

Benefits of Snow and Ice Melting Systems



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- PPI's five divisions focus on solutions for multiple applications:
 - **Building & Construction Division (BCD)**
 - Corrugated Plastic Pipe Association (CPPA)
 - Energy Piping Systems Division (EPSD)
 - Municipal & Industrial Division (MID)
 - Power & Communications Division (PCD)



HDPE Conduit for fiber optic



Gas distribution piping



HDPE water mains

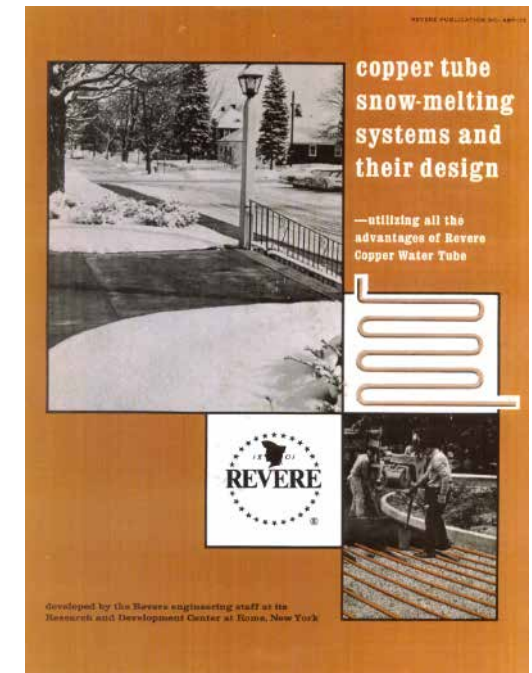
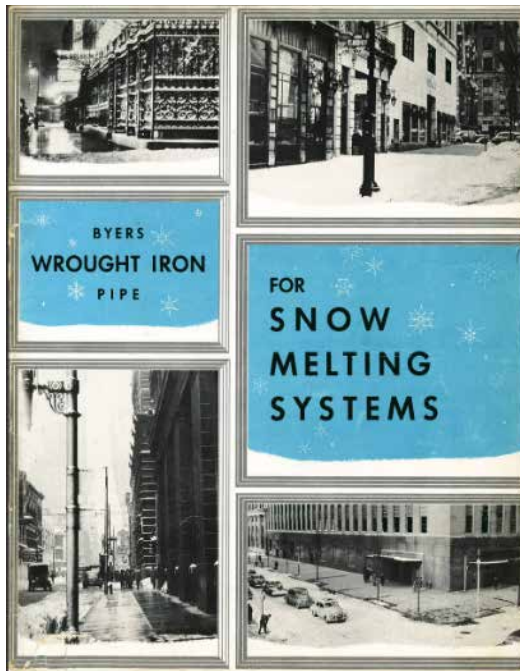
What Is A Hydronic SIM System?

- **Snow and Ice Melting** (SIM) systems are hydronic systems designed to remove snow and ice by circulating a heat transfer fluid through tubing installed in an outdoor surface
- SIM systems are used across North America in all climates
- The piping material for SIM distribution systems is typically:
 - **PEX**: Crosslinked Polyethylene
 - **PE-RT**: Polyethylene of Raised Temperature Resistance
 - Type K soft copper tubing
- Learn more about these materials at <http://plasticpipe.org/building-construction/>

What Is A Hydronic SIM System?

SIM systems are not new! See iron and copper manuals from early 1950's.

