



The best snow removal tool around!



All properly built roofs, whether for agriculture, retail/commercial applications or residential are built to withstand a “design” snow load, this may also be referred to as a “live load”. The design snow load is based upon the past history for your geographic area, the frequency and type (*wet or dry*) of snow and the severity of snowstorms.

Failed roof from too much snow



Roof snow load design may also consider such factors as the roof slope, its construction methods and the risk to human life. In recent years some areas of the Northwest have had these design load values increased by local building code departments because of the collapse of some roof structures. As evidenced December 2008, north Idaho had snow accumulations breaking several 127 yr old records. Some areas received more than 2’ of snow in a 24 hour period with higher elevation locations getting more snow than that. Over a 5 week period, those living around Spirit Lake, received a whopping 7 feet of snow. As a practical matter, consideration must be given to the weight of snow on a roof. Just because your roof has not failed in 20 years of previous winters does not mean conditions might be more severe this winter, but there are steps you can take and ways to determine when you should clear the snow from your roof.

GENERAL SAFETY CONCERNS

1. The weight of wet or heavy snow can cause your roof to fail and collapse. Every roof is designed to carry a certain amount of snow, if more than the design is allowed to accumulate, the roof could fail.
2. Snow can cover or restrict the roof mounted exhaust vent pipes of heating appliances such as gas or propane water heaters and furnaces. This will lead to carbon monoxide accumulations inside your home or business. The roof vents of propane and natural gas heaters must be kept clear to work properly.
3. Snow accumulations can cover the attic vents restricting the flow of air thru your attic and lead to ice dams and related moisture damage and mold accumulation in your attic.
4. If you are using your attic to store belongings it may greatly reduce the amount of snow the roof can support.
5. If you have added a 2nd layer of singles or otherwise altered or added weight of the roof, this will also lower the roofs ability to support its full design snow load.
6. Here in the northwest, it can be below freezing and snowing for days and then warm up changing to rain and refreeze again that night. Rain on top of snow dramatically increases the snow weight on every roof.

CONSTRUCTION INFORMATION

Generally your builder was required to follow the local building codes and required to build the roof to support a given snow load, (*at the time it was built*) in many areas of Idaho that may be about 40 lbs p/sq ft (*the value may vary between cities or counties and geographic locations*) and some city/county codes may have used a lower value in the past. Generally the higher the elevation of your property, the higher the required snow load design value. However, some locations do not have building codes or the building may have been built ignoring the code.

Several factors can affect the ability of the roof to support its design load. In addition to the snow load, roofs are typically designed to carry some additional “dead” loads which account for the weight of the framing material, insulation and inner sheet rock covering. All modern designs also include a small safety factor raising the loading a bit more. If you have access to the blue-prints for your building, it should indicate the design snow loading in “lbs p/sq ft” (*example- 40 lbs p/sq ft*).

Poor materials or poor construction and/or poor post-construction maintenance can result in a weaker roof structure with an actual load capacity significantly lower than the design snow load. There may not be any signs before a roof fails, however in some cases one or more signs may indicate that your roof may be weakening such as: observing

cracks in the ceiling sheet rock, the presence of wet spots inside the building, cracks in the upper corners of window or door headers, or a bowing or sagging of the roof ridgeline. Noises coming from the attic can be another warning sign.

The type of roof surface (*wood shingles, metal, fiberglass shingles, rubber coatings, etc*) and pitch (*the angle or rise of the roof*) also affects how much snow weight it can support and whether or not the snow will build up to a point and then slide off. The steeper the pitch of the roof, the more likely the snow will slide off. Metal roofs > 5/12 pitch will usually shed all snow unless “snow brakes” have been installed. Sliding snow can be a safety hazard and some owners will install snow breaks to keep the snow on the roof so it doesn’t slide off at the wrong time injuring someone below. Sliding snow on metal roofs can bend or break plumbing and other pipes sticking thru a roof. These pipes should have snow diverters or braces supporting them. Flat roofs will never shed the snow and will bear the entire weight of all snow accumulations. Flat roofs with parapet walls will accumulate snow drifts raising the snow loading even higher.

Small metal storage sheds and perhaps some older mobile homes may not support very much in the way of snow loads and may require the snow removed with less than 1 foot of snow accumulation. Never enter a building you suspect may have too much snow on its roof. If you suspect that it is failing, hire a professional engineer to examine it first.

The type of snow (*dry fluffy, packed or wet*) and any warm weather rain that occurs while snow is on the roof will greatly affect the weight of the snow on the roof. In general terms, you should seek to remove significant accumulations of snow before it becomes a safety problem. Each building is unique, each winter storm situation is unique, you will have to use your best judgment on how to avoid a roof collapse. The best action plan is to remove significant snow accumulations ahead of time.



