CE 15

Removing Ice on Roofs

THE 1998 ICE STORM

The ice storm that hit eastern Canada in January, 1998 was a laboratory for concentrated research into severe ice accumulation on roofs.

Removing ice on roofs describes some of the techniques developed from the research for dealing with extensive roof icing and ice dam problems.

Please note: Some of these techniques are for skilled tradespeople only. No ice problem on your roof is serious enough to risk broken bones—or worse.

THE BALANCE BETWEEN REMOVING ICE AND DAMAGING THE ROOF

Thick ice is hard to remove.You must decide if trying to remove it will cause more damage than leaving it on the roof. Tools, such as hammers, shovels, scrapers, chain saws, and devices such as shoes with ice spikes can damage roofing materials or the structure below. Chemical de-icers can discolor shingles, break down membranes and corrode flashings and drains. De-icers can also damage plants on the ground.

WHAT TO DO IN AN ICE STORM EMERGENCY

First: Observe and evaluate the situation every day. Is the ice causing a structural problem? Is there water damage? Do you have to do anything?

Second: Evaluate your capabilities and limits. Do you have the equipment, the agility and the help to work safely and efficiently? If you don't, get professional help before the situation becomes urgent.

Third: To prevent damage, do as little as possible.Total clearing has the greatest potential for damage to the roof and to people and property below. Often, clearing dangerous overhangs and icicles and making drainage paths is enough.

RECOMMENDED PROCEDURES FOR SLOPED ROOFS

When is there a problem?

The lower the slope, the greater the weight problem. During the '98 ice storm many flat roofs had 15 cm (6 in.) of solid ice, while most sloped roofs had little more than 5 cm (2 in.). Most of the ice collected at roof junctions, behind obstructions such as chimneys or skylights, and at roof edges. Drainage, not removal, solved the problem in most cases.

The information in *Signs of Stress* will help you decide if weight is causing problems on your roof. If your house doesn't show signs of stress, then there is no need to remove all the ice.

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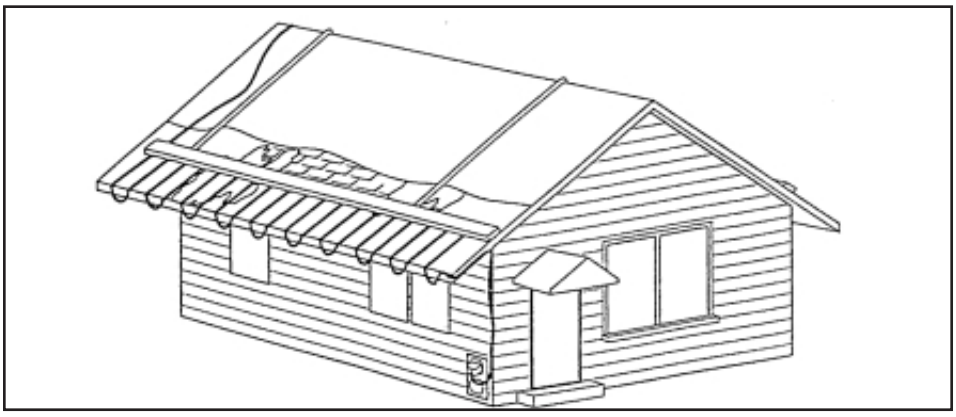

Figure 1 Cables secured to roof

Drainage

On a sloped roof, your goal is to make drainage paths through the ice on the lower edge of the roof. That's where most ice dam and water back-up problems occur. Always shovel off loose snow to expose the ice.

If you have power and electric heating cables, making drainage paths is fairly easy. Attach loops of electrical roof de-icing cables to one or more long boards. With ropes tied to the board and thrown over the roof, pull the board up beyond the ice dam, letting the electrical loops hang slightly off the edge of the roof (see Figure 1).

If you want drainage paths higher on the roof, use bundled loops of electrical de-icing cables. They can be drawn high on the roof. Make sure that they hang off the edge of the roof so you get complete water drainage.