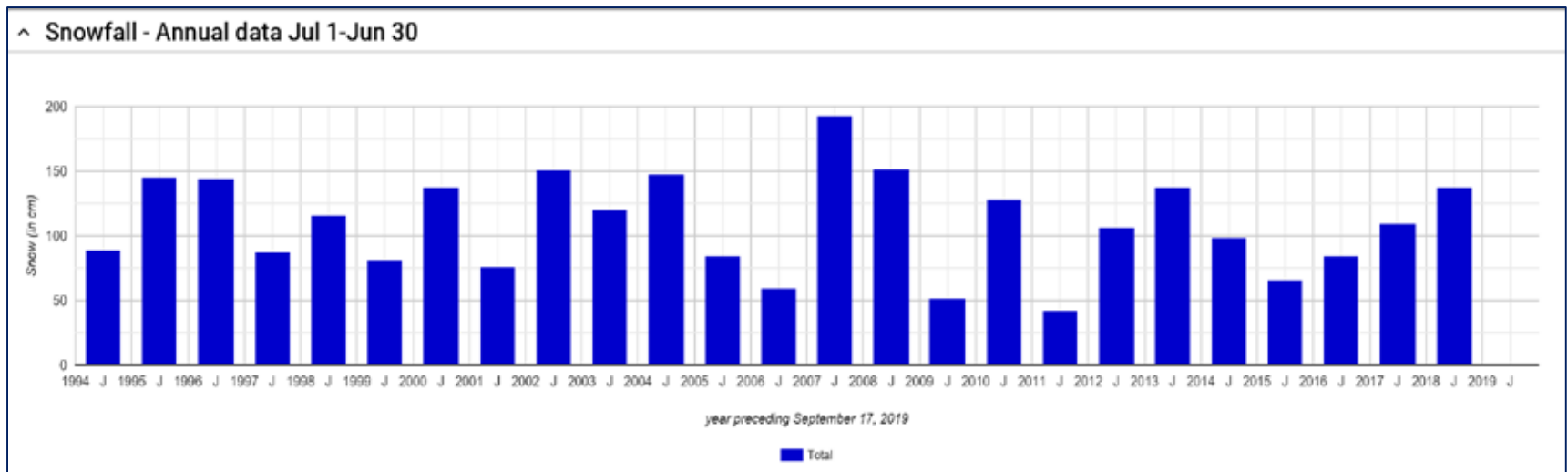
- A.M. Byers closed in 1969. Revere no longer produces tubing.



Opportunities with Hydronic SIM Systems

Annual snowfall data for **Toronto 1995-2018** shows cycles, not trends

- Winters are unpredictable but reliable
- Data at <https://toronto.weatherstats.ca/metrics/snow.html>



Opportunities with Hydronic SIM Systems

1. The safety, convenience and savings provided by a SIM system are more beneficial than ever, as changing weather patterns increase snowfall in many regions
2. Clearing slippery outdoor surfaces over a long winter is a high maintenance cost and involves the expense of harsh chemicals which can damage surfaces
3. Aging populations need access to services, yet may have limited mobility
4. Snow and ice melting systems can reduce liability while improving access
5. Operating costs for a hydronic SIM system are often much less than mechanical snow removal, saving facility owners money while reducing risks



Regulations for Hydronic SIM Systems

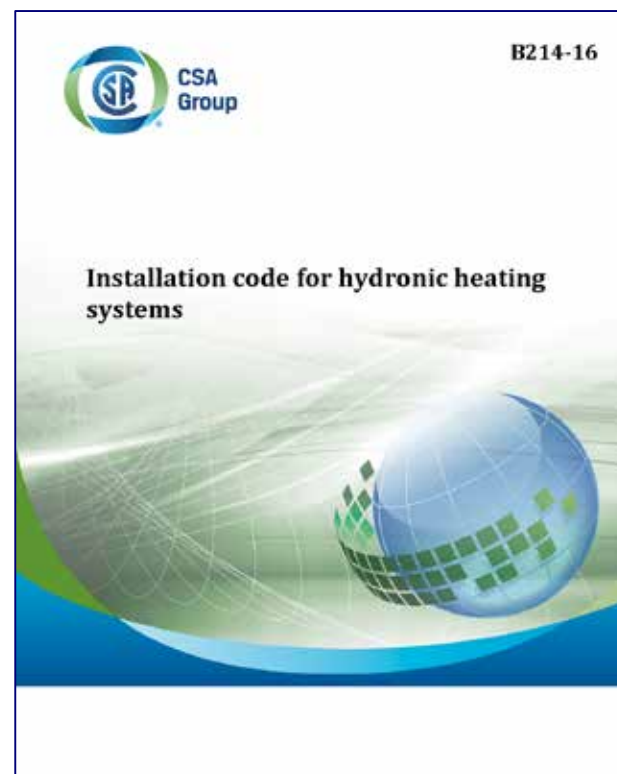
CSA B214 Installation Code for Hydronic Heating Systems

Chapter 17 “Snow and Ice Melt” includes:

- Controls
- Freeze protection
- Tubing placement
- Spacing of tube fasteners
- Loop lengths
- Insulation

Table 3
Loop lengths for snow and ice melt systems
(See Clause 17.3.3.)

