

Due to the recent heavy snowfall there is reason to have concern over heavy snow loads on farm buildings. There have been several farm buildings that have collapsed in Waupaca County and throughout northeast Wisconsin. In addition, many have concerns for buildings that still have significant amounts of snow on them.

“Snow and ice accumulations on roofs cause a loading which can cause roof collapse when the roof is not strong enough to resist the load,” said Brian Holmes, University of Wisconsin-Extension emeritus agricultural engineer.

He added, “The more dense the snow and ice, the greater the load for a given depth. Wind blown-off and snow slide-off can reduce snow load on a roof. However snow drifting into leeward or lower roofs and valleys and snow slide onto lower roofs can add significant loads from accumulated snow.”

In addition to estimating the roof loading, it’s important to know the loading the roof can resist. Wisconsin’s Uniform Dwelling Code requires most homes to have a minimum snow load rating of 30-40 pounds per square foot (lbs/ft<sup>2</sup>), with the greater requirement for Northern Wisconsin. Agricultural structures are exempt from this requirement. Furthermore, structural failures can occur at snow loads less than the building was designed for if:

- Structure was not designed, just built.
- Trusses/rafters/purlins/ with reduced quality materials or smaller dimensions than specified in design were used.
- Trusses/rafters/purlins installed at a wider spacing than specified.
- Critical bracing not installed or improperly installed
- Moisture condensed on or leaked onto structural members can cause decay/corrosion weakening the structure. Top chords of trusses, rafters, purlins and truss plates are particularly susceptible.
- Loads added to the roof which were not considered in the original design. Examples include: ceiling, roof surface overlay, equipment installed on roof or hung from trusses.

At snow loads greater than recommended or if the structure is showing stress from the snow (sagging, trusses out of alignment or bowed, creaking sounds etc.), you may need to remove some snow.

If you are unsure of the snow load on your roof, a ballpark estimate can be made using the formula:

Calculated Roof Loading (lb/ft<sup>2</sup>) = Depth (ft) x Density (lb/ft<sup>2</sup> /ft depth). The approximate density (lb/ft<sup>2</sup> /ft depth) for light snow is 5-20, packed snow 20-40, packed snow with ice 40-58, and ice 58. So for example, a roof with three feet of light snow has a estimated roof loading of 60 lb/ft<sup>2</sup> (3 ft depth X 20 lb/ft<sup>2</sup>/ft depth density = 60 lb/ft<sup>2</sup>).

### **Removing Snow – Use Caution**

If you need to remove snow from a roof, use caution. Falls from roofs or from ladders going to the roof can easily occur. Removing snow can allow the snow up slope to suddenly slide down, burying people or animals below. Using a roof rake from a safe distance away can reduce some of this risk to the person removing the snow.

**Some precautions to take when removing snow from a roof:**

- In uninsulated sheds, use a portable heater to warm the interior enough to encourage snow to slide off the roof so you don't have to manually remove it. Unvented heaters can cause oxygen depletion and carbon monoxide accumulation in an unventilated space. Plan to ventilate the warmed shed before reentering.
- Use a snow roof rake if at all possible. This allows you to stand on the ground in a safe place. Check the local hardware store or building supply store. Removing snow from the edge of the roof could allow snow above the edge to avalanche. Make sure you are out of the fall zone when scraping snow from a smooth roof surface.
- Use fall protection equipment when workers are on the roof. Tie workers off so they don't fall from the roof.
- If ladders are used, locate and secure them so they do not fall while workers are standing on them. Also, locate ladders so they do not fall if snow slides off the roof knocking workers off the ladder or leaving them stranded on the roof.
- Generally remove snow from the most heavily loaded areas first.
- Remove snow in narrow strips instead of large areas to help keep loading somewhat uniform.

- Don't pile removed snow onto snow-covered roof areas increasing the load in those areas.
- Use plastic shovels or wooden roof rakes to avoid damaging roofing material.
- Don't feel as if all snow must be removed. A layer of snow next to the roof surface can protect the surface from damage during the snow removal process.
- Do not pick or chip at ice near the roof surface to avoid damaging roofing material.
- Do not use snow blowers as they can damage the roof.

*This information was taken from a 2010 article written by Brian Holmes, Professor Emeritus Biological Systems Engineering Department University of Wisconsin-Madison, regarding Heavy Snow Loads on Farm Buildings.*