NATURAL HAZARD MITIGATION

INSIGHTS

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ICE DAMS

Ice dams on sloped roofs are a common headache across the northern areas of the United States in the winter. Anyone who has experienced water penetrating a roof in the middle of winter and splashing into an attic or running down exterior walls and dripping into rooms knows of the problem. Ice dams can cause stained or ruined walls and ceilings, saturated insulation, and dry rot of structural framing, leading to costly repair jobs. *(see Figure A, page 2).* Fortunately, there are a number of basic and practical ways to minimize the size and impact of roof ice dams.

HOUSE WITHOUT PROPER VENTING

An ice dam is an accumulation of ice at the lower edge of a sloped roof. Ice dams form in cold weather when there is a layer of snow on the roof. Heat within the house rises into the attic and warms the roof. The snow on the roof melts a bit and water runs under the snow down to the roof edge. The lower edge of the roof tends to be coldest because it extends past the warm interior of the house and does not get as much of the structure's heat.

At the lower edge, a bit of the water refreezes under the snow and forms a thin layer of ice. When that happens again and again, the thin layer builds up. If there is a gutter, it can quickly fill with a solid block of ice that grows back up to the roof edge and becomes part of the ice dam forming at the edge. But ice dams form even without gutters. It is just a matter of the right conditions before there is a formidable ridge of ice running along the length of the lower edge of the roof.

HOUSE WITH PROPER VENTING

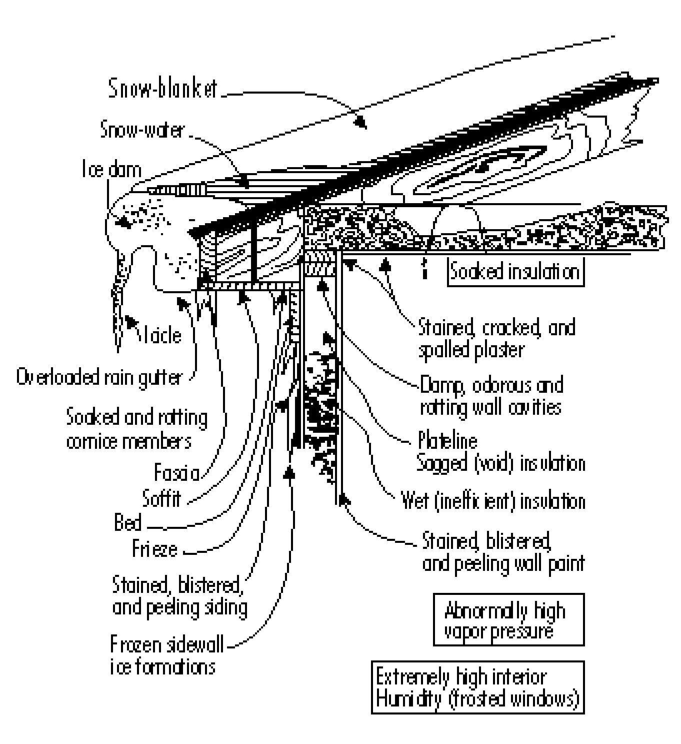

FIGURE A - ICE DAM

Daily temperature cycles in the winter contribute to the problem. As the sun rises and the temperature climbs during the day, the snow on the roof will melt a bit more — until nighttime brings plunging temperatures that freeze the water where it has accumulated at the edge behind the dam.

Over time, the ice dam expands to the point where it holds back a pool of water on the roof. The growth of the dam can force that water under the roof covering. From there, the water may find its way into the attic or down the walls of the house.

HOW TO REDUCE ICE DAMS

A two-step approach is the most effective way to reduce the size of ice dams. First, keep the attic floor well insulated to minimize the amount of heat from within the house that rises into the attic. Second, keep the attic well ventilated so that the cold air outside can circulate through it and reduce the temperature of the roof system. The colder the attic, the less thawing and refreezing on the roof. These two measures are the best ways to keep ice dams from growing too large.

INSULATING THE ATTIC

The attic floor should have sufficient insulation to keep the transfer of heat from the downstairs to the attic at a minimum. In general, the attic temperature should be 30° F (-1° C) or lower whenever the outside temperature is 22° F (-5.5° C) or lower.