Nominal size	Maximum active loop length, m (ft)	Total loop length, m (ft)
PEX or PE-RT tubing		
1/2	40 (130)	45 (150)
5/8	70 (225)	75 (250)
3/4	90 (300)	100 (325)
1	135 (450)	145 (475)



Outline

1. Benefits of SIM systems
2. Typical installation techniques
3. Common applications
4. Operating & installation costs



1. Benefits of Snow and Ice Melting Systems

This section will explain six benefits of SIM systems

- Better safety
- Reduced liability
- Healthier convenience
- Lowered maintenance costs
- Minimized environmental impact
- Long-term reliability



Benefits of Snow and Ice Melting Systems

Better Safety

- Snow and ice melting systems eliminate build-up of snow and ice, keeping surfaces clear during snowfall events and evaporating water to prevent freezing
- Systems provide better safety for walkers and drivers than mechanical snow removal



Benefits of Snow and Ice Melting Systems

Reduced Liability

- Keeping residences and businesses free of snow and ice improves access and safety, while eliminating a source of liability risk in winter
- Snowbanks and trip hazards are practically eliminated
- Liability insurance premiums might even be reduced, reducing ownership costs



Benefits of Snow and Ice Melting Systems

Healthier Convenience

- For the ultimate in snow removal convenience, SIM systems clear outdoor surfaces, leaving them dry
- No snow banks are left behind
- For residential customers, this eliminates potential health risks of aching backs and heart attacks



Benefits of Snow and Ice Melting Systems

Lowered Maintenance Costs

- Traditional snow removal is very expensive and unpredictable
- Facility owners can pay \$1,000s per year for labor, equipment, supplies
- Hydronic SIM systems are usually less expensive to operate than mechanical removal
- Indoor maintenance costs are reduced by avoiding sand and salt getting tracked inside



Left: Snow removal equipment and supplies at parking garage



Right: Salt at bank entrance

Benefits of Snow and Ice Melting Systems

Minimized Environmental Impact

- Hydronic SIM systems are powered by heat sources such as high-efficiency boilers, electricity, geothermal heat pumps or waste heat (commercial, industrial)
- They extend lives of surfaces by eliminating scraping, salting and sanding operations
- Run-off of deicing chemicals (e.g. salt) onto lawns and drains is eliminated
- Less fuel is used to power boilers than to power trucks (lower CO₂ emissions)
- These factors can reduce environmental impacts



Benefits of Snow and Ice Melting Systems

Long-term Reliability

- Plastic tubing does not corrode on the inside or outside
- Hydronic boilers, circulators and piping components are highly reliable
- With proper design and installation, hydronic SIM systems provide decades of reliable operation with virtually no maintenance to piping systems
- The piping material for SIM systems is typically:
 - **PEX**: Crosslinked Polyethylene
 - **PE-RT**: Polyethylene of Raised Temperature resistance



*Courtesy
REHAU*



*Courtesy
Dow*

Benefits of Snow and Ice Melting Systems

Long-term Reliability

- PEX and PE-RT tubing have long-term pressure ratings of:
 - 160 psi @ 73°F (1,110 kPa @ 23°C)
 - 100 psi @ 180°F (690 kPa @ 82°C)
- Actual burst pressure is well over 500 psi
- These are tough and durable, yet flexible, products
- PEX tubing is produced in accordance with national standard **CSA B137.5**
- PE-RT tubing is produced in accordance with national standard **CSA B137.18**



Courtesy NIBCO

Benefits of Snow and Ice Melting Systems

Long-term Reliability

- Piping in the mechanical room and to supply manifolds can be a variety of materials:
 - **PEX** or **PE-RT**
 - **CPVC**: Chlorinated Polyvinyl Chloride
 - **PP**: Polypropylene (PP-R or PP-RCT)
- Supplies to remote manifolds are usually piped with **pre-insulated PEX** tubing



Benefits of Snow and Ice Melting Systems

Summary: Benefits include...

