

Ice Dams

by Alex Wilson

If you mention ice dams around here, most builders groan and nod, with an I'm-all-too-familiar-with-that-problem look. The past two winters, while great for the New England ski industry, have been among the worst in recent memory for ice dams.

In this column, I'll take a look at the problem of ice dams: why they occur, and how you can avoid them (or at least reduce the potential damage).

The Cause

Ice dams form when snow melts on a building, allowing water to flow down the roof surface and freeze at the overhang. I've seen ice dams more than a foot thick. The ice acts as a dam, causing additional snowmelt to back up the roof—as much as four feet or more—and force its way through the roofing and into the house. That's when you get a call.

Heat loss is most often credited with causing ice dams. Heat escaping from the attic or through cathedral ceilings warms the blanket of snow on the roof, which then melts from the underside. Because the snow itself acts as an insulator, the melting can occur even when outside temperatures are well below freezing. Water runs down the roof until it gets to the roof overhang, where the roof surface is cooler. Here the water freezes, building the dam.

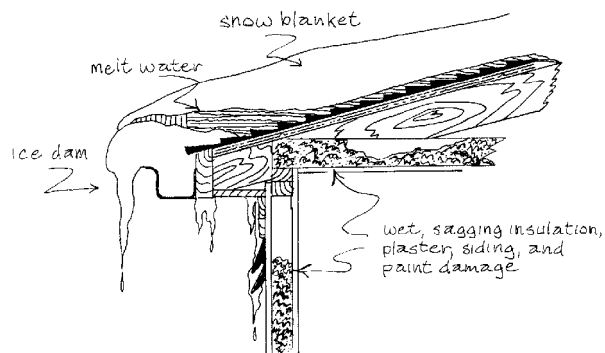
Sunlight and warm outside temperatures can also melt the snow. In this case, however, the dams form later in the day when the air is cooler. (The fact that ice dams can form on unheated buildings is evidence of this effect.)

We generally think of ice dams forming a reservoir of water behind them. When the ice dam gets thick enough and the reservoir backs up far enough, the reasoning goes, the water reaches holes in the roofing or gaps between courses of shingles, and leaking occurs. Picture a small lake nestled into the eave of the house.

But the actual mechanism may be quite different, in at least some cases. The bottom surface of the snow, after thawing and freezing repeatedly for days or weeks, may form a solid glaze on the roof surface. This traps a thin layer of water that can extend well up the roof past the top of the actual "dam." Furthermore, this water can be under pressure high enough to force it through even small nail holes or roofing overlaps.

The major factors that influence the formation of ice dams and the damage they can cause are:

Ventilation. Keeping the underside of the roof surface well ventilated is the most important factor you can control. Install continuous soffit vents along the roof edge. The soffit vents should be open to the attic space if the attic is unheated, or open to the top of the rafter cavities in the case of a cathedral ceiling. With cathedral ceilings, you should hold the insulation away from the roof sheathing using a product such as



The classic ice dam: An all-too-familiar sight throughout northern New England.

Propa-Vent.

To exhaust this air, use either continuous ridge vents or gable-end vents. Even in unheated attics, where gable-end vents have traditionally been used, continuous ridge vents are more effective. Whatever is used, the idea is to allow cold air to flow under the roof surface and keep the roof as close to the outside temperature as possible. This is sometimes called the "cold roof" approach.

Skylights. Skylights—and, to a lesser extent, other roof penetrations in cathedral ceilings—can cause the most troublesome ice-dam problems. Skylights increase problems in two ways: by melting the snow that falls on them, even in very cold weather, and by sealing off the air flow through the rafter cavities above and below the skylight. This stagnating air will be warmer than the air in vented rafter cavities, and will result in more snow melting.

To vent the rafter cavities above and below skylights, cut notches into the tops of the rafters just below and just above the skylight headers. At the bottom of the skylight, this will allow air to flow into adjacent rafter cavities and up to the ridge vent. At the top of the skylight, the grooves will allow air to flow into the rafter cavities above the skylight and keep it from stagnating. There won't be a great deal of air flow but it does help, according to Mark Kelley of Acorn Structures, a Massachusetts manufacturer of panelized houses.

