Re-thinking Solutions to Ice Damming

As autumn approaches, leaves and temperatures are dropping. To the delight of skiers everywhere, snow will soon be accumulating. Snow on your driveway is seldom more than a pain in the back. Snow on your roof can lead to leakage, even if your roof is new. The culprit is ice damming, the insidious snow-melting phenomenon that is all too familiar to many of us.

Let's do a quick review of ice damming and its causes.

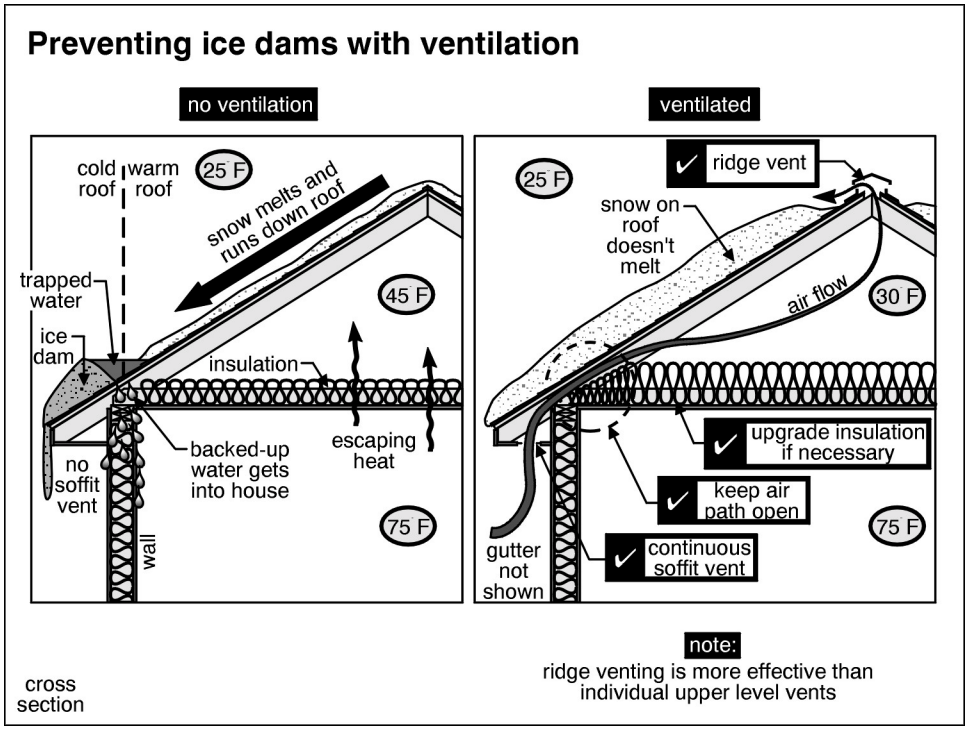

Figure 1

Snow accumulates on the roof. In areas where the snow is covering the transition between interior and exterior spaces, ice dams may form. If there is sufficient heat loss from the heated space to melt the first few inches of snow on the shingles, water will form. The water will run down the roof until it encounters the un-melted snow over the unheated space. There it stops, and re-freezes. After a while, a dam of ice forms on the roof above the exterior wall. The dam can cause the water to form a small pool. Shingle type roofs cannot stop pooling water. Water may back up under the edges of the shingles.

(Sidebar i - Carson, Dunlop engineers try to identify houses that may be prone to ice dam formation. We look for vulnerable areas including long valleys, particularly on low-sloped roofs; roofs with large eave overhangs; areas where components like chimneys and dormers are close together, where leaves and snow may naturally accumulate.)

Once under the shingles, the water is free to leak into the ceiling and wall. Naturally, some will find a way to drip onto your most expensive furniture.

Now what? Let's assume you manage to salvage the furniture, and the weather warms up enough to melt the snow, stopping the leak. How do we prevent it from happening again? If left uncorrected, water damage will occur to at least the ceiling or wall finishes, and at worst, structural rot can occur.

For years the mantra being chanted on correcting the cause of ice damming has been "insulation and ventilation". The prevailing opinion has been that adding insulation and ventilation to attic spaces will stop the snow melting.