- Better safety
- Reduced liability
- Healthier convenience
- Lowered maintenance costs
- Minimized environmental impact
- Long-term reliability

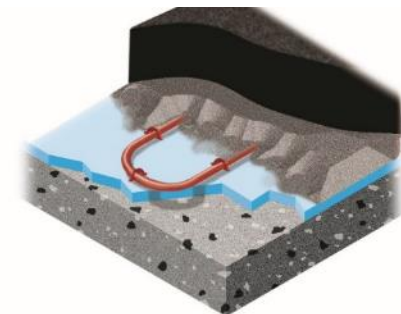
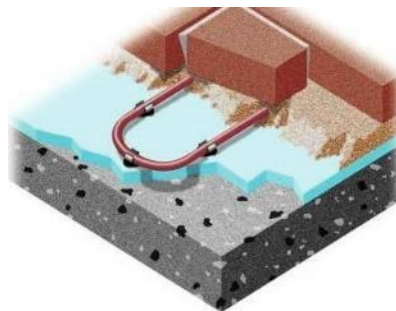
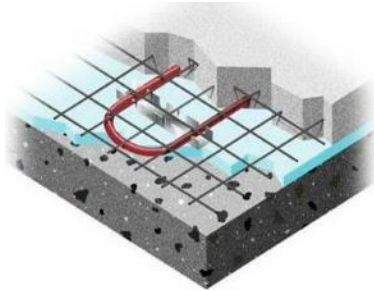


2. SIM Installation Techniques

Three typical installation types for outdoor surfaces

1. Poured concrete
2. Interlocking pavers
3. Asphalt

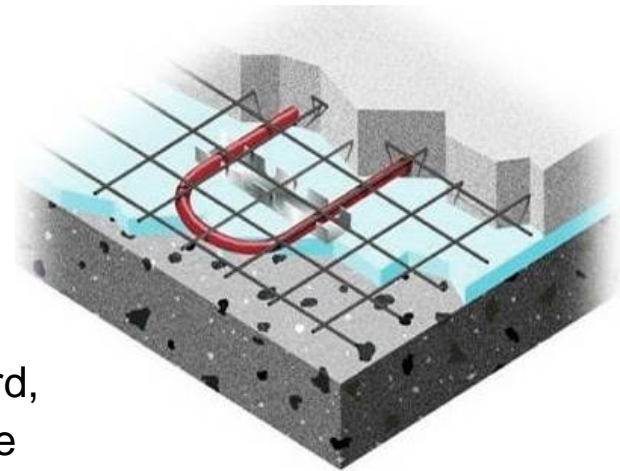
Hydronic snow and ice melting systems can be successfully installed in practically all types* of external surfaces **Permeable concrete is the most difficult surface*



SIM Installation Techniques

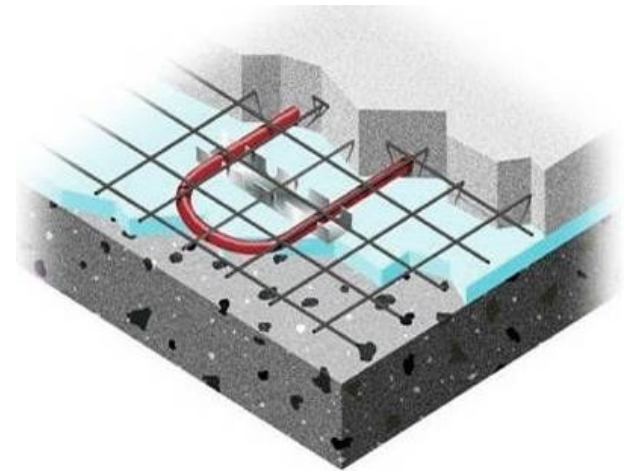
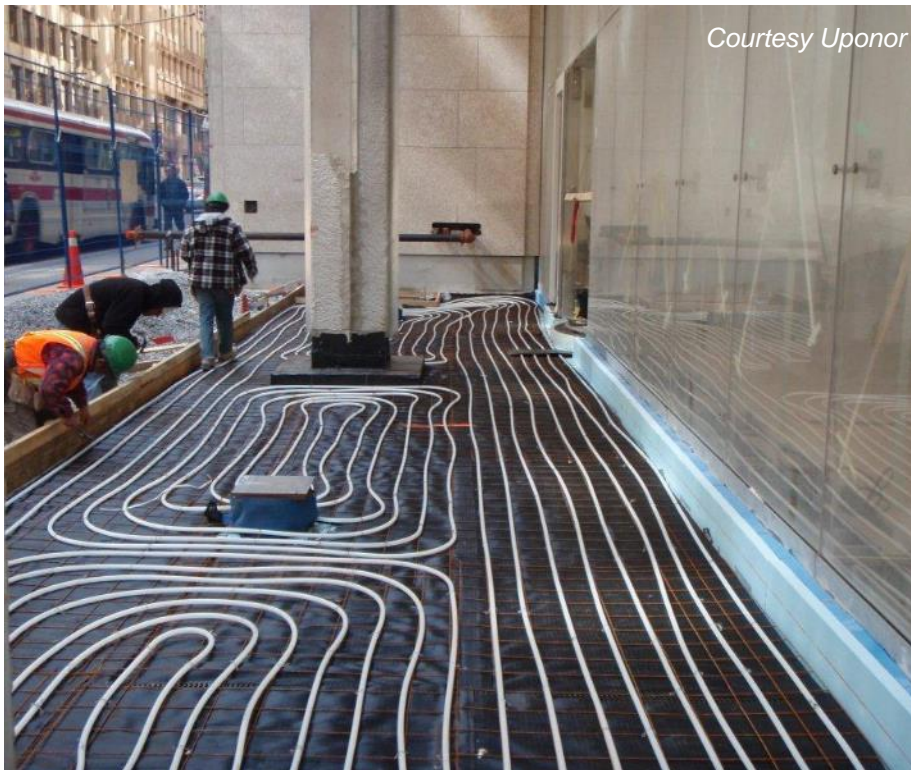
1. Tubing embedded within poured concrete

