

# Toolbox Talks

## Preventing Roof Collapse (Ice & Snow Accumulations on Roofs)

All properly designed and constructed roofs are built to withstand a “design” ice and snow load. The design considers factors such as the type of structure, its construction and the risk to human life and safety. The “snow load” design is based on the expected frequency and severity of snowstorms. This is critical in Maine where design loads can range from 50 to 100 pounds per square foot. Snow load is only a portion of the total design load which must also consider wind and the “dead load” or weight of the roof structure itself.

Municipally-owned properties have the same risk of collapse as all structures. Poor materials, construction and lack of post-construction maintenance can result in a weakened structure. Lack of proper design or design to standards lower than today’s is not uncommon. Newer building codes provide better guidance for estimating snow loads. There are many structures in Maine built by volunteers whose enthusiasm for volunteerism far outweighed their engineering and construction abilities. Metal roofs can suffer from corrosion of metal members and connectors which can reduce their ability to resist high snow loads. After construction, proper maintenance is important and any damage or leakage should be repaired immediately.



Snow and ice on a roof exerts vertical loads that can cause a roof to sag or bow downward. This loading also transfers horizontal forces that can cause walls to deflect outward at either the top or bottom of the wall. Minor sagging or deflection that occurs in a properly constructed roof usually goes unnoticed, is temporary and disappears after the load is removed. When sagging and deflection becomes permanent, there is structural deficiency and in extreme cases, the roof may collapse. The weight of accumulated snow and ice, not the depth, is key to assessing a roof’s vulnerability. The weight of snow is determined by its water content. One square foot of water, an inch deep, weighs 5.2 pounds. Three to five inches of “old” snow is equal to one inch of water, so anything more than two feet of “old” snow could be dangerous. This is especially true if the roof has been previously compromised or damaged by heavy loading.



Before removing snow from a roof, you must determine what is at risk and what is the level of risk? What additional damage might be done to the roof? Is it possible and practical with the available equipment to safely remove snow and ice? What about the safety of the person who is working on the roof? The liability of having someone else remove the snow must be considered before taking action. Removal of snow and ice should be an infrequent, situational activity to address a singular circumstance. If a roof is in such condition that frequent snow/ice removal is required,

then an engineering study should be conducted and long-term remedial action taken.



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## ***Buildings at greater risk:***

- Buildings with lightweight roofs, such as metal buildings or built-up roofs, on bar joists.
- Roof overhangs that project several feet beyond the horizontal support, if there is substantial ice buildup.
- Multilevel roofs where a lower roof is subject to an accumulation of sliding or drifting snow from the upper roof.
- Valleys that allow an accumulation of drifting, sliding or melting snow.
- Buildings constructed with no consideration to design load.
- Buildings with multiple additions or modification done by non-professionals.



## ***How to do a visual inspection:***

- Look for sagging or bowing of roof rafters or purlins. Start by sighting along the ridge line and eave line. Note “dishing” of the roof.
- Look for deflection at the top and bottom of walls. Note outward bowing.
- Look for bowing of roof truss, bottom cords or web members.
- Look for separation of ceiling joists and/or trusses from wall plates.
- Look for bowing of headers or columns.
- Look for movement of flashing around chimneys, door trims, ceiling moldings, staircases, etc.
- Investigate attic and overhead areas for decay, rotting, insect infestation, etc.



If any of the conditions outlined above exist, the structure should be analyzed by a qualified individual such as a professional structural engineer. Remember, wood structures will usually show stress before they fail, unlike metal structures that usually will not. Creaking or moaning in a building, observed movement, severe deflection or bowing are indicators of pending collapse. If there is any doubt about roof integrity, evacuate the area until the situation can be analyzed.

