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LEWIS T. HENDRICKS, HOWARD L. GRANGE, and LINDA J. CAMP

Preventing Ice-Dams on Minnesota Homes

Each year ice-dams cause millions of dollars in damage to homes located throughout Minnesota. Yet, there is little understanding among homeowners, builders, and suppliers of the cause of these ice-dams and the remedial measures that could help to prevent further damages to residential units. Because of this lack of understanding, much time and money are wasted on measures that do not even begin to address the real problem. However, when the right steps are taken, not only will a home be free from ice-dams, it will be cooler in the summer as well.

HOW ICE DAMS ARE FORMED

In general, ice dams are formed when attic heat moves upward to warm the roof and melts roof-snow at or near ridge areas. Melting of snow occurs at the snow-shingle interface and runs downward (under the snow) as snow-water. At or near the edge of the roof, colder conditions exist that usually result in the freezing of the snow-water, thus forming the ice-dam. Subsequent melting of roof-snow usually accumulates as a pocket of snow-water that eventually backs up under the shingles to cause major damage in the plateline area. This damage can appear in the form of soaked (inefficient) insulation; stained, cracked, and spalled plaster or sheetrock; damp, odorous, and rotting wall cavities; and stained, blistered, and peeling wall paint, both inside and outside the house (figure 1).

Ice-dam problems have become more frequent in recent years because of present construction methods and standards along with concern over energy conservation. Typical American houses built before 1930 were constructed with relatively steeply pitched roofs, with "open" (spaced) sheathing, and mostly with wood shingles. These shingles had gaps between them which served to ventilate attics and to cool the roofdeck. In addition, most pre'30s houses had no insulation in either ceilings or walls because there was little interest in conserving fuel.

On the old "heat wasters," the excessive attic heat supported rapid flows of snow-water downroof to the cooler eave projection and beyond. When air temperatures were less than extremely cold and attic heat was in plentiful supply, rapid melting of roof-snow quickly cleared the roof of snow—with only a gutterful or eave-line of ice and icicles. These houses flowed comparatively rapidly and copiously with snow-water; their roofs cleared fairly rapidly; snow-water penetrations were of comparatively short duration; and, massive eave-ice usually was all that remained of the roof-snow until the next snowfall.

Because of concern for energy conservation, modern homes and pre-'30s homes which have been "modernized" now must meet certain standards, codes, and recommendations for insulation and ventilation. However, these standards frequently represent minimum requirements, and as a result, warm, if not hot, attics are an undesirable characteristic of millions of American homes. Roof-snow blanketing on modern houses, in contrast with the old "heat wasters," melts slowly; beneath the cover water pools may threaten penetration in the house for periods of weeks or months in the snow and cold of the upper midwest.

PREVENTING ICE-DAMS

Though a number of factors enter into the formation of ice-dams, the fundamental problem is undesirable attic heat which results in a warm roof surface. Quite logically then, the solution to the problem is to try and maintain a cold roof.

The effectiveness of cold-surface snow behavior to avoid massive ice formations is exhibited everywhere in winterized snow country. There are no massive ice formations on felled timber, rock outcrops, woodpiles, picnic tables, sheds, and unheated buildings. In homes, continuous removal of attic air to maintain the roofdeck at atmospheric air temperatures requires minimizing the amount of heat entering the attic, together with free movement of air from eave inlets to uproof (ridge) outlets. In short, it means insulating room ceilings far more than customary to minimize heat losses and attic temperatures, and ventilating profusely at all eaves and ridge for a natural flow of air to sweep out the warmed attic air (figure 2).

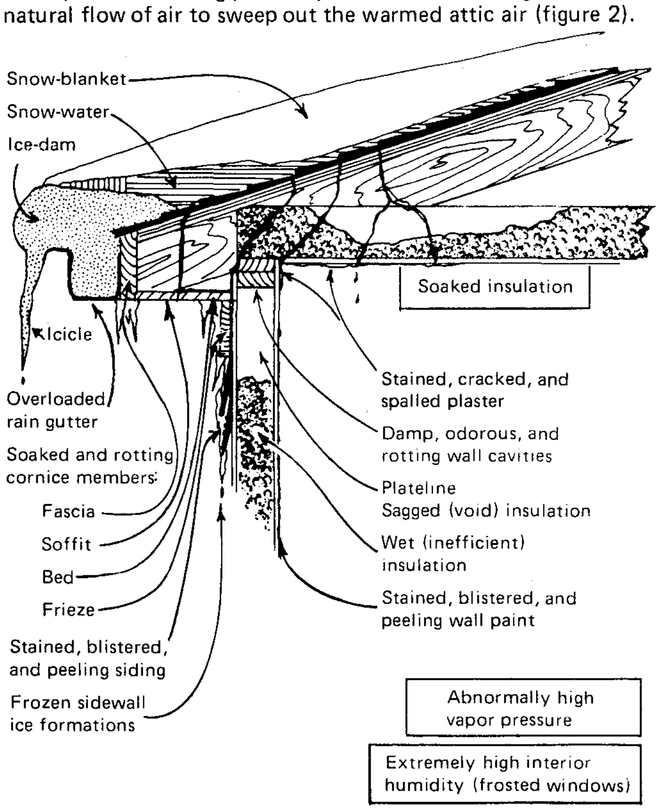

Figure 1. This sketch of the ice-dam problem identifies both the ice-dam and its damages. Of course, all the damages illustrated may or may not occur at any one instance.

