

RISK CONTROL BEST PRACTICES:

Roof Snow Loading

This guide provides best practices for evaluating exposure to roof collapse due to snow loading.

The Importance of a Roof Survey

A roof survey is the first step in avoiding roof collapse due to snow load. Conduct the survey as far in advance of winter as is practical to allow time to make repairs or alterations. Prioritize and remedy any concerns noted. Some factors, such as roof design and type, may be impractical to change. In these cases, take alternative maintenance and storm-monitoring precautions.

Roof Evaluation Key Points

1. Roof Construction Design

- Large, flat, open-space roofs on structures such as garages, theaters, auditoriums, gymnasiums, bowling alleys, supermarkets and warehouses.
- Saw-toothed roofs, barrel roofs and others of similar design, which tend to allow snow accumulation in the voids (low points).
- Flat roofs or roofs with slopes of less than 30 degrees (or a rise of 4 inches per foot), which reduces the ability for snow to slide off.
- Multilevel roofs, which allow snow accumulation in areas where high and low levels intersect.
- Curved roofs, which may accumulate snow on the leeward (downwind) side at the eaves.
- Roofs of metal deck construction with unprotected bar joist supports. Unlike other types of roofs that tend to collapse in sections, light steel support systems can fail suddenly and completely.
- Preengineered (Butler-type) buildings with standing-seam versus lap-seam roofs. Newer designs for these all-metal standing-seam roofing systems are less stable under snow loading. The clips used to attach the standing-seam roof (lap-seam uses screws) do not aid in bracing the purlins, so braces or stiffeners may be needed to prevent the purlins from rolling over.

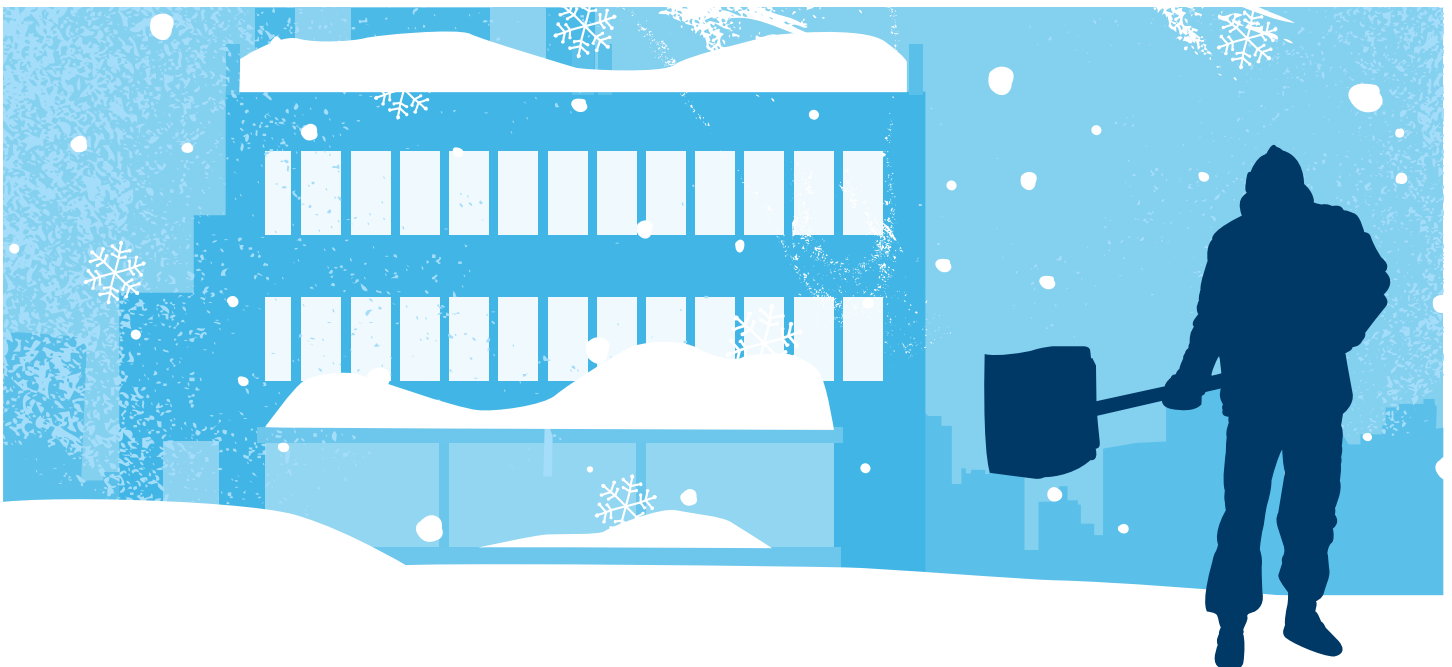
2. Snow Drifting and Insulation Issues

- Although most roofs can support a uniform blanket of snow, snow drifts can cause a load imbalance that results in roof collapse.
- Identify areas that collect drifting snow and consider the direction of prevailing winds.
- Heavily insulated roof areas prohibit the escape of heat, which slows the process of melting snow accumulations.