It is easy to see that if a house has little insulation, heat loss from the house will cause snow to melt. If we can keep the roof cold, we won't get much melting, and won't get ice dams. Luckily, upgrading insulation in attics and roof spaces is often easily done. Fig. 2 illustrates recommended levels.

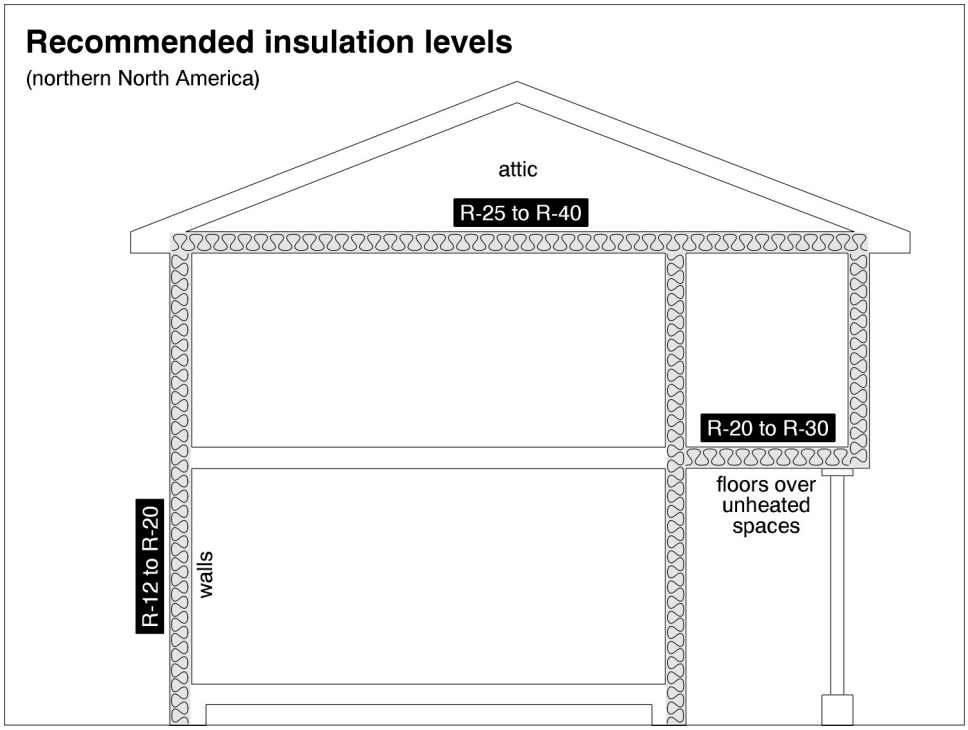

Fig. 2 – Recommended insulation levels

So now that we have good insulation levels, what about ventilation?

Roof and attic ventilation is generally a good thing, and as shown in Fig. 1, adding ventilation to an attic may stop ice dams from forming. The goal is to keep the attic cold in winter with good ventilation. However, it will not work in all cases. In fact, in some rare instances adding roof or soffit vents may increase the risk of ice dams. The reason lies in the often-neglected problem of **air leakage**,

or air loss (not to be confused with hair loss, an equally troubling but entirely different problem).

What we mean here is the leaking of warm, moist air from the house into roof spaces. Air loss occurs in every house. Warm air is light and buoyant, so it is always seeking a way out, in the UP direction. UP is where your roof is. Fig. 3 describes this *stack effect.*

