Snow Loads

By Joel Curtis

Each year during our snow season, the National Weather Service receives many inquiries asking for snow load information after significant storm or long term accumulations. Here is a brief review on how snow loads can be easily calculated from a couple of measurements. The essential measurement that is required for these estimates is the water equivalent (WE). In some instances, you will also need to know your roof angle.

If you don't have a weather office nearby to provide you with the water equivalent of snowfall, you can calculate it yourself. You will need a long cylindrical container deep enough for the snow depth. A capped piece of PVC would work well. Invert the cylinder and take a core sample of the snow all the way to the ground. Tip it right side up and allow the snow to melt indoors. The inches of water remaining in the cylinder represent the water equivalent of the snow that was on the ground.

The density of water by definition is 1000 kg (kilograms) per cubic meter at 4 degrees Celsius, however, most snow load information is requested in the English measurement system of pounds per square foot.

$$\frac{1000.0}{\text{cubic meter}} = \frac{2204.6 \text{ lbs.}}{35.3 \text{ cubic feet}} = 62.4 \text{ lbs./cubic foot of water}$$

Refined even further, 62.4 pounds of water on a square foot, 1 foot deep, or 5.2 pounds per inch. The Snow Load Information table below conveniently gives the snow load for each increment of one inch of water equivalent. There are several cautions in using this table. You should measure the snow on your roof, if possible, because of the great variations in snow depth that may occur over even a small geographic area. Another assumption is that the snow metamorphosis (transformation with age) is also uniform and will yield similar water equivalents across the geographic area and various heated roofs. It is important to note that this is a rough estimate of the snow load and should be used with caution.

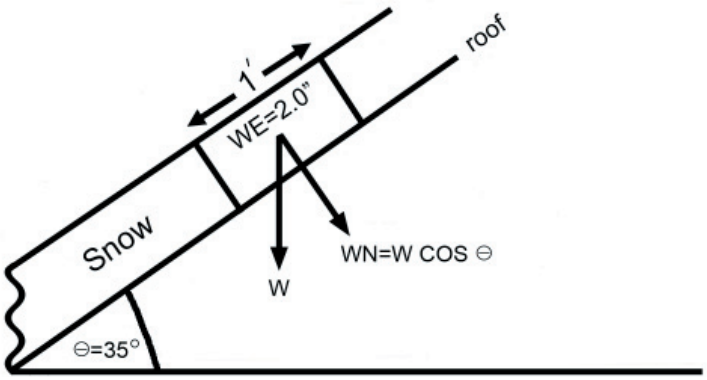

Figure 1

You may also need to adjust your snow load calculations based on the pitch of your roof. Figure 1 illustrates the loads normal and tangent to the roof's surface.

Example: Consider a pitched roof that is 35 degrees up from the horizon. A water equivalent of 2.0 inches is observed at a nearby weather office. This yields a load, W, against a flat roof of 10.4 pounds per square foot. But only a portion of that load is directed directly into a pitched roof. That portion is found by multiplying the load on a flat roof by the Cosine of the roof pitch.

So, the load (force per unit area) normal or directly against the roof, WN, is computed by:

(10.4 lbs/sq. ft.) (COS 35 degrees) = 8.5 lbs/sq. ft.

The force in the direction along the plane of the roof is cumulative for the roof-wise column of snow. Snow will remain on the pitched roof only as long as there is a balancing force of friction in the tangential (up-roof) direction.

Another item to consider is the snow load on the wings of light aircraft. A guideline is that light aircraft wings are stressed downward for a "minus 2 Gs" - twice the aircraft's static weight. Most owners realize that when it snows, they had better relieve the snow weight off the wings. Consider that the average light aircraft has 150 square feet of wing area and a total aircraft weight of 2000 lbs. This would yield 26.67 lbs. per sq. foot or a water equivalent of 5.1 inches as a very rough guideline for wing damage due to snow accumulation.

These guidelines should help provide you with an idea of the weight of the snow on your roof. Now get out there and enjoy the winter weather!

SNOW LOAD INFORMATION

WATER = 62.4 lbs/cu.ft.

Inches	WE=lbs/sq.ft.	Inches	WE=lbs/sq.ft.
1.0	5.2	21.0	109.2
2.0	10.4	22.0	114.4
3.0	15.6	23.0	119.6
4.0	20.8	24.0	124.8
5.0	26.0	25.0	130.0
6.0	31.2	26.0	135.2
7.0	36.4	27.0	140.4
8.0	41.6	28.0	145.6
9.0	46.8	29.0	150.8
10.0	52.0	30.0	156.0
11.0	57.2	31.0	161.2
12.0	62.4	32.0	166.4
13.0	67.6	33.0	171.6
14.0	72.8	34.0	176.8
15.0	78.0	35.0	182.0
16.0	83.2	36.0	187.2
17.0	88.4	37.0	192.4
18.0	93.6	38.0	197.6
19.0	98.8	39.0	202.8
20.0	104.0	40.0	208.0