3. Condition/Maintenance

- Determine snow load:
 - Consider hiring a consulting civil engineer to determine the snow load that can be safely handled by the design load of the roof. Use this information to determine when snow removal actions should begin in the event of a storm.
- For roofs with poor drainage or no drainage at all:
 - Install two roof drains or scuppers (as applicable) for roofs of up to 10,000 square feet.
 - At least one drain or scupper should be provided for each additional 10,000 square feet of roof area.
 - Drain diameters of at least 6 inches (or least 8 inches for scuppers) can accommodate roof areas of 15,000 square feet.
 - Roofs with severely inadequate drainage and no overflow-relief protection should be provided with additional drainage. This is especially important for buildings with lightweight roof construction.
- Drains and scuppers should be inspected and cleaned out (as needed) at least every three months and after storms.
- For roofs with new roof-mounted equipment (such as heating/air conditioning units or solar panels) that add a permanent load not accounted for in the roof's original design:
 - An engineering evaluation of the supporting roof framing and columns for the resulting dead load plus live load should be completed and the roof reinforced as needed.
- For roofs with evidence of past or present leakage:
 - Infrared thermography detects the presence of wet insulation, which is evidence of a roof leak. Left unchecked, this can lead to water damage and roof collapse. This test is best done prior to winter and following a heavy snow.
- Look for ripples or bends in metal supports, cracks in wood members or noticeable deformations in the roof.
- Look for water that pools or ponds in areas of the roof (but never has before). As snow melts, it creates ponds in depression or alley roof areas. Ponding causes roof sag, making even deeper ponds, increasing the potential for collapse. This is the second-most-frequent cause of collapse.
- Wood bowstring trusses may deteriorate near the eave lines. Moisture, heat and humidity weaken construction.
- Roof areas shaded from direct sunlight or wind permit snow to remain on the roof longer and can result in heavier load because of snow turning into ice.
- Previous collapses indicate a weakness in the design or condition of a roof.



Be Prepared in Case of Heavy Snowfall

If the National Weather Service predicts 6 or more inches of snow in a four-hour period or a total accumulation exceeding 6 inches, be prepared to implement your severe-weather plan.

- Determine a safe maximum snow depth and be prepared to clear snow from the roof when one-half of this depth is reached. Doing so provides sufficient roof load capacity to allow for people and equipment on the roof.
- Have the following on hand:

Snow Removal Equipment



Snow shovels

(plastic shovels minimize damage to roof coverings and snow doesn't stick to them)



Light-duty wheelbarrows



Plastic tarps



Heat tape/tracing for drainpipes

Other Equipment and Supplies



Emergency power and surplus fuel supply

(in UL-listed safety containers)



Fuel supplies for heating system



Additional portable heating devices

(maintained and operated per manufacturer specifications)



Salt for clearing drains

- Be ready to hire vetted roofing contractors or temporary staff.
 - Plan for sufficient staffing or arrange the services of a snow removal contractor.
 - Maintain a good relationship with a snow removal contractor well in advance of winter.
 - Secure (and keep current) certificates of liability and workers' compensation insurance for contractors.
- Create a roof plot plan with photographs. Whether contractors or employees do the work, the roof layout and configuration should be confirmed before starting snow removal activities. The roof plot plan should:
 - Identify and mark all protrusions, including skylights, hatches, drains/scuppers, vent pipes and utility wiring. Consider snow depth and snow drift potential when marking these areas.
 - Locate load-bearing walls.
 - Identify all control and sectional isolation valves to gas, water, sprinkler and electrical circuits so they can be shut off if necessary.
- Maintain and cycle heating system to ensure it is in good repair.
 - System usually can be shut down or run at lower temperatures (such as during off hours and weekends). When a snowstorm is expected, run the heating system at regular levels, 24 hours a day. When individually controlled building space heaters are used, it is especially important that all of the units be kept in operation. Shutting off certain units may result in uneven melting of snow on the roof.

What to Do During and After a Storm

- Monitor National Weather Service storm warnings.
- Have on-site monitoring of roof conditions for signs of overstressing and other concerns. Ensure whoever is monitoring has reliable transportation to the site (which must be kept accessible) and a reliable means of communication at the site.