- In poured concrete, the tubing is simply embedded within the concrete
 - Very popular for stained concrete
- Recommended to place the tubing 2 to 3 inches (5 - 8 cm) below the surface for faster response time (not always practical)
- Tubing is often stapled directly onto the insulation board, or tied to rebar or wire mesh within the poured concrete
- Some insulation board has the integrated “knobs” for holding the tubing
- This is a simple and affordable technique for installing SIM piping



SIM Installation Techniques

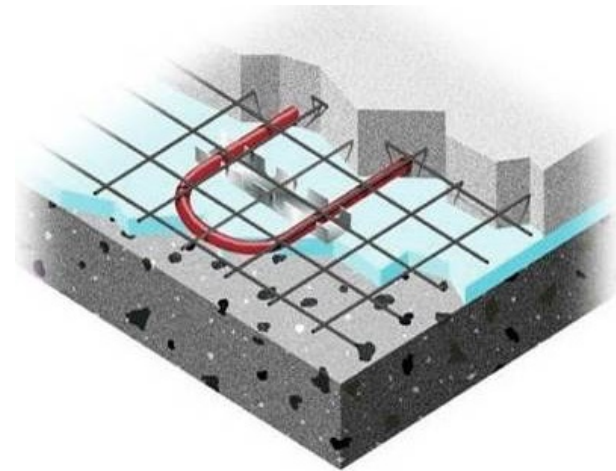
1. Tubing embedded within poured concrete



Poured concrete with tubing
embedded 2 to 3 inch from top surface

SIM Installation Techniques

1. Tubing embedded within poured concrete

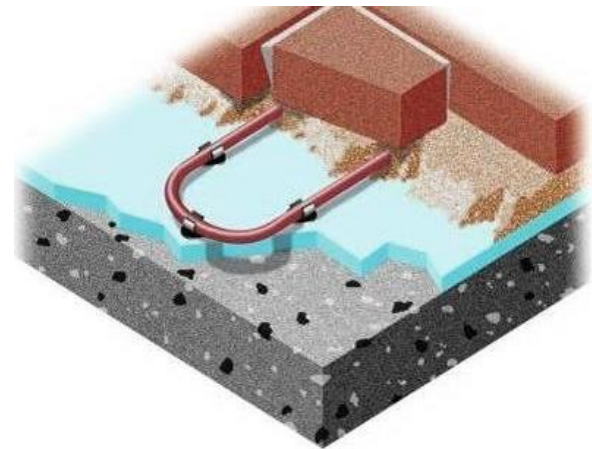


Poured concrete with tubing
embedded 2 to 3 inch from top surface

SIM Installation Techniques

2. Tubing installed under interlocking pavers

- Plastic tubing is installed above insulation using plastic rails, staples or screw clips
- Tubing is encased within 1 1/2 inches (4 cm) of sand bed, compacted to 1 1/8 inches (3 cm) thick
- Pavers are placed above sand bed, and installed normally
- Technical specifications and drawings of SIM systems with pavers can be found at www.icpi.org