SNOW WEIGHT CONSIDERATIONS

Consideration must be given to the type of snow accumulating on the roof and whether or not that snow may compact and get heavier, or get heavier from rain or newly added wet snow. As evidenced in the table below, it only takes 11 inches of heavy snow to equal over 6 feet of dry snow. This means you as a business or home owner have to think ahead of the next show storm. The water content of dry snow is only about 3%, while very wet snow and ice can reach 100% of the weight of water. Gutters and roof drains will freeze over and plug-up causing even more weight to accumulate. Ice dams can form at the edges of a gently sloped roof which can cause the melting water to back up on the roof also greatly increasing the load on the roof.

TABLE #1 Approximate equivalent load and depths for a given truss/roof load design (light/dry, heavy, wet are subjective terms)

| Design Snow Load (lb/sq ft) | Feet of Light/Dry Snow | Inches of Heavy Snow | Inches of Wet Snow | Inches of Ice | Inches of Ponding Water |
|-----------------------------|------------------------|----------------------|--------------------|---------------|-------------------------|
| 10 | 3' 3" | 6" | 4" | 2" | 2" |
| 20 | 6' 5" | 11" | 8" | 4" | 4" |
| 25 | 8' | 14" | 12" | 5" | 4.5" |
| 40 (typical?) | >8' | 23" | 16" | 8" | 7" |
| 60 | >8' | 34" | 24" | 12" | 11" |

Generally 1" of rain fall will equal 10" of snow, however in the Inland Northwest, 1" of rainfall can equal about 18" of snowfall

From table #1, we can determine that a 40# designed snow load roof should have the snow removed at approximately 2’ of snow, while a 60# designed now load roof can wait until there is approximately 3’ of snow on it. However both will hold over 8’ of dry fluffy snow. The tricky variable is how much does the snow weigh on your roof and how much more can it withstand? When we are outside shoveling snow off our sidewalk is when we notice if the snow is heavy or light. As you can see in the table, it really makes a difference in determining when to shovel your roof.

TESTING THE WEIGHT OF SNOW

To demonstrate the weight of snow and to prove out the above table we went out and took several snow samples (*Spirit Lake area*) to provide a reality check on how much snow weighs in north Idaho. In the 1st set of pictures we took a one square foot slice of normal snow fall from a snow bank in our yard. This snow was not packed and was originally the dry light fluffy snow but had since received a little freezing rain and sleet upon it. The day we did these tests it was just below freezing outside. The snow was not “wet” but rather dry to the touch.



Fig A the block of snow



Fig B 12” square x 29” high block of snow, 47.4 lbs

The 12” square block was 29” tall and you can see by the scale it weighed 47.4 lbs. That equates to 1.62lbs p/inch or 19.5 lbs per cubic foot. Most roofs in our area would have been built at the 40 lb design loading thus allowing for a snow depth of 24” on the roof. Hence the advice from the Spokane Building Department to shovel snow off the roof with greater than 2’ of snow. The undisturbed snow in this test was mildly compacted from setting and represented about 2 weeks of snow fall. In round numbers this equated to 20lbs per cubic foot of snow. **Thus, just two feet of this type of snow would reach the design load of many area roofs.** However, if it were to rain or wet snow was to come, the design load would be quickly exceeded. When to shovel is often just a best guess and sometimes a homeowner is willing to gamble that no more heavy snow or rain is coming.

We decided to weigh two other samples of snow to see how much they would weigh.



Fig C 1cf of the top 12” of norm snow fall



Fig D 1cf of packed snow from a snow plow bank

In **Fig C**, the weight was 16.2 lbs per cubic foot and it would take about 2.5 feet of this type of snow to exceed a 40lb design load. The snow in **Fig D** is from a snow bank that a snow plow plowed the snow into. While the snow was compacted it still felt like it could be compacted much more. The weight of this sample was 25.6 lbs per cubic foot and would exceed a 40lb design load with just over 1.5 feet of it. We also weighed a cubic foot of freshly fallen snow and determined it weighed 8 lbs p/cu ft. From the above real case test examples it should be obvious the weight of snow can vary quite a bit. Thus, every building and home owner must anticipate and estimate their actual snow weight.