You can use chemical de-icers on the edge of the roof. Clear the snow. At about every three feet along the edge of the roof, break the ice crust just above the ice block on the edge of the roof. Put de-icer in each hole above the ice dam and in a vertical line down to the edge of the roof. Use noncorrosive de-icers (see *De-icers)* and use as little de-icer as possible. Repeat as necessary rather than overdoing it the first time.

Removal

Removing ice mechanically from a sloped roof is always dangerous—both for the person doing it and for the roof. Removing ice will probably invalidate your shingle warranty. If ice must be removed, have it done by a professional with proper equipment and training.

Researchers learned a great deal about removing ice from sloped roofs by mechanical means in the winter of 1998. The most important lesson: always start at the top and work down. Starting on the bottom can release ice above you that can slide down and hit you. Small bumps of ice that remain on shingles are caught by ice blocks sliding down. As they slide, they catch and rip off the shingles.

Working from the top down allows you to use the ice on the roof as a slide for the ice that is being freed. Use a sledge hammer rather than an ax. The flexibility of the roof deck will cause the ice to fracture and you will not cut into the shingles.

Freezing Rain

Freezing rain is caused when there is a particular atmospheric "sandwich" of cold and warm air. Precipitation, usually snow, is formed in cold air high up in the atmosphere. As it falls, it travels through a layer of warm air that thaws it into light rain. Just before it hits ground level, it moves into another layer of cold air that brings its temperature to below freezing, but it doesn't have time or the conditions necessary to crystallize yet.When it hits an object, it immediately freezes.

Snow will collect and then fall off wires and tree branches, and remain relatively light as it accumulates on roofs. Freezing rain compacts into tenacious ice that can weigh almost as much as water. The ice storm of 1998 was in fact a continuous series of small storms, one right after the other, that deposited up to 15 cm (6 in.) of ice on tree twigs, telephone wires, electrical lines and roofs. There is no way to stop freezing rain and it is not generally considered a hazard unless it becomes unusually thick.

The 1998 ice storm created two problems: direct weight and blockage of the natural flow of rain and melting ice. The freezing rain stuck all over the roof, not just on the bottom edge, and created ice dams. The dams backed up run-off water just about anywhere on the roof. Flat roofs suffered serious weight problems, while sloped roofs tended to suffer more water-penetration damage.

Common Winter Ice Dams

Under normal winter conditions, many houses in Canada form ice on the edge of sloped roofs or over part of flat roofs.

This is very different from freezing rain. It is caused by heat from the attic melting the bottom of the snow on the roof. When outside temperatures are just below freezing (0 to - 10°C), water flows down the roof under the snow and freezes when it reaches an unheated portion of the roof. This can create an ice dam on the lower edge of a pitched roof. Water can then back up under the shingles and into the roof space.

The first line of defence against ice dams is to reduce the attic temperature by stopping air leaks from the house below and adding sufficient insulation to the attic floor. Heating cables and other de-icing techniques are a last resort to minimize ice build-up and prevent water damage. For full details on dealing with common ice dams, see the CMHC's *About Your House: Attic Venting, Attic Moisture, and Ice Dams* (order # 62034).

Signs of stress

Water leaks showing up inside the house are troublesome and expensive to repair, but don't necessarily mean that there is a structural problem requiring total clearing of the roof. Opening drainage paths may stop or minimize the leaks and avoid the expense and danger of clearing the roof. Structural stress shows up first at internal doors. They begin to jam. New cracks show up in drywall and plaster. Jammed doors and cracks in drywall and plaster are usually near the centre of the house, not on outside walls.Watch carefully for these signs of stress. If there is significant change as an ice storm continues, take action. If signs of stress appear but do not change from day to day, the structure is holding solid.

On sloped roofs, another indicator is excessive sagging of the ridge line. If in doubt, arrange for an inspection by a professional, although during a crisis, that is easier said than done.