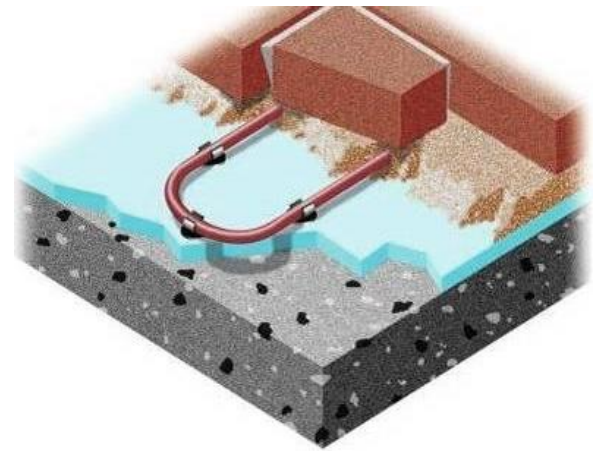


The Media

- Compacted sand bed is recommended
- Stone dust loses strength when wet, and can heave when frozen

SIM Installation Techniques

2. Tubing installed under interlocking pavers

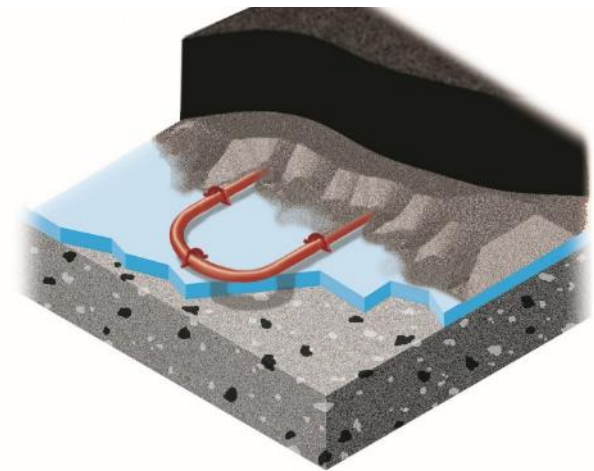


Pavers installed over sand bed
with embedded heating tubing

SIM Installation Techniques

3. Tubing installed under asphalt

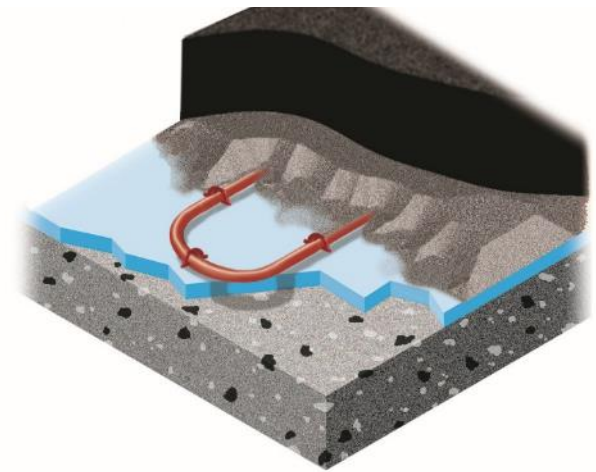
- Plastic tubing is installed above insulation using plastic rails, staples or screw clips
- Tubing is encased within 3 inches (7.5 cm) of stone dust or sand media, compacted
- Asphalt is placed above the media (dust or sand) and compacted normally
- Cold water is flushed through pipes during placement of asphalt and until it cools
- Water flow is regulated to be less than 150°F (65°C) at the manifold outlet to keep the tubing “cool”



Media: Compacted stone dust works best. No pea stone or crushed gravel.