From **Table #1** we can determine that it would take more than 8' (feet) of the very dry fluffy snow to reach 40 lbs of weight per square foot, however what home owners must consider is how soon will it be before any new wet snow or rain comes? As snow sits, it will compact to some degree and become denser, the height will look smaller but it can weigh approximately the same. **DO IT YOURSELF TEST** As a practical matter any person can determine the weight of snow on their roof. Simply take a plastic garbage bag, measure a 12" cubic square of snow, dig it out and put it in the plastic bag. Get on a scale without the bag and then get back on with the bag, the difference is how much the weight of the snow is per cubic foot. Then measure the depth of snow on your roof, to calculate the weight p/sq ft, but as we've mentioned several times already, another very important question is; "*is more snow or rain coming?*"

If wet snow or rain comes before the dry snow is melted from the roof, the dry snow will act like a sponge making the existing snow much heavier. The unknown question is how much rain will the snow absorb? That depends on a lot of factors, however we do know this. Water weighs 8.4 lbs p/gallon or 62 lbs per cubic foot. When the weather man says we are expecting 1" of rain, that 1" will add about 5 lbs for each square foot of roof area if it is absorbed by the snow. Again, there are other factors to consider, for instance when the weatherman predicts 1" of rain, it may be 2" in one geographic area and just a 1/2" in another area. You should plan for the worst case scenario to protect your building.

An average size small business or house roof (*a 26' x 48' or a 1200sf house*) will result in a total snow load design carrying capability of approximately **25 tons!** (*at 40 lbs p/sf*) Imagine if 25 tons were to fall in on you. It should be obvious you do not want to exceed the design limits of your roof.

SNOW REMOVAL CONSIDERATIONS

Several methods of removing snow are available: (a) shovel it off, (b) use a snow rake from the ground, (c) for flatter/lower pitched roofs some have used snow blowers or **Snowscoop** (*Premier Manufacturing, Spokane*) brand scoops with protective roof ski option. Removal can be done in several ways but here are some things to consider:

- A. The roof will be extremely slippery and likely have a layer of ice on it. Use caution when climbing on a roof.
- B. Watch out for any overhead wires or other electrical wiring or devices that could cause electrocution.
- C. Watch out for sky lights which are made of glass or plastic, they will not support the weight of a person.
- D. You may damage the roof especially if covered with asphalt, fiberglass, or wood shingles when shoveling the roof off. Always shovel down hill with the slope of the roof.
- E. Roof overhangs and eaves may not support as much snow and may fail sooner.
- F. Having too many people on a roof at the same time may add enough weight to cause a roof to collapse.
- G. Snow should be removed near evenly from both sides of a roof to avoid placing an uneven load on one side or the other.
- H. If snow is pushed off from a roof onto a wood deck or another roof surface below, the roof or deck will also have to be cleared to prevent it from being over loaded. (*many decks are also designed to support 40lbs p/sf*) Remember if you are clearing 1200 sf of snow onto a 400sf deck, the total weight of the roof snow is now on a smaller area. The loading would be 300% more than it was on the roof because the snow compacts as it is shoveled onto the deck below.
- I. Be careful not to damage roof vents, plumbing vents and other through the roof protrusions.
- J. When snow piles up around the base of a house the snow can block off dryer vents, exhaust fan vents, and water faucets. Consideration should be given to these items and perhaps also have the snow removed from around the home or business as well. The sides of buildings can cave inward from snow pressing against it.
- K. Never block or cover the escape doors or bedrooms windows with piles of snow. Should there be a fire, you must have a way to get out.
- L. Do not try to chip ice off the roof, generally its best to leave it unless it is deep or causing water to dam up.
- M. Be careful not to damage gutters when pushing snow off from a roof.
- N. Never put a heater in an attic to melt the snow thru the roof. Only ducted type heaters should be used for this.

Snow roof rakes (*available at hardware stores*) allow the owner to stand below the roof and pull off the snow without having to go up on the roof. These work very well for the lighter type snow and for single story applications.

Some landscaping, roofing, and construction companies switch to snow removal during the winter months. Handyman and high school kids will generally offer their services for hire to earn extra money. Make sure you hire experienced people who are familiar with the hazards in removing snow. Please read our other publication on clearing snow from a low sloped roof. Ideally crews should be licensed and insured for your protection. Never pre-pay for services, inspect all work afterwards. Your roof is actually a fragile surface, it can be damaged very easily if workers do not take care.



Roof Snow rake in action



Roof clear but house buried!



From the roof to the deck!



36" of snow on a deck

For **Snowscoop** brand snow scoops, snow rakes, and other snow removal tools, please visit the web site at www.snowscoop.net Don't wait until you need one to order one, be prepared and have it beforehand. Commercial snow removal companies use our products; each is designed to reduce the time it takes to do the job. Homeowners, property managers, and commercial businesses all agree, "**Snowscoop**" products are the way to go!

Information freely provided by: **Snowscoop**™ Premier Manufacturing, PO Box 566, Liberty Lake, WA 99019 (509) 928-7556

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