow loads. Buildings with lightweight roofs, such as metal buildings or built-up roofs on bar joists, generally provide less protection from overload than heavy roofs.

**Safety margins used by engineers are based on a combination of the weight of the roof and the snow loads.**

- There is usually a larger safety margin against excess snow loads for heavy roofs than for lightweight roofs.
- Flat roofs, the step-down area between roof sections, are a potential source of roof overload.
- Most roof designs can handle at least 20 lbs. of snow per square foot.
- These designs can range from:
  - 10 to 20 lbs. per square foot in Mid-Atlantic states.
  - 40 to 70 lbs. per square foot in New England states.

Most snow or rain loading collapses occur on flat roofs with slopes of 1 percent or less, on roofs of lightweight construction, or on roofs that were designed for minimum loads for their areas. As rainwater and snowmelt water flows to low areas, those areas can sag, allowing a deeper pond to form, which in turn collects more water. This is the "ponding cycle," which has been responsible for most roof collapses due to rain loads or rain-and-snow loads.

**Estimating the weight of snow**

- Fresh snow:
  - 10-12 inches of new snow is equal to 1 inch of water, or about 5 pounds per square foot of roof space.
  - You could have 4 feet of new snow before you need to worry.
- Packed snow:
  - 3 to 5 inches of old snow is equal to 1 inch of water, or about 5 pounds per square foot of roof space.
  - Anything more than 2 feet of old snow could be dangerous.
  - The total accumulated weight of 2 feet of old snow and 2 feet of new snow could be as high as 60 pounds per square foot of roof space, which approaches the load-handling limits of even the best-designed roof.
  - Ice is much heavier, with 1 inch equaling about 12 inches of new snow.

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