SNOW-FREE CONCRETE

Melting snow away preserves concrete and keeps surfaces safe. BY JOHN VASTYAN

Whether you're placing concrete or installing stamped concrete or pavers, snowmelting systems secure the beauty and integrity of the surface by safely melting snow without using chemicals. The ability to install snowmelting systems—a capability that can differentiate your firm—also means a substantial up-sell: more income with each job sold.

A snowmelting system works by heating a mass or surface so that walkways, driveways, and other areas remain dry and clear. Most snowmelting systems are "hydronic," using circulated fluids to heat these outdoor masses, although some use electric heat.

Snowmelting systems are ideal for commercial and residential applications—especially critical areas such as hospital and senior housing entry areas, helicopter pads, and delivery ramps. A snowmelting system performs a valuable, and sometimes lifesaving, function.

Typically, most of the components of a snowmelting system, especially the heating plant, sensors and controls, are installed by a plumbing

A concrete slab will quickly hide the network of radiant heat tubing below.

> "A snowmelting system will usually cost between $6 to $12 per square foot, with commercial systems at the higher end."

and mechanical contractor. Concrete contractors often, and should, become involved when it's time to embed the heating elements in the slab.

Snowmelting classifications

Snowmelting systems are generally grouped into three classifications based on the amount of snow actually melted. The systems can be designed to:

- not melt snow while it's falling, but afterward
- melt half of the snow during snowfall, the rest afterward
- melt all snow and ice while snow is falling

Snowmelting loads

It takes a lot of energy to melt snow, roughly five to six times the load required to heat a building of similar size. For example, it may take only 30-40 Btu per hour per square foot to heat a structure with a floor-warming (radiant heat) system. But it can take up to 150 Btu per hour per square foot or more to melt snow and ice and ice from a surface.

When snowmelting is first started, energy is lost when the fluid is moved from the heated pipe to the surrounding ground; frequently, the ground is frozen hard. Because the warmed fluid gives off heat as it travels through the slab, contractors prefer to lay the tubes in a spiral or serpentine pattern to distribute the heat evenly.

Insulation

Insulation substantially reduces operating cost. When added under the slab and at its perimeter, heat loss into the ground is reduced, and the slab heats faster. The preferred insulation material is usually 1- or 2-inch thick rigid polystyrene foam.

Insulation also helps to channel the heat in the direction it's wanted. Contrary to popular belief, energy doesn't necessarily rise. It travels in any direction, from hot to cold, or from areas of high concentration to low concentration. This works great for interior spaces. But outdoors, four "thieves" work in tandem to steal the heat.

Thief #1: Ground. Heat is literally sucked into the surrounding ground. Heat loss to the ground is about 10 to 15 Btu per hour per square foot.

Thief #2: Atmosphere. The atmosphere works even harder than the ground to swipe the heat you'll be putting into the slab. That's why energy must be fed into the slab continuously. Loss to the atmosphere can be up to 90 Btu per hour per square foot.

Thief #3: Water. As the snow or ice turns into water, it runs off into drains, storm sewers, and surrounding areas. This water runoff carries precious energy away from the slab, too. Care must be taken to ensure the water runoff from the snowmelting system has a place to go. If not adequately designed for, water will run off the slab and "pool" in low spots around the system and freeze. It may be necessary to heat drain pipes and water runoff areas.

Thief #4: Evaporation. As melting snow and ice turn from liquid to gas, more energy is carried off. This energy also must be replaced by our heat source.

High-tech tubing

Typical snowmelting systems employ tubing buried in a concrete slab. The most popular tubing used is either cross-linked polyethylene (PEX), or synthetic rubber (EPDM). PEX is made of high density polyethylene that has been "linked" into long, stronger chain molecules. EPDM rubber also is cross linked for strength and durability. Both varieties of tubing have a long history of performance and longevity.

According to Keith Whitworth, a regional manager and design engineer at Springfield, Mo.-based Watts Radiant (www.wattsradiant.com), tubing comes in a variety of sizes, typically ½ to ¾ inch inside diameter (ID). The flexible tubing ties into supply and return piping at distribution points, or manifolds, that come in pairs: a supply manifold where the tubing starts and a return manifold where the tubing stops. The layout usually is easiest if these manifold pairs are located together next to the zone or area to be snowmelted.

Tubing is spaced from 6 to 12 inches on center and circulates a solution that has been heated to 110° F to 140° F. Tube spacing is varied according to the degree of snowmelting required.

Tubing usually is strapped or tied to rreinforcement, whether mesh or rebar. Even if reinforcement is not needed for other reasons, it may be needed to keep the tubing from floating to the concrete's surface during the pour. A minimum of 2 to 3 inches of concrete covermust be maintained over the top of the tubing. Tubing also can be hooked to a base material with turf hooks, stapled into rigid insulation, or otherwise connected to a compacted base.

At expansion joints, where slab movement could cause stress, it's necessary to take special precautions. "We recommend slipping the tubing through collars cut from plastic pipe or pipe insulation and placing it several inches below the expansion joint," says Whitworth.

"Another key precaution," he says, "is that the system must be pressure-tested before and during the concrete pour to ensure that no damage has been done to the heating elements during installation."

