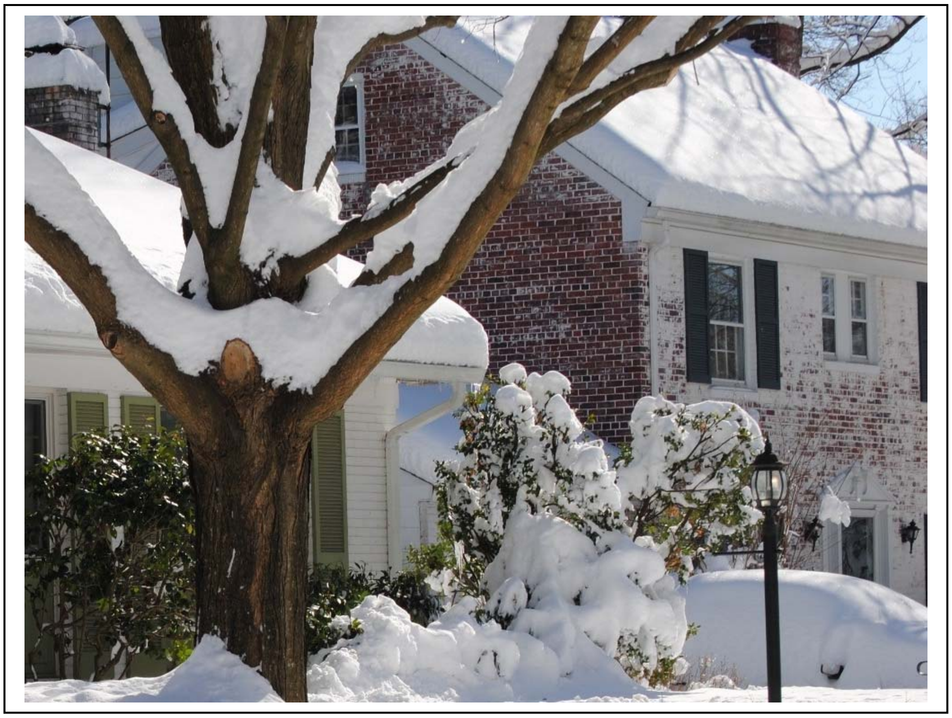
Snow Density, Mass and Roof Failure



During snowfalls, most children are excited by the accumulating snow, while many parents may worry if the weight of the snow will eventually cause their roofs to collapse. Although a small amount of snow weighs next to nothing, a few feet can weigh many pounds. How much snow is too much for the average roof on a house? Engineers estimate that 65 pounds per square foot (320 kg/m^2) is the average amount that a standard wood-framed roof can hold before it collapses. Dry snow has a density of about 50 kg/m^3 while wet snow has a density of 200 kg/m^3.

Problem 1 - Two houses are covered with a blanket of snow. House A has dry snow to a depth of 1 meter, and House B has a roof covered with wet snow to a depth of ½ meter. Which house is at greater risk of roof collapse?

Problem 2 - A snow storm of wet snow began at 6:00 am and continued steadily all day at a rate of 20 cm/hour. At what time will the snow accumulating on the roof reach the critical load for roof collapse?

Problem 1 - Two houses are covered with a blanket of snow. House A has dry snow to a depth of 1 meter, and House B has a roof covered with wet snow to a depth of ½ meter. Which house is at greater risk of roof collapse?

Answer: House A has 1 meter of dry snow covering every square meter of surface, so the mass of this snow on the roof is 50 kg/m^3 x 1 meter = 50 kg/m^2. House B has wet snow to a depth of 1/2 meter so the mass is 200 kg/m^3 x 1/2 meter = 100 kg/m^2. **House B is at greater risk even though it appears to have much less snow cover.**

Problem 2 - A snow storm of wet snow began at 6:00 am and continued steadily all day at a rate of 20 cm/hour. At what time will the snow accumulating on the roof reach the critical load for roof collapse?

Answer: The wet snow density is 200 kg/m^3. It is accumulating at a rate of 0.2 meters/hour. To reach 320 kg/m^2, which engineers say is the critical loading for roof collapse, you need to accumulate a thickness of 320/200 = 1.6 meters. At a rate of 0.2 meters/hour this will take about 1.6 meters x (1 hour/0.2 meters) = 8 hours, so by about **2:00 pm**, the roof might collapse.