RECOMMENDED PROCEDURES—FLAT ROOFS WITH CENTRAL DRAINS

When is it a problem?

In most areas, flat roofs are built to safely hold a maximum of 17 to 20 cm (7 to 8 in.) of solid ice, or 38 to 43 cm (15 to 17 in.) of hardened snow, or 70 to 80 cm (about 30 in.) of fresh snow.

If there is more than 15 cm (6 in.) of hard ice on your roof, you will have to lighten the load. Freezing rain accumulation can often resemble a hard snow more than a solid block of ice. Testing and judgment is useful. Pour hot water from a thermos in one spot. If it melts a small bowl and holds water, it is probably hard ice. If it cuts through to the roof, the accumulation is more likely hardened snow.

There may have been significant renovations below the roof to many older dwellings with flat or basin roofs. If walls have been removed or modified without full structural compensation, the roof may not even support 15 cm (6 in.) of ice. If signs of stress (see above) are significant, reduce the weight on the roof no matter how much ice is on the roof. You may also have to build temporary bracing inside the house.

Under certain freeze-thaw-freeze conditions, ice can exert strong lateral pressure on the parapet and other roof flashings. The pressure can cause roof

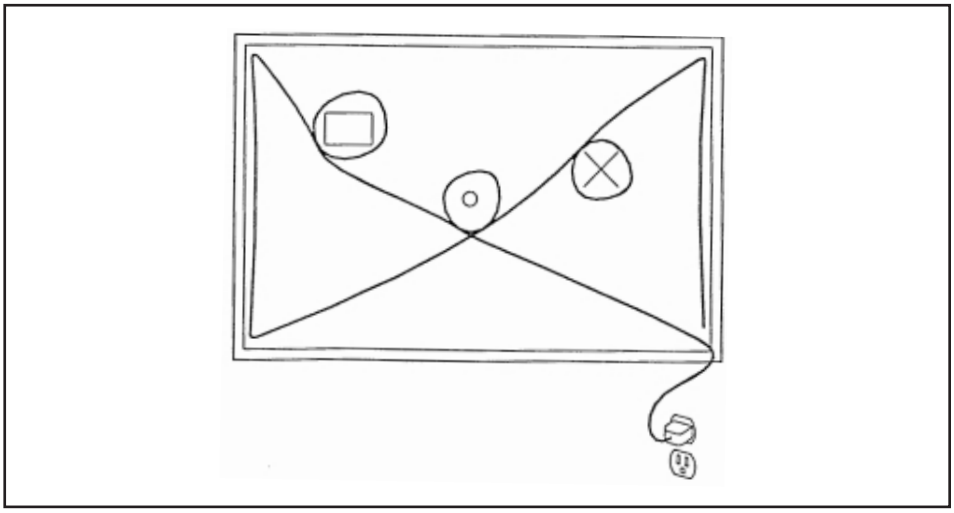

Figure 2 'X' Formation on flat roof

leaks. It is a good idea to use one of the drainage techniques described below to separate the ice field from all flashings, leaving room for expansion of the ice field.

DRAINAGE

Electrical Cables

If electrical power and wires are available, this is the easiest and most effective method of creating and maintaining drainage paths on flat roofs.

Shovel off loose snow. Clear about 60 cm (2 ft.) all around the drain. The safest way to do this is to use non-corrosive de-icers or hot water— a hammer or shovel may cause the drain to leak.

Lay electrical de-icing cables from near the drain to each corner of the roof. (Do not put the electrical cables inside the drain-the drain pipe may contain inflammable gases.) Run a loop around obstructions, such as skylights and ventilation hoods. If you can work safely near the edge of the roof, run a cable around the inside perimeter (Figure 2).

The cable will melt its way to the roof surface and keep drainage paths open. It will not penetrate the ice until it is warmer than -10°C and, of course, will not work if there is no electricity.