Even a well-insulated attic floor may have a number of openings that can permit warm air from below to seep up into the attic. For instance, these items may cut through the attic floor:

- exhaust pipes and plumbing vents
- fireplace and heating-system chimneys
- light fixtures

Seal all the openings around these penetrations, but be careful not to block the attic vents with insulation. The attic vents, as explained below, must be kept clear so that they can do their job. In addition, the attic may have either pull-down stairs or a set of regular stairs leading up from the lower level. Either is an avenue for rising heat. Weatherstripping around the edges of the attic access door and insulation on the attic side of the door should minimize the passage of heat to the attic. *(see Figure B, page 3).*

VENTILATING THE ATTIC

There are several ways to ventilate your attic. You can do it with eave vents, soffit (cornice) vents, a ridge vent, a gable vent, or some combination of these. Most modern residential roofs combine a ridge vent with soffit or

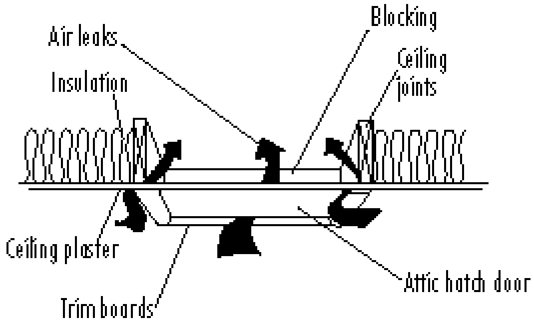

FIGURE B - ATTIC OPENINGS

eave vents. To the extent that household heat penetrates the attic, it should be able to rise and escape through, for instance, a ridge vent, while soffit (cornice) or eave vents pull in cold air to replace it. *(see Figure C).* Local building codes may require a minimum level of ventilation.

Proper ventilation of the attic to let cold in, together with insulation on the attic floor to help keep household heat out, work together to minimize the likelihood that ice dams will form.

OTHER METHODS

There are other ways to reduce the likelihood of ice dams, but their effectiveness is questionable and no one should consider them a cure-all.

One is to install electrical wires, also known as heating coils, along the edge of the roof. The coils typically sit on top of the roof covering and tie into the electricity supplied to the house. When you turn them on, they generate a low level of heat sufficient to melt ice near them. Many homeowners object to heating coils for aesthetic reasons. They are also somewhat costly to operate.

Another method with aesthetic drawbacks is to install metal sheeting on the roof from the edge back about two feet. The metal makes it difficult for ice to grab a toehold at the edge.

Installing and securing heating coils or metal sheeting may involve puncturing the underlayment that sits over the roof sheathing. That can increase the chances of leaking if an ice dam does form.

MINIMIZING THE DAMAGE

It is difficult to eliminate ice dams completely. Consequently, it is advisable to take steps to avoid their damage in colder regions of the United States where they may occur. In particular, make the roof more resistant to the water that backs up behind an ice dam.

IMPROVING WATER RESISTANCE

Residential roofs are generally designed to shed and resist water. They are not designed to be waterproof. However, you can increase the ability of the roof to resist the water that ice dams want to force into the roof structure.

Most of the building codes in the United States are based on one of three models. Each of the model codes requires some type of extra protection against water penetration from ice dams where winter temperatures or conditions cause them.

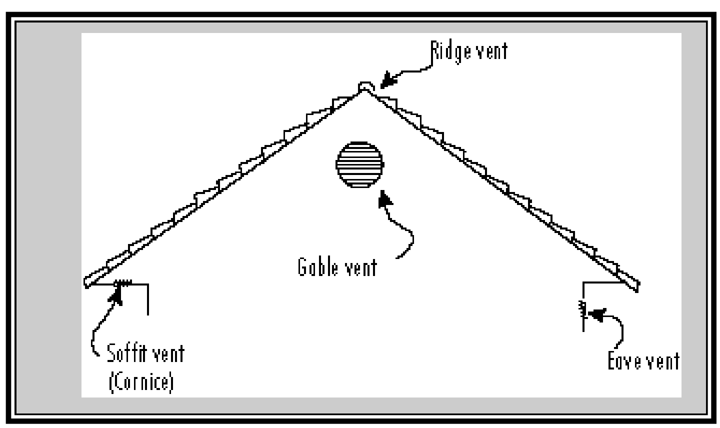

FIGURE C - TYPES OF VENTS

For example, the BOCA National Building Code published by the Building Officials and Code Administrators, International, Inc., calls for ice dam protection wherever the average January temperature is 25° F (-4° C) or less. (Section 1507.2) (1996). The Standard Building Code published by the Southern Building Code Congress International, Inc., requires ice dam protection in all areas of the country where the January mean temperature is 30° F (minus 1° C) or less. (Section 1509.4.2.1) (1996). The Uniform Building Code published by the International Conference of Building Officials refers simply to areas subject to wind-driven snow or roof ice buildup. (Chapter 15) (1996). *(see Figure D).*