SIM Installation Techniques

3. Tubing installed under asphalt

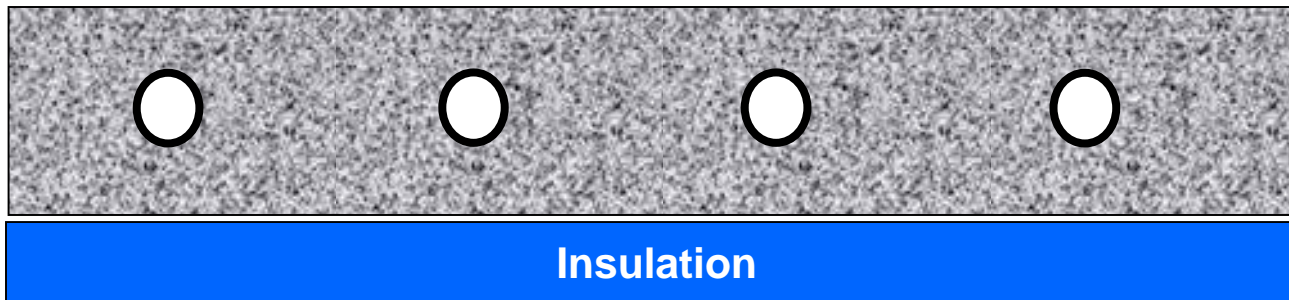


Tubing embedded within sand
or stone dust below asphalt

SIM Installation Techniques – Piping Design

The piping designer has several options:

- a. Tube size (3/4 tubing is typical; 1/2 or 5/8 tubing is sometimes used)
- b. Tube spacing (6 to 9 inch tube spacing is typical, based on width of area)
- c. Tube circuit lengths (150 ft. to 300 ft. circuit length is typical, but this is based on load, tubing size, heated area and the selected circulator)



Poured concrete with tubing embedded 2 in. to 3 in. from top surface is ideal for faster response time

SIM Installation Techniques – Piping Design

Piping example:

- a. $\frac{3}{4}$ Tube size
- b. 8 inch (20 cm) on-center Tube spacing (works well for 20 ft. width)
- c. 250 ft. (76 m) Circuit lengths (to keep head loss low)




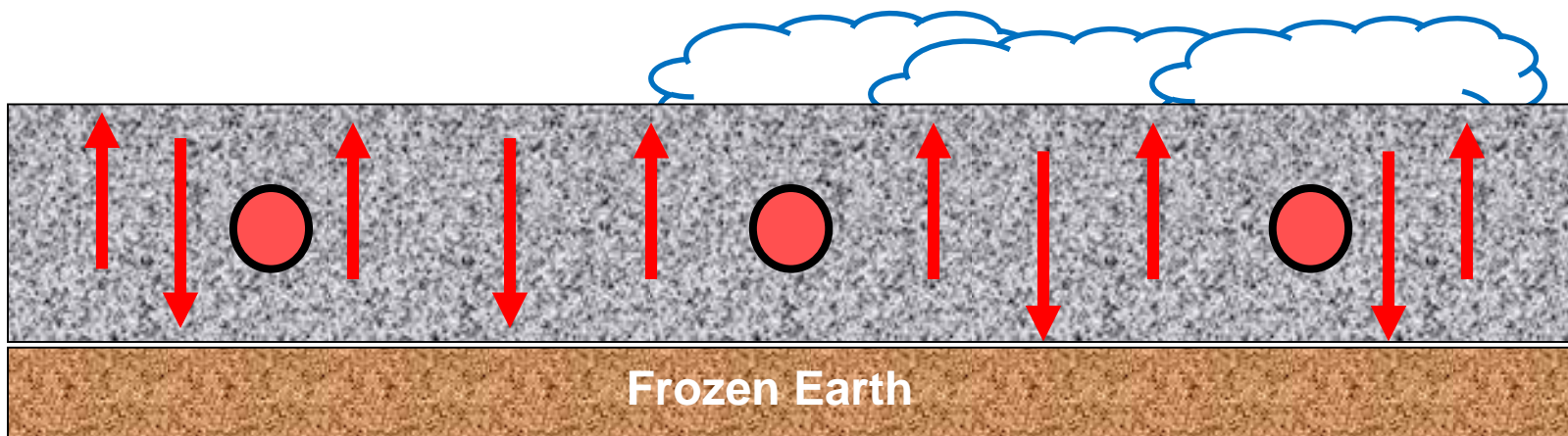
Poured concrete with tubing embedded 2 in. to 3 in. from top surface is ideal for faster response time

SIM Installation Techniques - Insulation

Importance of Appropriate Insulation

- A significant amount of heat can be conducted to the frozen earth below the SIM surface if appropriate insulation is not installed
 - Without insulation, downward losses can exceed **50%** of all the energy supplied to the area (you'd better double the size of heat source and circulators!)


