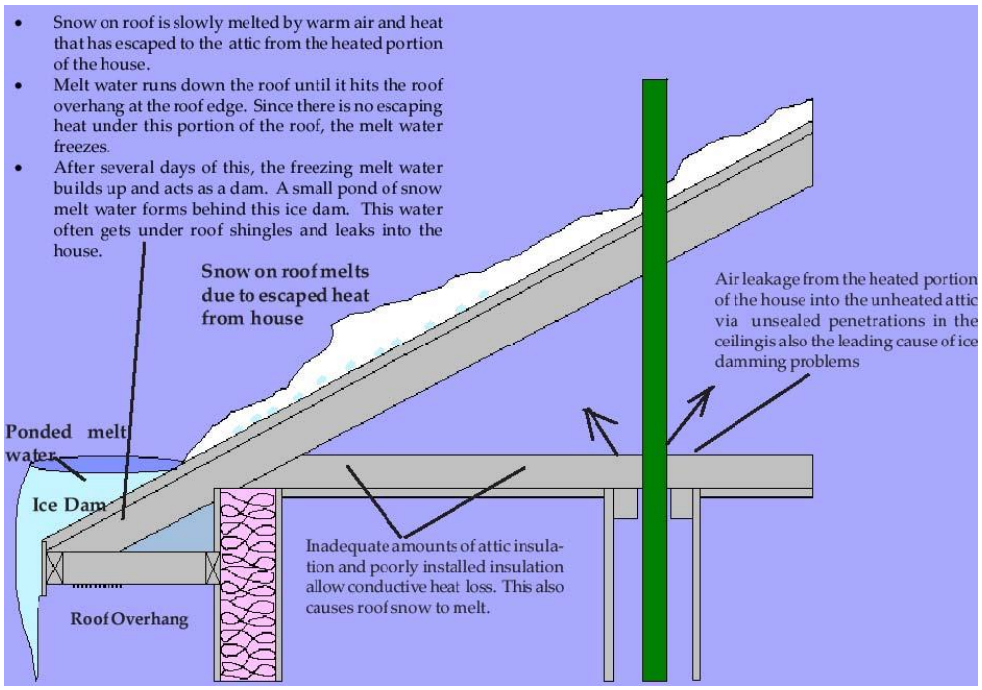
Ice Damming Basics

As shown in the following graphic, ice damming begins when melted water from snow refreezes on a roof. This generally occurs near the eave of a building, although it can develop at any change in slope (such as in a valley). When more melted water backs up behind this ice dam, it seeks any weakness in the roof system and may flow under shingles, underlayment, or flashing, possibly resulting in damages to the interior of the building below.



When the accumulated water on the roof penetrates the building envelope, ice damming often causes telltale symptoms that include water leaks, water stains, and fungal growth around the exterior walls and perimeter ceilings of the affected buildings. Ice damming can often be prevented by properly ventilating the attic, so that heated air is allowed to effectively escape. Ice damming can also be prevented by insulating the ceiling so that the loss of heated air inside the building into the attic is minimized, thereby reducing the opportunity for heat to warm the underside of the roof and melt the accumulated snow. Obstructed or inadequate soffit vents can cause heat buildup in the attic above the exterior walls of the house, promoting ice damming.

While most damming occurs at the gutter line, water can also back up over step flashing, beside dormers, and to other parts of a structure with a difference in elevation. Another common location for ice damming is above and below skylights, where air passages have not been provided to allow circulation.

Residential Building Code Considerations

Building codes in a number of northern states require roofs to be installed with added protection against ice damming. An ice and water shield is the default added step in residential roofing; codes require that

an additional waterproof membrane be applied to the roof sheathing along the eaves to a distance at least 2 feet inside the interior face of the exterior wall[1]. This barrier is applied beneath the shingles and with care paid to lapping details, so that successive courses of conventional roof underlayment shed water onto the ice and water shield rather than underneath it. This shield then provides a waterproof barrier between the shingles and sheathing that prevents water from entering the attic and/or living quarters. Most southern states do not have this requirement, but do require underlayment be placed beneath the shingles.