What should the ice dam protection consist of? In general, the model building codes specify two layers of nonperforated type 15 felt underlayment cemented together and extending from the eave line to a line 24 inches past the exterior wall line of the building. You should check the code for your area or ask your local building inspector for specifics and for application details. Several companies manufacture waterproof membranes that serve the same purpose.

The Roofing and Waterproofing Manual (1996) of the National Roofing Contractors Association (NRCA) mentions three possible types of membranes:

- Two plies of No. 15 asphalt-saturated organic felt, one nailed to the deck and the second set in hot asphalt (on steep or special steep roofs) or asphalt lap cement;
- A combination of a heavyweight coated base sheet nailed to the deck, and another felt ply or plysheet set in hot steep asphalt or asphalt lap cement; or
- A self-adhering polymer-modified bitumen membrane that complies with ASTM D 1970.

According to the NRCA Manual, the membrane should start from the lower edge of the roof and extend upslope a minimum of 24 inches beyond the inside line of the exterior wall of the building. If the roof slope is less than 3 inches per foot, the membrane should extend a minimum of

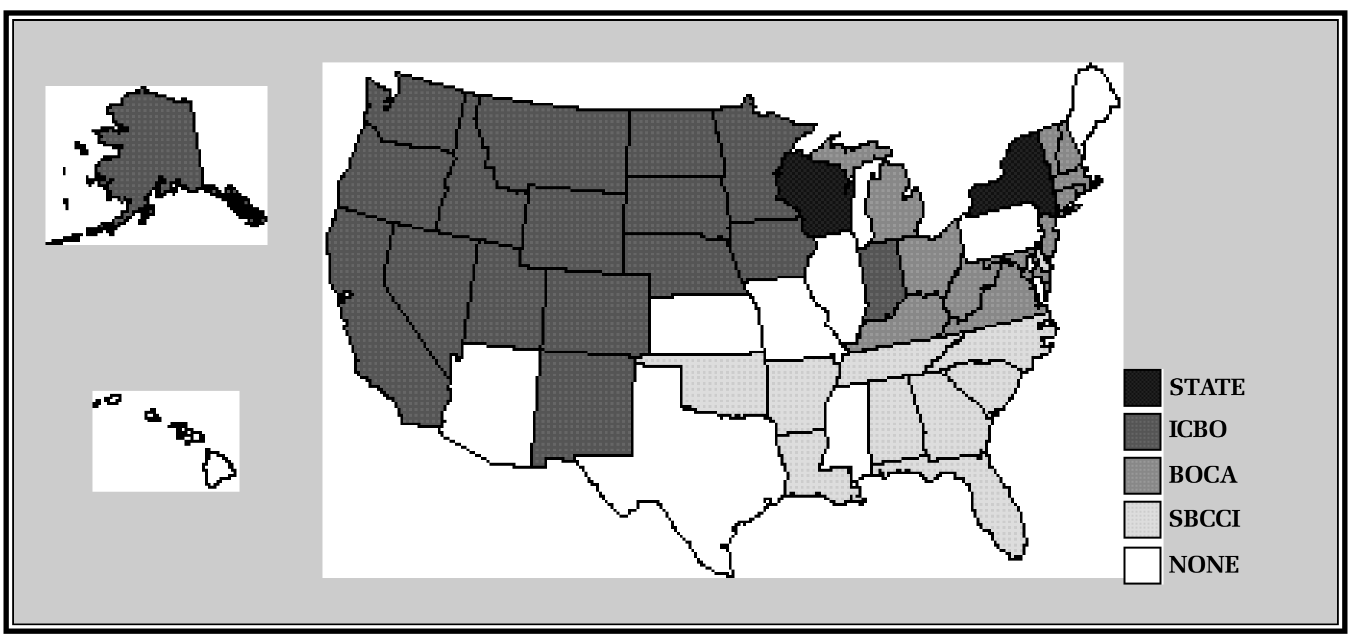

FIGURE D - GENERAL AREAS OF BUILDING CODE INFLUENCE (1996) (AS EVIDENCED BY THE ADOPTION OF A STATEWIDE BUILDING CODE BASED ON A MODEL BUILDING CODE).