De-icers for cutting into ice

Pour a 6-mm thick by 75-mm wide (1/4 in.-deep by 3 in.-wide) path of de-icer from the drain to each corner of the roof and circle obstacles such as ventilators and skylights. Use the same drainage pattern as you would for electrical cables. See Chemical De-icers for details on products. You may need to use a de-icer more than once to melt through to the roof and to keep drainage paths open.

Ice removal is not a good do-it-yourself project. But homeowners can shovel heavy snow off the top of the ice, which might keep the weight load under control.

Ice thickness and weight of ice can be reduced with de-icers such as urea or even wood ashes. Both are slow and work only in relatively mild weather. To ensure water run-off, create drainage paths as described above. Ashes must be directly on the ice, with no snow over or under the ashes, so they can trap the sun's heat.

Chemical De-icers

Many de-icers don't show their ingredients on the packaging. Others list ingredients without showing the relative importance of each.This is no help in deciding which de-icer is safe for a roof or better at cutting drainage paths or reducing ice weight.

In general, the least expensive, most effective de-icers are highly corrosive and should not be used on a roof. Urea, the least corrosive, is also the least effective. In between are several products that are a bit more expensive, still effective and reasonably low in corrosive action.

In general, larger rock-like products tend to cut through ice quickly. Finer, powder-like products tend to perforate the ice. This creates a honeycomb effect that makes the ice lighter. Liquid products are the most effective for detaching blocks of ice from the surface.

Avoid

Salts containing oxidizing agents (these accelerate corrosion and rust and can deteriorate other roofing materials) such as:

NaCl (Sodium Chloride)
$CaCl_2$ (Calcium Chloride)

Safer materials

CMA (calcium magnesium acetate)

The following are normally used as fertilizers:

Urea
KCl (Potassium chloride)
$(NH_4)_2\ SO_4$ (Ammonium Sulfate)

Life Safety

Ice is slippery and in emergency conditions medical help may not even be able to get to you. Not only can you slip, but ladders can slip. Removing ice from the edge of a sloped roof can release large fields of ice higher up that can slide down on top of you. During the 1998 ice storm, more than one person died from icicles falling from above when they were simply standing in the driveway below.

Double and triple your safety precautions, or stay away from the roof. Rope off areas and access doors where overhead ice is heavy or slides may occur (Figure 3). Never work alone. Always have someone on the ground to ensure that what you throw off the roof is landing safely.

On a sloped roof, always tie the ladder down and have a safety rope over the top of the roof secured on the other side. The safety rope should be attached to a full safety harness, like mountain climbers use—it is not there just in case you slip—it is there because you will slip and more than once.

Special ice cleats are available in shoe repair and hardware stores for attaching to shoes and boots, making them much like golf shoes. These are good for not slipping, but are not good for shingles. Walking on ice-covered sloped roofs is best left to professionals with professional equipment.

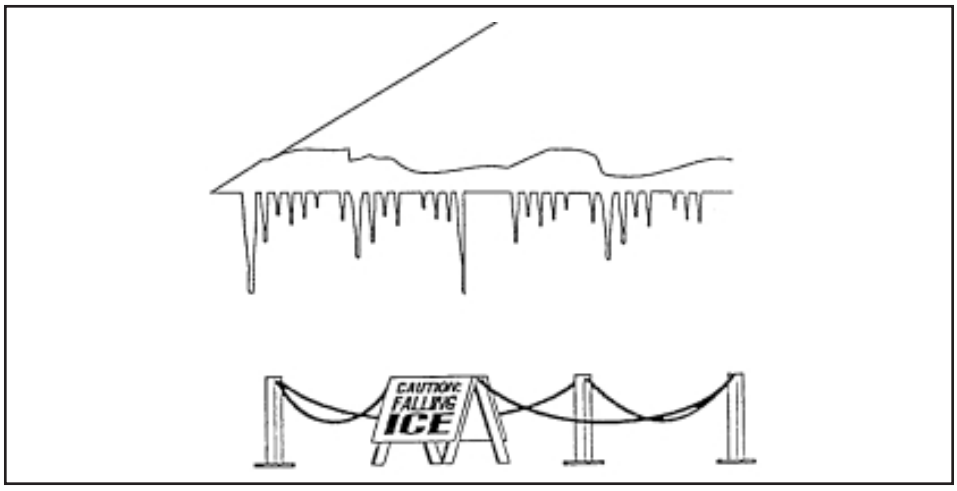

Figure 3 Rope off areas where overhead ice is heavy or slides may occcur.