Insulation

It is difficult to stipulate the amount of insulation which will be sufficient to adequately contain waste heat because of the innumerable variables in residential designs and requirements. In general, though, a home is not adequately protected until insulation approaches 10 to 12 inches or an R-value of 38.

Equally important as the quantity of insulation is how adequately the insulation is installed. In many homes today continuity of the protective ceiling blanket is frequently interrupted by bridging, wires, recessed ceiling fixtures, etc. Coldroofs for eave ice prevention cannot tolerate such flaws, voids, thin spots, and discontinuities. Likewise, uninsulated chimneys, gas vents, bathroom, kitchen, clothes dryers, and any other warm exhaust equipment may contribute to a troublesome supply of attic heat. Some pipes may have to be rerouted and all of such attic heat contributors should be carefully wrapped with effective insulation. Chimneys and furnace flues should not be insulated without contacting local building inspectors.

It is important to emphasize that adequate insulation *alone* will not prevent ice-dams; it must be done in conjunction with adequate ventilation.

Ventilation

When it comes to preventing ice-dams, it is impossible to have too much ventilation. The Northern States Power Company has recommended that homes have one square inch of ventilation for each square foot of ceiling. Ventilation should be equally distributed between inlet and outlet areas. Overall, the goal is to have a sweep of cooler outside air entering through the soffit which moves along the ridge rafters and exits through a ridge vent near the peak of the house as shown in figure 2.

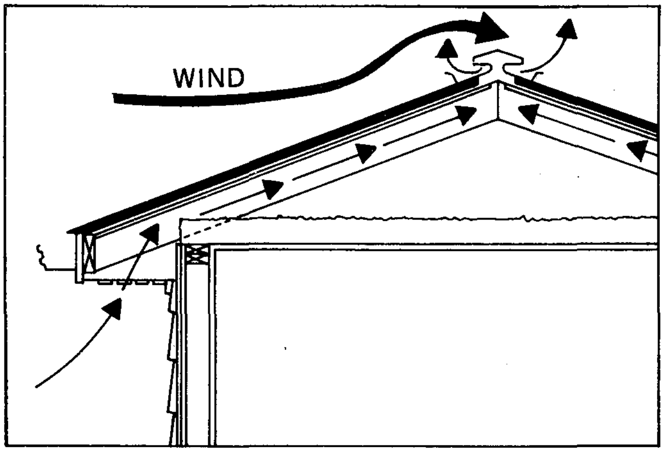

Figure 2. Movement of air when there is adequate insulation and ventilation.

Many insulation companies and lumberyards are currently marketing a variety of devices to achieve such continuous soffit ventilation and continuous ridge ventilation. In addition, some companies are selling what are commonly known as "air chutes." These are strips of plastic, waxed cardboard, or other material which help maintain a flow of air over the plateline area, and which may be put into place when insulation is installed or during construction. When correctly and carefully installed, such devices can be very helpful in accomplishing correct ventilation.

There are other approaches to ventilation which homeowners may wish to use, including individual soffit vents, individual roof louvers, and power vents. In general, however, these do not perform as well as the continuous ventilation method. Whatever the method, homeowners should check to see that insulation or other materials do not block air passages, especially in the plateline area. And again, homeowners should understand that adequate ventilation must be accompanied by adequate insulation to be effective in preventing ice-dam formation.

TEMPORARY AND EMERGENCY MEASURES

For the homeowner who already has snow-water or ice-dam problems, there is an immediate need for some kind of action. In such situations, there are a number of short-term measures that can provide some relief. However, it cannot be stressed too strongly that such measures are only temporary and will probably have to be repeated each time there is a new winter storm. In the long run, homeowners can best spend their time and money on proper insulation and ventilation.

Most snow can be removed with a "roof rake" and push broom. However, extreme caution must be taken to insure personal safety and cause as little damage to the roof as possible. Homeowners should never chop through the ice down to the shingles or use a blow torch.

Building owners often install electric cables along the eaves and in the valleys to prevent ice-dams. Unfortunately, the melting effectiveness of such heat tapes is limited to only a few inches from the cable and the sawtooth melting often causes uproof secondary ice-dams to develop. In addition, these electric cables use up a great deal of energy.

Hosing with tap water on a warm day or having the roof steamed are two other common approaches. However, with the first approach water runoffs could damage shrubbery and with steaming there is the risk of expansion and contraction of the roofdeck.

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