Snowmelting applications

Helipads. With space becoming more precious, many hospitals are forced to install helipads on building roofs. These rooftop helipads can become extremely dangerous when coated with ice and snow.

Sidewalks. Convenient and more inviting to passersby, snowmelting systemscan increase business and decrease liability. Customers are more likely to shop stores with clear sidewalks, free from ice, snow, and chemicals.

An elevated walkway and steps can easily receive radiant snowmelting treatment. The Onix tubing used here for the steps is a special EPDM synthetic rubber tubing with layers of aluminum and Kevlar. Unlike PEX, which must be protected from sunlight and jobsite hazards, Onix is very durable and can be exposed to UV radiation for weeks prior to the concrete pour.

The concrete pour of the helipad. If care is taken to ensure a quality installation, the subterranean tubes will distribute liquid heat for decades, offering trouble-free snow and ice melting without the need for chemicals or shoveling.

A carwash is a prime candidate for a radiant snowmelting system. Here the concrete is carefully placed over the tubing.

School entrances. Children are protected by maintaining clear walkways. Snowmelting systems keep accidents at a minimum and prevent chemicals from being tracked inside.

Stairs. It's all too common for stairs to become slippery and dangerous during the winter season.

Hospital entrances. "Because they are usually considered critical systems," says Whitworth, "these snowmelting systems are most frequently 'idled' during the winter months—continuously operated at a reduced output—to decrease system lag time." That minimizes the time required for the system to reach full operating temperature and start melting snow after sensors detect precipitation.

Parking garage ramps. Snowmelting systems ensure that cars driving in from the street can safely negotiate up and down parking garage ramps. System sensors are usually placed away from the ramp so that they can detect snowfall or precipitation, and temperature.

Loading docks and ramps. Here, moving the goods is the essence of business. Another good application for snowmelting systems.

Operating systems

On-off operation. Some snowmelting systems operate only when there is ice or snow. These on/off systems work in the presence of precipitation when the ambient temperature is below 35° F. While less costly to operate, these system take longer to start melting ice and snow because they must first increase the temperature of the slab.

Idled operation. In order to help systems respond faster, some systems are idled—or operated at reduced output—until precipitation is sensed with a temperature below 35° F to 38° F, when the system is operated at full output. These systems permit faster system response, and no snow or ice accumulation is permitted.

Sophisticated controls. Automatic controls that sense slab temperatures, outdoor temperatures, and precipitation can also be used. They're more costly, but allow greater system control.

UPON THIS ROCK

Radiant heat in and outside a concrete home

If homeowners choose a concrete home, then radiant heat is the way to go. Slab on grade, combining massive concrete walls and large, glass-enclosed areas challenges the best of conventional forced air systems.

In this Springfield, Mo. home, abundant Frank Lloyd Wright-inspired concrete acts as an effective thermal storage system. Even the finished floors, concealing a half-mile of radiant heat tubing, are the actual scored and colored slab. It provides optimal comfort and an attractive, easy-to-maintain floor surface. Installer Bob Rohr says that, combined with a substantial under slab insulation to minimize heat loss, the high efficiency system will provide unsurpassed comfort and low operating cost for years to come.

Weather-responsive controls and multiple zones allow the home office and guest rooms to be controlled separately in this 2800 square foot home that includes some walkway snowmelting, a radiantly-warmed, sunken concrete bath, and a cascade that spills from the back of the house where water accents the mature property's sloped features.

Top: This all-concrete home in Springfield, Mo. receives a careful layout of tubing prior to the concrete pour. Bottom: The same house, a few months later, easily deals with snow and ice.
PHOTOS: WATTS RADIANT

System cost

Snowmelting systems themselves are not that expensive to operate, especially the on/off types because, typically, they operate only a few times a year. The biggest cost with a snowmelting system is the upfront price.

"Considering the cost of insulation, tubing, boiler and pump system, and all installations, a snowmelting system will usually cost between $6 to $12 per square foot, with commercial systems at the higher end," says Whitworth.

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Operating cost

On/off system. This is the cheapest system to operate. As an example, a Class II system in Buffalo, N.Y. may cost about $0.21 per square foot per year. The same system in Chicago, Ill. may only cost $0.12 per square foot per year. Minneapolis or St. Paul may be in the range of $0.25 per square foot per year.

Idled system cost. Because it may operate any time the temperature is below 38° F, it will clearly cost more to operate these systems. Considering that it may operate for up to ⅓ of the year (about 3000 hours), the total system energy would be 300,000 Btu per year. Hospitals may have waste heat from steam or condensation that may be readily available, greatly reducing or eliminating energy needs.

Conclusion

Icy surfaces are no longer a threat. Home or facility maintenance costs are reduced because snowplowing is eliminated or reduced, and ice-melting chemicals that kill landscaping and degrade concrete aren't required.

The cost of the system is more than returned with one avoided lawsuit. Even insurers recognize the value of these systems by rewarding commercial building owners with reduced insurance rates.

So, whether you're melting snow for a sidewalk in Columbia Falls, Mont., or warming an emergency room entrance in Gnome, Alaska, a properly installed snowmelting system will easily do the job. **CC**

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