All building codes require attic ventilation. In most cases a ratio of 1:150 is required.[2] This means there must be at least 1 square foot of net free ventilation for each 150 square feet of attic floor space. As noted above, this ventilation space must be unobstructed in order to function properly. In some cases, insulation is improperly placed in the attic and thus obstructs the eave soffit vents. An example is blown insulation, which can be easily blown between roof rafters into the eave, thereby inadvertently blocking soffit vents.

Investigation Considerations

If snow is present on the roof when the investigation is underway, look for an accumulation of ice near the eave. Gutters can remain filled with ice even if a partial melt occurred prior to the investigation.

If all ice and show has melted at the time of the site
visit, pay close attention to the interior damage. Where has water reportedly entered the house? Is this near an area where ice/water would have logically accumulated on the roof – generally along the perimeter of the exterior walls and dormers?

Attic studies are critical in the accurate diagnosis of ice damming. Inside the attic, check for signs of water intrusion on the roof sheathing, on the first-floor ceiling insulation along the roof perimeter, and in areas susceptible to ice damming. This may be difficult in roofs having a low slope since the attic space will decrease rapidly near the eave. In such cases, if the damages will warrant more than a cosmetic repainting of the affected drywall, it may be warranted to remove the drywall and overlying insulation to expose the roof deck above the area of interest.

[1] Note that this two-foot distance is to be measured horizontally from the inside of the exterior wall – not along the slope of the roof. [2] In some cases, this can be reduced to 1:300 when a vapor barrier is installed.

If ice damming has repeatedly occurred, the roof sheathing may have a line of discoloration parallel to the exterior wall. Look upslope of this area for fungal growth on the sheathing. If attic ventilation is inadequate, moisture will condense on the sheathing. If the sheathing is rotten or moldy, this is an indicator that ice damming and/or attic "sweating" from improper ventilation and/or inadequate insulation may be an ongoing problem.

How does the attic "feel"? Attic conditions should be similar to outdoor conditions. On a cool, breezy day, the attic should not feel warm or humid.

Check for obstructed soffit vents. Is the attic floor insulated so heavily along the roof eave that the soffit vents are obstructed? Some overlapping roof designs create "dead zones" where the air does not properly circulate. Are there areas in the roof where the movement of air would be hindered?

Construction Considerations

In some cases, improper construction may allow heat from the living space to readily enter the attic, raising the temperature and melting the snow on the roof. In addition, as noted above, improper or improperly installed attic insulation can allow warm air to enter the attic, causing snow on the roof to melt.

Cathedral ceilings are common places of ventilation and insulation issues. Did the insulation get properly secured when being installed so that it doesn't gradually sag in the space between rafters, thereby blocking airflow? Were the right size rafters and insulation used to keep an air space open between the insulation and roof deck above?

Make sure penetrations around ceiling fixtures (lights, fans, etc.) as well as any vents or flues routed into the attic are properly sealed. Can interior light be seen in a dark attic? If so, chances are high that heat is readily venting into an attic that is meant to stay cool in the winter.

Remediating Ice Damming

Ice damming usually does not force whole roofs to be replaced. Roofs can often have existing ventilation improved or additional ventilation added with great effectiveness. Adding or improving ceiling insulation is a common-sense approach to fighting ice damming.

In cases where ice has frozen between shingles, it can loosen the sealant strips. However, this condition should be present only in areas where ice damming would have occurred – not high up on the roof slope or in the field of a slope. In these cases, shingles can be manually re-sealed using industry standard techniques and materials.

In cases where additional ventilation and insulation prove insufficient, roof system reconstruction may be justified in the areas where ice damming is known to occur. A common culprit is the absence of an ice and water shield where it should have been installed, or it is found to have been installed improperly. Improper lapping details and areas of coverage are frequent causes.

Damages from ice damming are preventable. With proper roof ventilation, ceiling insulation, and roof system construction, there is little justification for damages from ice damming, even under the most dramatic winter weather.