

Roof collapse warning signs may be cause for evacuation and/or closure. Owners and/or occupants should perform an evaluation of roof conditions by looking for potential signs of failure such as obvious sagging, cracking, leaking, or other structural deformities.

Design snow loads are measured in pounds per square foot (psf) and can range from 20 psf to over 70 psf. Fresh snow can range from 10 to 20 pounds per cubic foot. Snow that has partially thawed and then frozen may approach 40 to 60 pounds per cubic foot.

Warning Signs of a Potential Roof Collapse

Prior to a roof collapse, buildings generally exhibit signs that the roof is in distress and action should be taken to mitigate a roof collapse. The following are some of the symptoms that have been reported prior to roof failure:

1. sagging roof steel – visually deformed
2. Severe roof leaks
3. cracked or split wood members
4. bends or ripples in metal supports
5. Cracks in walls or masonry
6. Cracks in welds of steel construction
7. Sheared off screws from steel frames
8. sprinkler heads pushed down below ceiling tiles
9. water ponded where it never has ponded before
10. doors that pop open
11. doors or windows that are difficult to open
12. bowed utility pipes or conduit attached at ceiling
13. creaking, cracking or popping sounds

Actions You Can Take To Help Prevent Roof Collapse or Snow Damage:

The majority of roof collapses can be prevented if appropriate action is taken prior to winter weather. It is recommended that a winter storm contingency plan be developed. The following items should be addressed before and during a snow or rain event:

1. Know your roof and building framing layout. It is helpful if it is easily viewed from the roof structure
2. Keep roof drains clear of ice and accumulated debris. Inspect roof immediately after major winter storms where precipitation more than 8 inches of snow fall and/or 2 inches of rain fall has occurred in a 24 hour period.
3. Keep gutters and downspouts clear so they will flow freely. Remove snow and ice from drainage devices first.
 1. Remove snow in strip patterns, starting at the drainage device and proceeding up slope. Remove snow in strips equal to 1/3 the column spacing width starting at mid-span between columns.
 2. Remove unbalanced and drifted snow loads first.
 3. Do not stockpile snow on the roof.
 4. Do not use sharp objects or snow blowers on roofs as they will subject the roof to additional damage.
 5. Provide heat-tracing in gutters and downspouts.
 6. Keep the bottom of downspouts clear of snow and ice so the water has a place to drain.
 7. Truncate downspouts 2 feet above grade to ensure they flow freely and do not freeze at the bottom.
 8. Ensure that snow is not plowed or shoveled against downspouts, which will prevent proper drainage.

9. Do not block exits or fire escapes
10. Many structural engineers recommend removal of snow accumulations from the roof when approximately 50% of design strength is reached. Snow sampling can be implemented to measure and approximate the actual snow loads. Normally, this procedure would require taking several 12" x 12" full depth samples of the snow and weighing them. It is important to determine the load by actually weighing samples of the snow and not by measuring snow depth. Due to the differences between fresh and frozen snow, or light and wet snow there is no definitive correlation between snow density and snow depth

Snow Load Based on Accumulation Depth:

| Snow Depth on Roof (ft.) | Dry Snow (lbs./ft. ²) | In Between Snow (lbs./ft. ²) | Wet Snow (lbs./ft. ²) |
|--------------------------|-----------------------------------|--|-----------------------------------|
| 1 | 3 | 12 | 21 |
| 2 | 6.5 | 24 | 42 |
| 3 | 9.5 | 36 | 62 |
| 4 | 12.5 | 48 | 83 |
| 5 | 15.5 | 60 | 104 |

11. Do not install equipment (air handlers, air conditioners, transformers, etc.) or storage below eaves where the equipment could be impacted by snow or ice sliding off the roof.
12. If there is existing equipment located below eaves, a structurally sound roof should be installed over the equipment to help prevent damage to the equipment from falling snow or ice.

If You Suspect Your Roof Has a Problem

In the event that any of the warning signs are present, quick action can help prevent a roof collapse or help minimize damage. It is suggested that you:

1. Contact a structural engineer to evaluate the building.
2. Initiate snow removal if safe.
3. Initiate emergency actions, such as removing mobile equipment, covering equipment and storage with plastic, backing-up computer systems, etc.

Always use extreme caution if you or an employee attempts any type of snow removal. It is recommended that you contact a qualified contractor or the building owner immediately when you have concerns about your roof. If a roof collapse occurs, call 911 immediately and secure personnel in a safe location.