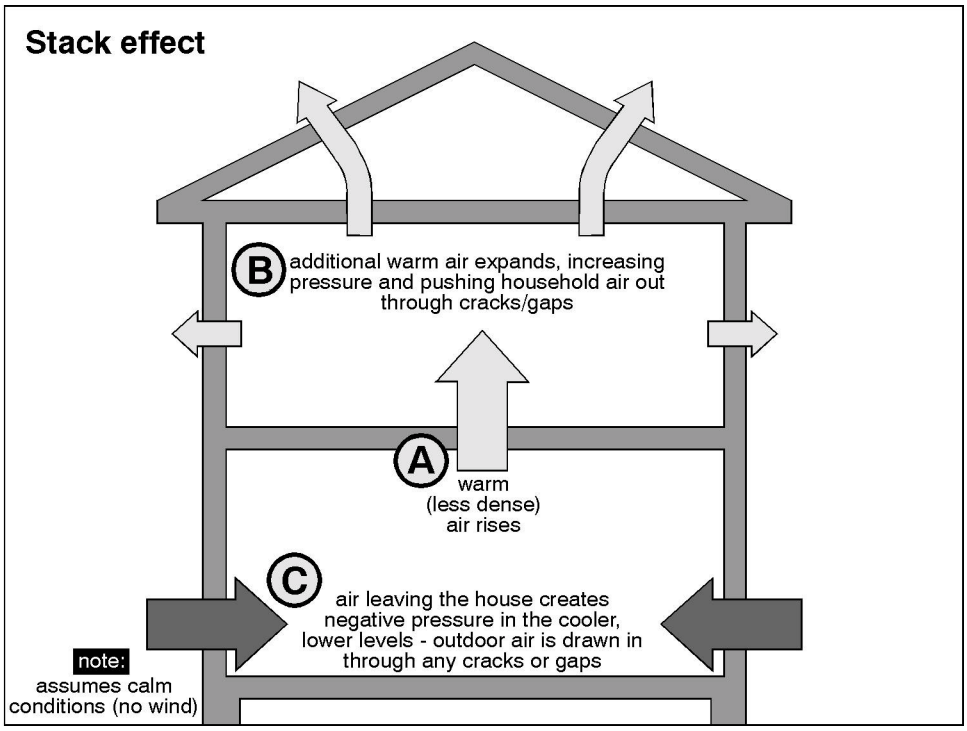

Fig. 3 – The Stack Effect

It's not surprising, then that the leakage of warm air from the heated spaces in your house is the primary cause of the melting snow that is at the heart of ice damming.

The job of attic ventilation is to evict the warm air that has taken up residence in the roof spaces. If a house has only a small amount of warm air loss occurring, then it will only need a relatively small amount of ventilation to deal with it. Here's a maverick idea: if a well-insulated house has NO warm air loss, it will require NO ventilation (for ice damming reasons, anyway. There are other good reasons for ventilation).

Conversely, if a house has many warm air leaks, it may be impossible to add enough attic ventilation to overcome the resulting heat build-up. Or, if the warm air exit is very close to the roof boards, and hence close to the snow, it may be impossible to mix it with enough cold air soon enough to prevent it from melting the snow. This can readily occur in the attic of a low-sloped roof.

The situation can be even worse if the attic ventilation lowers the air pressure in the attic. This can **increase** the rate of leakage of warm moist air out of the house into the attic, making the attic warmer.

(Sidebar ii: Inspectors, appraisers, and other building professionals can often get clues from the house about its ice dam history. Efflorescence on brickwork below the eaves, water stains on ceilings or around windows in rooms below valleys or other vulnerable areas, and condensation stains or mould in the attic are all potential indicators of ice damming.)

You can see from this perspective that adding ventilation addresses the *symptom* of a warm attic, but we can address the *cause* if we seal up the air leakage paths into the attic spaces. Sounds easy enough, and in some cases it is, so a handy homeowner can, with some dexterity and a few air sealing products, do it themselves. There are however some air leak paths that require a specialist to find and fix.

Here are some of the common problem spots that can be addressed from inside the rooms. Remember that a painted and intact drywall or plaster ceiling is a good air barrier, so the most common air leak paths are places where the ceiling is discontinuous. Fig. 4 illustrates some of these:

- **Attic access hatch** – an attic hatch or door needs to be both insulated and weatherstripped. Foam board works well to insulate, and common closed-cell foam is used to weatherstrip.
- **Potlights** – they are mounted directly in attic space, and require the ceiling to be cut open. No wonder warm air finds a good path to the attic at potlights. The best way to seal them is to wrap a pre-made plastic shroud around them, from inside the attic. If this is impossible, a well-caulked joint between the light box and the ceiling will help. Be careful with this. Potlights generate lots of heat and you don't want to cause a fire. This one is a job for a specialist.
- **HVAC registers** – if the house has air vents in the ceilings, the joint between the ducting and the ceiling should be caulked (remove the vent covers first). Attic ductwork should be well air-sealed and insulated.
- **Other ceiling fixtures** – Ceiling mounted electrical devices like lights and bathroom fans should be sealed at their boxes