36 inches upslope from the inside line of the exterior wall of the building.

For roofs with asphalt shingles, the Residential Asphalt Roofing Manual (1984) of the Asphalt Roofing Manufacturers Association (ARMA) calls for a double layer of saturated felt underlayment as the membrane on low slopes and coated roll roofing on normal slopes. Both should have cemented laps. Here are ARMA's instructions:

- **Low Slope (2 to 4 inches per foot):**

  Up to a point at least 24 inches beyond the interior wall line, overlap each saturated felt underlayment by 19 inches and cement the horizontal joint over the entire length of each felt. Uniformly apply asphalt plastic cement at the rate of two gallons per 100 square feet so that there will be no contact between felts when the application is completed. Press the overlying sheet firmly into the cemented area. The underlayment should overhang the metal drip edge by 1/4 to 3/8 of an inch. *(see Figure E).*

- **Normal Slope (4 inches per foot or greater):**

  Install a course of smooth, coated roll roofing, of not less than # 50, parallel to the edge. This course should overhang both the underlayment and the metal drip edge by 1/4 to 3/8 of an inch. Apply the roll roofing flashing strip, ascending from the bottom of the roof, to a point at least 24 inches beyond the interior wall line.

  If a second flashing strip is required to reach that point, locate the lap in front of the exterior wall line. Overlap the flashings at least 2 inches and cement the horizontal joint over its entire length. Side laps should be 12 inches and cemented. *(see Figure F).*

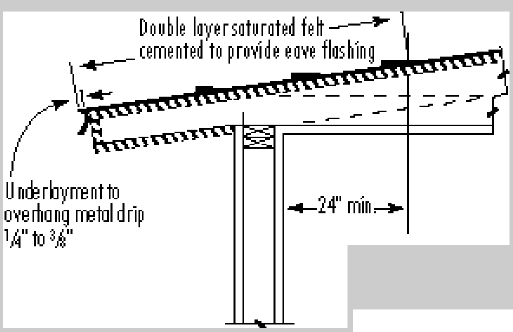

FIGURE E - LOW SLOPE

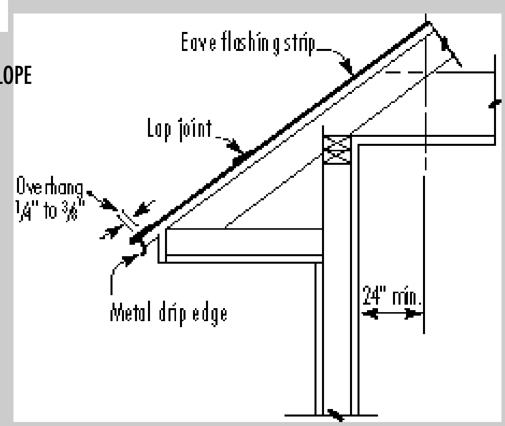

FIGURE F- NORMAL SLOPE

For severe icing conditions on low or normal slopes, extend the flashing to at least 36 inches beyond the interior wall line and cement it to the underlayment using two gallons per 100 square feet. Continue the application as stated above.

It is important to remember that ice dam membranes do not prevent ice dams from forming on the roof. All they can do is prevent or minimize leaking into the house once the ice dam has established itself.

LOWERING THE DAM

Ice dams begin to form under a layer of snow. Keeping the snow off the roof will help to reduce the size of any dam that begins to form. While it is far better to keep the attic space cold and to install ice dam protection membranes in case ice dams still occur, as a last resort a homeowner can use a snow rake to clear snow three or four feet back from the lower edge. The problem with this approach is that the rake can inadvertently damage the roof covering and nothing is done to solve the problem on a long-term basis.

If an ice dam has formed and water is leaking into the house, carve channels in the ice about six inches wide every 18 inches or so to allow space for water to run off the roof. This is strictly an emergency measure. If possible, have the work done by a roofing contractor. It is too easy to get hurt or damage the roof.

It is far better to take steps to prevent ice dams, or to reduce the likelihood of water damage, before the winter makes it difficult or impossible to work on the roof. The initial cost of installing an ice dam protection membrane, for example, can be quickly offset by the elimination of future damage caused by roof ice dams. A few practical steps ahead of time can eliminate costly headaches later on.

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