

Roof Ice Dams

It's Not Really a Roofing Problem!

Nothing highlights construction shortcomings like severe winter storms. Too often, possible problems are neglected during the construction season when winter and its bad weather seem far removed.

The winter of 1999 produced many ice dams on shingle roofs in central and eastern Canada. The resulting leaks caused widespread damage to ceilings, walls and interior furnishings of many homes.

by Joe Sartor

Why Ice Dams Form

Ice dams are caused when heat from the attic melts the accumulated snow on the shingles above the outside wall, while the snow on the eaves overhang and in the eaves trough does not melt because it is surrounded by cold outside air. The melting water then freezes as it runs down over the cold overhang, and forms a dam that prevents the water from the melting snow getting down and away in the eaves trough.

As the level of the dammed melt water rises, water starts to run up and under the shingle tabs. The water then enters the vertical joints between the shingles, and spills down onto the roof sheathing, where it spreads out, finding joints or holes in the sheathing, and dripping down onto the insulation over the ceiling near the outside wall. If the water does not go any farther, nobody notices, and it is not a problem. However, when enough water accumulates, it spills over or soaks the insulation, and wets the ceiling drywall or plaster below—becoming a built-in leak problem.



The Usual Remedy

For new construction, a common procedure for preventing leaks of this kind is to apply a width of waterproof membrane, such as peel-and-stick membrane to the sheathing under the shingles at the eaves so when the dammed melt water leaks through the shingles, it cannot wet the sheathing. Some building codes may require this membrane over the eaves, or a shingled layer of asphalt-impregnated felt paper covering the whole roof under the shingles.

A popular remedy for existing houses is to install heating cables in a zigzag pattern on the shingles over the overhang to melt that snow so that no ice dam can form. Heating cables have their drawbacks. People forget to turn them on, so ice

dams can still form, or they forget to turn them off and risk overheating and damaging the shingles.

What seems to have been forgotten by everyone involved in this kind of remedial work is that installing a membrane, felt layer, or heating cables only treats the symptom and not the cause of ice damming. Left unresolved, ice damming can damage the roofing, as freeze/thaw cycles acting on the melt water under the shingles can lift the nails and bend or crack the shingles. The wood joists, rafters, and sheathing can also rot over the years if wetted by the leaks.

The Real Remedy

The cause of ice damming has nothing to do with the roof or the shingles. It has everything to do with heat loss due to low insulation levels at the ceiling edge, proper attic ventilation at this point and warm air leakage from the house below. If no heat escapes from the ceiling edge, and there is enough attic ventilation on the underside of the sheathing, the shingles will not heat up enough to melt the snow near the eaves. There will be no melt water and no ice dam, and thus no leaking.

To correct or prevent both the ice dams and the leaks, it is not the roofing that needs remedial work, but the ceiling edge insulation, air leakage and eaves ventilation. Sometimes air leakage from inside at the wall is the main problem and needs to be corrected.

Increasing the amount of attic ventilation to prevent the escaping heat from melting the snow on the roof seldom works. Increased attic ventilation does not dissipate the heat escaping from the ceiling below to stop the snow on the roof from melting at that point.

What is really needed is full depth ceiling insulation at the roof edge, full ventilation at every rafter space between the top of the insulation and the roof sheathing, and eliminating interior air leakage especially near the outside wall. If there is no heat under the sheathing, there will be no melting and damming on the roof and no leaking through the roof into the ceiling below.

Examining The Problem

A close look at a typical wall/roof/ceiling detail shows why leaks due to ice dams happen so often.

Usually, the rafters are low to the top of the outside bearing wall for reasons of economy or aesthetics, bringing the roof sheathing very close to the ceiling edge below. This means a restriction

in the insulation that can be fitted between the ceiling and the sloping roof, resulting in excessive heat loss into the roof at that point. In addition, there is seldom a full ventilation space between the rafters above the insulation, so a thermal bridge is created that allows the heat loss to warm the sheathing and shingles, and melt the snow which then freezes to cause the damming and leaking. Usually there is a lot of air leakage at the outside wall, adding to the heat concentrated under the roof at that point.

To conform to the insulation requirements of most current building codes, the space under the roof sheathing should be about 12" thick at the outside wall. (10" for batt insulation and 2" for ventilation; at the very minimum, the insulation over the outside wall should be no less than the insulation in the wall.) Very few roofs meet this requirement. Some older homes only have about 4 - 5" for both insulation and ventilation above the ceiling. And of course, the older homes have more air leakage at the outside walls directly below this vulnerable location, especially if they are solid brick with lath and plaster on strapping.

Preventing Ice Dams on New Construction

First, air leakage from the ceiling, and especially from the corner at the outside wall, must be eliminated to keep that area cool. If roof trusses are used, it is simple (but slightly more expensive) to raise the heel by cantilevering the bottom horizontal truss member or raise the heel of the truss to fit the required insulation and ventilation space. If framing is used instead of trusses extra work will be required to raise the rafters to provide this space.

Naturally, raising the roof sheathing will change the outside appearance of the house as it raises the eaves and exposes more outside wall at the top over the windows. Some builders resist doing this as it may alter the aesthetics besides increasing costs. However, not doing it usually results in ice damming in most Canadian climates.

Correcting Ice Damming on Existing Houses

Controlling the air leakage, providing enough insulation and ventilation in a thicker, more airtight roof structure will prevent ice damming in a new house. But what about an existing house experiencing this problem? How do we remedy it? In a restricted space, we need to provide adequate

insulation, ventilation, and eliminate air leakage from the inside.

Make sure every rafter space is vented across its full width, using properly-sized vent baffles above the insulation. Where trusses have not been used, this is difficult because the ceiling joists are usually nailed beside the rafters, so the vent space is narrower and not uniform in width. Regardless the difficulties, it must still be done properly to be successful.

Remove the insulation and any wood members which might interfere with new insulation and ventilation. From the ceiling edge, fit properly-sized vent baffles, making sure that there is a minimum 1½" depth for ventilation across the full width from rafter joist to rafter joist in every rafter space. Then apply low-expansion spray-in-place polyurethane foam insulation. The foam insulation must completely fill the tapered space under the baffle and over the ceiling between the ceiling joists/rafters, from the outside of the structural wall inward far enough to allow the full depth of batt insulation to continue. When installed this way, the foam insulation provides high-quality insulation, (more than R-6 per inch) filling in all the nooks and crannies effectively reducing thermal bridging in this tight space. Foam insulation also seals off, any air leakage in that area. This is especially important in older, solid brick-&-block houses, where there is massive warm air leakage upwards from the vertical strapping space between the plaster and the masonry wall.

By doing the corrective work, all conditions which might heat the roof sheathing and produce ice dams (warm air leakage, inadequate insulation, and lack of full ventilation space under the sheathing) have been eliminated.

Ice damming, the resulting leaks, and possible damage to the roof itself are eliminated by simply bringing the ceiling insulation, roof ventilation, and air leakage up to current code standards, both in existing houses and in new construction. Just fixing the roof will not do it, because it is really not a roofing problem.

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