Roof pitch. Roof pitch affects the formation of ice dams. The steeper the roof, the more likely it is that snow will slide off and ice dams won't form.

But more important, steeper roofs are less likely to leak if ice dams do occur, because the water won't be able to back up the roof as far. Kelley has never experienced ice-dam problems in houses with 12-in-12 or greater pitches. With 8-in-12 pitches, he has occasionally seen ice dams; with 6-in-12, they are common.

Roofing material. The roofing material affects the formation of ice dams for the same reason as the roof pitch. With metal and slate roofs, there is less friction, so the snow can

slide off more easily. Asphalt, fiberglass, and wood-shingle roofs, on the other hand, tend to hold the snow much better. But any type of roof surface can experience ice damming, especially on shallow pitches. When ice dams do form, metal roofs, in general, are most impervious to leaks. But metal roofs are also the most difficult to properly flash at skylights and other penetrations where leaks from ice dams are common.

Snow belt, a wide flashing that is used at roof eaves, is an excellent way to reduce the risk of damage from ice dams. The flashing typically extends three feet up the roof, but belts as wide as six feet are sometimes used. The first course of shingles starts near the top of the flashing:

Brad Dunbar, of Jancewicz & Sons, a roofing, insulation, and siding business in Bellows Falls, Vermont, recommends double-lock, standing-seam snow belt. This is the best defense against water penetration. Snow belt is available in galvanized steel, aluminum, and copper.

Snow belt, like metal roofing, helps keep ice dams from forming by allowing snow to slide off the edge of the roof. But the primary function is to prevent backed-up water from penetrating the roofing. Quality snow belt is an excellent defense.

An alternative to metal snow belt that is gaining popularity is a bitumen membrane, such as Ice & Water Shield (manufactured by W.R. Grace & Co.). "Bituthene" is a synthetic rubber membrane that is installed at the lower edge of roofs right on the sheathing. It comes in three-foot-wide rolls, which is usually sufficient. On some roofs with shallow pitch, installing two layers with a six-inch overlap may be justified. The material is self-healing, meaning that it seals around nail holes and other penetrations.

Jim Williams, an architect and builder in Brattleboro, Vermont, says that if roofing is done late in the season, the bitumen membrane may not be totally effective until the second winter—that is, until it has been heated thoroughly by the summer sun and allowed to flow into

any nail penetrations and other holes.

Roof orientation. North-facing roofs are the most prone to ice dams because they have the least sunlight falling on them. East orientations are next, followed by west and south. East orientations are more prone to ice damming than west ones because when the sun shines on an east roof, the air temperature is lower, so less melting will occur. South-facing roofs are least likely to experience ice dams.

Weather conditions. As mentioned at the beginning, weather is the most significant cause of ice dams, and there's nothing we can do about it. Acorn Structures did not experience a single ice-dam problem in any of their houses from 1975 through 1985; during the past two winters, however, they have had about a dozen cases. Ice dams form when there is a lot of snow. And rain on top of snow can cause the worst problems.

Daily temperature cycling also influences the formation of ice dams. Good maple sugaring weather—warm, sunny days followed by cold, below-freezing nights—can be terrible for roofs if there is a lot of snow. It can quickly build up very thick ice dams.

Summary

While you can't prevent ice dams in all situations, you can take some measures to reduce their likelihood. The first step is to understand how ice dams form, and why. The next step is to design your houses to prevent ice damming. Ventilate the roofs properly with soffit and ridge vents. With cathedral ceilings, make sure air can flow freely above the insulation next to the roof sheathing. On the outside, use a Bituthene-type product or a snow belt at the roof edge that extends at least three feet up the roof (or farther on pitches of less than 6 in 12). Where appropriate, use metal roofing. Build steeper roofs.

Some of the products are expensive, but they are less expensive than call-backs. And besides, wouldn't you rather be skiing in snowy winters than dealing with call-backs? ■

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