Detaching ice blocks from surface

Liquid de-icers (e.g. Clear Away) were efficient at melting the bond between blocks of ice and roof membranes.

Methyl alcohol worked as well.

TECHNIQUES WITH MODERATE SUCCESS

Cutting drainage paths with hot water

This is actually rather effective if you can get hot water very close to the ice (50 to 100 cm—about 2 ft.) and prevent the hose and nozzle from freezing (Figure 4).

The drain must first be freed of ice, so that the water can drain away.

However, this means you will be undercutting the mass of ice above you, and this ice may come down.

The only safe way to do this job is to melt thin slices off the ice—about 30 cm (1 ft.)—all the way from the gutter up the roof. Keep your ladder off to the side, so it won't be hit by ice coming off the roof.

Hot water jets from regular garden hoses proved very effective on metal sheds and glass sunrooms when directed from dormer windows above. Do not walk on metal or glass roofs. Cut the ice into sections with the jet, then flood the glass to unhook and slide the ice off. Windows below may need protection from rebounding ice.

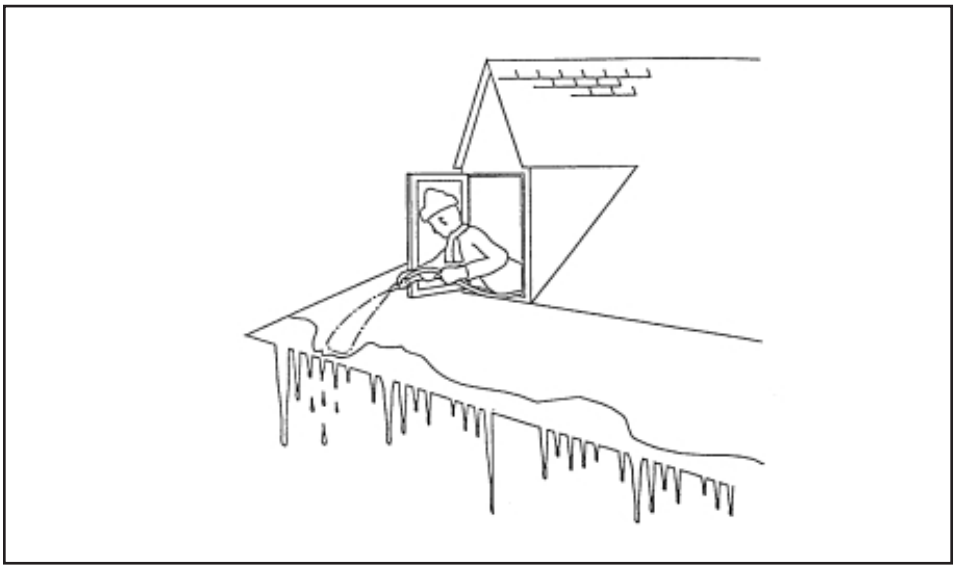

Figure 4 Hot water being sprayed from dormer window

Steam

In the research conducted in 1998, no suitable contractors were found to be using steam.

Subsequently, CMHC has heard from contractors who have had success with this method. If you can find an experienced contractor, this method may work for you.

EXPERIMENTS THAT DID NOT WORK

Solar Collectors

Both clear and black polyethylene and solar swimming pool covers were tested for melting ice. Wind problems (how do you keep the cover in place?), lack of evaporation, as well as snow cover rendered them all just about useless.

Liquid De-icers

Although they did work to liberate the ice blocks cut by chain saws off flat roofs, they were not effective in cutting drainage paths on the edge of sloped roofs.

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