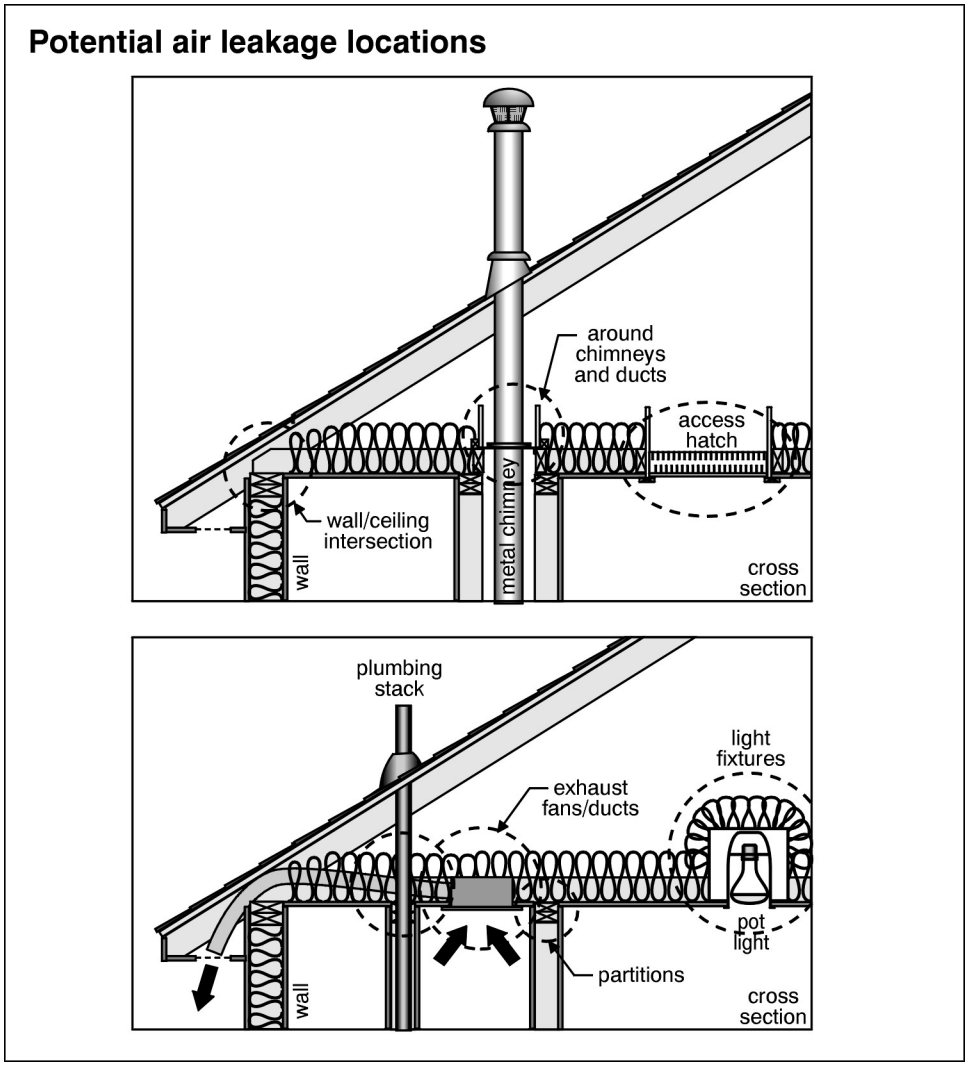

Fig. 4 – Potential air leakage locations

The more difficult air paths to seal are those accessible only from the attic. In these areas, the attic floor is discontinuous. Due to poor access, uncomfortable and irritating work environment, and the risk of stepping incorrectly and ending up with both legs straddling a 2x4, sticking into the room below, sealing warm air paths from inside the attic is best left to a professional. Common problem areas are:

