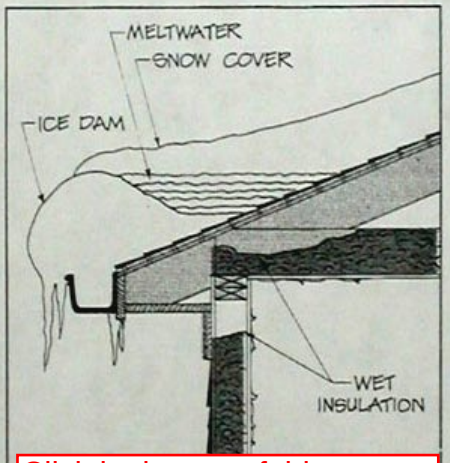
met with standard good building practices: bathroom and kitchen vents, poly under the slab and good surface and subsurface drainage. If you expect a large moisture source for the size of the house, provide mechanical ventilation controlled by a humidistat.

Roof leaks aside, the worst moisture problem will occur the first year as wood, concrete, and other materials dry out. To avoid problems, use kiln-dried rafters and space apart the roor sheathing to allow it to expand when moist. The American Plywood Association recommends ¼-inch spacing along the long sides of a 4x8 panel and ⅛-inch spacing along the ends to prevent buckling.

## Ice dams

Ice dams form when snow sits on a roof for three or four subfreezing days. Since light, dry snow makes good insulation, its presence warms up the roof below and causes melting. The water then drips down, and refreezes. Studies in the 1960's proved that the best cure for ice dams was the so-called "cold roof," where cold air circulates directly below the roof sheathing, keeping it cold.






*Low slope, no roof ventilation, and large heat losses through the ceiling add up to ice dams in snow country. Wet insulation, stained plaster, and peeling paint may result.*

These studies, however, were based on homes with far less insulation than we use today. Are the results still valid? Or are we wasting time and money venting roofs?

In theory, with enough insulation you shouldn't get ice dams, since high insulation levels will keep the roof cold enough despite snow buildup. One exception would be a low-pitch roof that could hold enough snow to compete in R-values with the roof insulation.

## Snow and wind

On the subject of too much ventilation, it's worth noting that many people have problems with snow blowing in ridge vents and cold air blowing through insulation at the eaves—so-called "blow-by." Blow-by creates cold spots on the ceiling and, in bad cases, mildew growth. The cure is a good insulation baffling system at the eaves and, in snowy, windy country, a filtered ridge vent.

## Raindrops

All roofs leak eventually, except maybe in indoor-test facilities. When they do leak, a large area can get drenched before the leak is spotted and fixed. This causes particular trouble in flat roofs. Various strategies are used to dry out flat roofs, including special through-the-roof vents and perimeter vents. In an otherwise sealed roof assembly, tests at the Army Corps of Engineers' Cold Regions Research and Engineering Laboratory show these have little effect on saturated insulation.

An unvented vaulted roof is a similar case. Drying can't occur downward due to the vapor barrier. Nor can much drying occur upward due to the sheathing and shingles. Fortunately, the small amount of air movement through standard asphalt shingles can probably take care of an occasional small leak.

## Sweden

While some people are forging ahead with unvented roofs in retrofits or new construction, little is really known about them here in the States. But the practice is common in Sweden, according to British energy consultant David Olivier. Based on a recent tour of Sweden, he observed that these unvented roofs generally work if:

- the vapor barrier is perfect
- the roofing is clay or concrete tiles, slates, or other materials that are not absolutely airtight
- the climate is comparable to southern Sweden (6000 to 8000 degree-days)
- great care is taken that the lumber does not get soaked before or during construction.

## Summary

A non-vented roof is a bit risky, but with a good vapor barrier, you can probably get away with it. Vent shallow roofs, such as over shed dormers, if at all possible. Where ventilation is not practical, as in some retrofits, pay close attention to sealing air leaks through the ceiling.

In unvented roofs, I'd be happier if the roofing were air- and moisture-permeable. Wood shingles or shakes meet those tests. With standard self-sealing asphalt shingles, I just don't know. If anyone does, please let me know.

Venting can actually hurt if it contributes to air leakage from indoors to the roof cavity. In these cases, though, the best treatment is not to add or reduce ventilation, but to seal the leaks from the inside.

Finally, if cooling is an issue where you build, consider roof venting for the cooling effect alone.