Snow Removal Practices

- Ensure those performing snow removal – whether contractors or employees – are knowledgeable and experienced.
- Begin snow removal before the condition becomes critical so that remaining roof-loading capacity can accommodate personnel and equipment that have to be on the roof for snow removal.
- Determine a safe maximum snow depth and be prepared to clear snow from the roof when no more than one-half of this depth is reached.
- In order of priority, the top three areas that should be cleared of snow are:
 1. Where immediate roof bracing/support is necessary.
 2. Areas around drain(s). Salt can be used to keep drains from freezing.
 3. Large accumulations due to drifting and those in long expanses of unsupported roof area.
- To avoid damaging the roof membrane, do not attempt to remove all snow down to the roof covering.
- Snowblowers must be adjusted or operated in a manner that avoids contact of the rotating component with the roof surface.
- Plastic shovels are preferred over metal shovels to avoid puncturing the roof.
- Plastic tarps can be filled with snow and the contents released over the side of the building. Avoid overloading isolated areas by not overfilling the tarp. Fill tarps on roof areas that have already been cleared.

Other Actions During a Snowstorm

- Inspect roof drains regularly during the storm to ensure they are working.
- Clear snow accumulation from exterior roof drains at the ground level outlet. In an emergency, the insulation can be removed from interior roof drain risers to allow building heat to penetrate and prevent ice plugging.
- Continue to monitor roof conditions, especially for drifting. Consider the direction of prevailing winds and be cognizant of freezing rain, which can contribute significantly to roof loads.

In the Case of an Impending Roof Collapse

- Get out of the building immediately.
- Contact your claims adjuster for next steps.
- If safe to do so:
 - Call utilities and contractors for structural evaluation.
 - Shut off damaged water, gas, process and electrical systems.
 - Secure the damaged area and close and/or cover building openings to prevent snow penetration.

Roof Snow Loading Evaluation Checklist

BUILDING:		DATE:		
ADDRESS:		INSPECTOR:		
CONSTRUCTION/DESIGN HIGH-RISK FACTORS		YES	NO	N/A
Roof design: large, flat, open-space roofs, saw-toothed roofs, barrel roofs, roofs with slopes of less than 30 degrees, multilevel roofs, curved roofs.				
Roofs of metal deck construction with unprotected bar joist supports.				
Areas that collect drifting snow have been identified.				
Heavily insulated roof areas.				
Preengineered (Butler-type) buildings with standing-seam roofs.				
Comments:				

CONDITION/MAINTENANCE HIGH-RISK FACTORS	YES	NO	N/A
Engineering evaluation for design load of roof and new roof-mounted equipment.			
Drainage: two roof drains/scuppers for up to 10,000 square feet. One drain/scupper for each additional 10,000 square feet. Drain diameters of at least 6 inches (or scuppers of 8 inches) for 15,000 square feet. Inspected/cleaned at least quarterly and after storms.			
Areas shaded from direct sunlight or wind.			
Damage, including any of the following: previous collapses, evidence of past or present leakage, ripples and/or bends in metal supports, cracks in wood members or noticeable roof deformations, water pooling or ponding, wood bowstring trusses with deterioration near eave lines.			
Comments:			

PREPARATION	YES	NO	N/A
Snow removal equipment: snow shovels (plastic preferred), light-duty wheelbarrows, snowblowers and surplus fuel supply, plastic tarps, heat tape/tracing for drainpipes.			
Other equipment/supplies: emergency power and surplus fuel supply, fuel supplies for heating system, additional portable heating devices, salt for clearing drains.			
Provisions for sufficient staffing and/or arrangements for snow removal contractor.			
Roof plot plan: Identify protrusions above roof surface and location of load-bearing walls; take photographs.			
Backup communications: cellphone or two-way radio, weather radios or scanners/television. NOAA Weather Radio requires a special receiver and broadcasts on frequencies on the VHF band (162.400-162.550 MHz). Click here for NOAA Weather Radio receiver information.			
Identify control and sectional isolation valves to gas, water, sprinkler and electrical circuits.			
Heating system: System is maintained, and notification method is in place to maintain regular levels when storm is expected.			
Freeze protection for roof drain risers.			
Comments:			

About Trident

Trident's understanding of the unique risks faced by cities, counties, schools and special districts is one reason so many public entities trust Trident to meet their insurance and risk management needs. Contact us to learn more about our products and services.

Disclaimer: The insurance policies, not this guide, form the contract between the insured and the insurance company. The policies contain limits, exclusions and conditions that are not listed here. All coverages are subject to individual underwriting judgments and to state legal and regulatory requirements. This guide is provided for informational purposes only and does not constitute legal advice. Policies for this program are issued by one or more insurance companies of Argo Group International Holdings, Ltd. Trident is a registered service mark of Argo Group International Holdings, Ltd.