- **Plumbing stacks and chimneys** – large chases running the entire height of the house, housing smallish pipes…great paths for heat loss
- **Attic mounted ductwork** – Ductwork in general is usually poorly sealed at joints, and leaks air readily. In winter, ductwork that travels through an attic will leak warm air directly into the attic. If this doesn't melt snow on the roof…it's probably summer. Additionally, the vertical chases in which the trunks of the ductwork run provide air paths to the attic
- **Interior partition walls** – partition framing is accessible from the attic. Each stud bay can act as small chimneys that exit through gaps at cap plates

- **Knee-wall Attics** – Houses with half-storeys have triangular attics at the edges of the uppermost floor. These attics are prone to warm air infiltration at the floor joist area. Refer to Fig. 5. Also vulnerable on a knee-wall are wall-mounted heat ducts and electrical outlets.

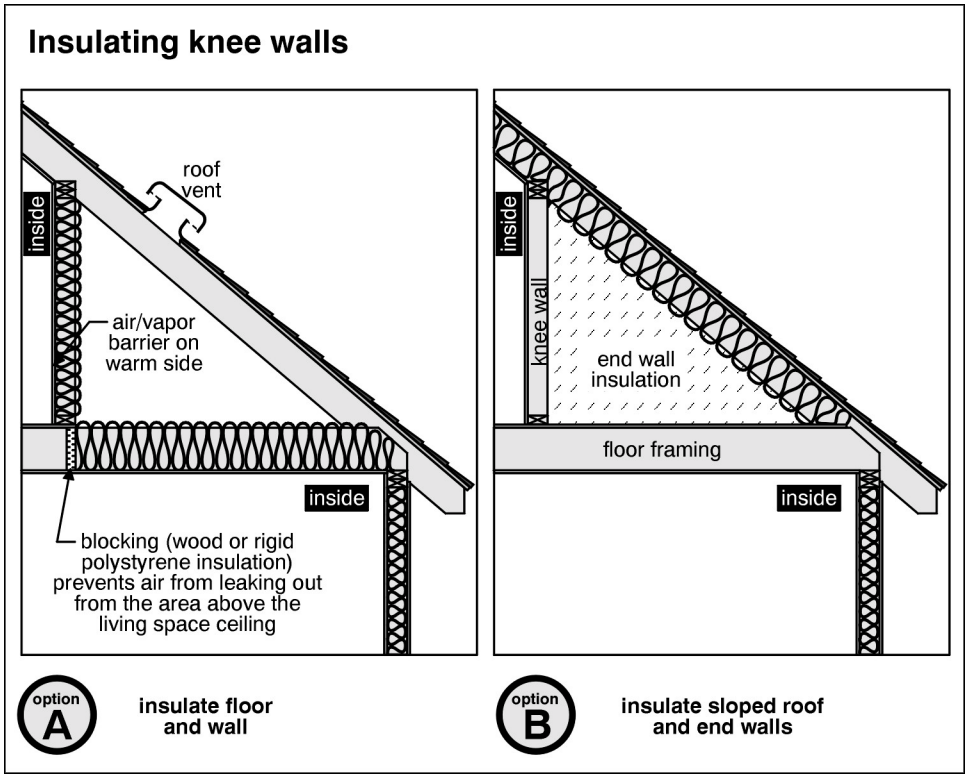

Fig. 5 – Insulating knee walls

In all of these locations, expanding foam, caulking, and foam gaskets can be used to close off warm air entry points.

The cost of remedial work of this type will vary depending on the size and shape of the house, and the number of potential air leak paths. Expect a minimum of $500, and up to $2,500 or more. These are relatively small numbers in comparison to the potential water damage repair costs, especially if recurrent, or the loss in property value due to obvious water damage.

Once the warm air is kept inside the rooms where it belongs, the existing level of attic ventilation will often be sufficient to keep the attic and roof spaces cold enough to prevent ice dams from forming. Then instead of gazing out the window at the impending snowstorm and feeling a sense of dread about that recurring ice dam, you can…worry about that 6-car driveway you will have to shovel. Better dig out the chiropractor's number too.

*This article was submitted by Carson Dunlop, a Toronto based Consulting Engineering company that has specialized in **Home Inspection** since 1978. For more information, call 1-800-268-7070 or visit www.carsondunlop.com.*