 = Tubing filled with warm glycol

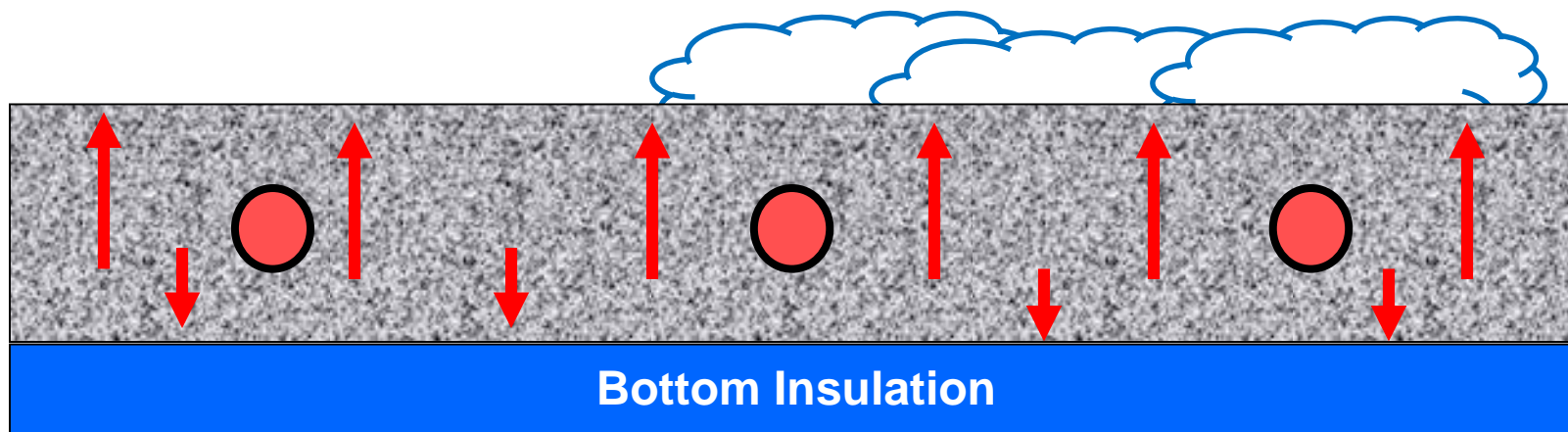


SIM Installation Techniques - Insulation

Importance of Appropriate Insulation

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 = Tubing filled with warm glycol



SIM Installation Techniques - Insulation

Importance of Appropriate Insulation

- [CSA B214-16](#) requires **at least R-5** insulation below SIM areas, but many designers specify **R-10**, since insulation also improves response time
 - Typical insulation thickness is 1 in., 1 ½ in. or 2 in. (25 mm, 38 mm, 50 mm)
- Be sure the insulation is rated for outdoor use and meets the expected compressive loading from vehicles, or settling can occur



SIM Installation Techniques - Drainage

Drainage

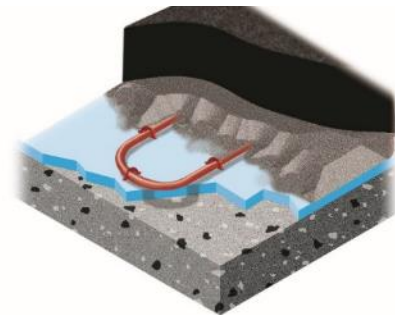
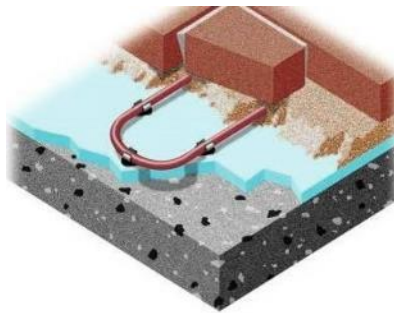
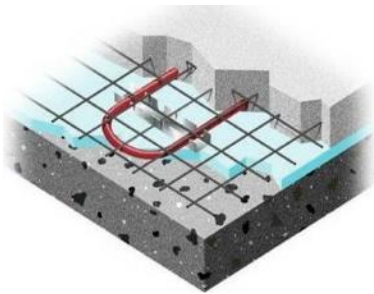
- Slope surfaces for natural drainage
- Drain to lowest points of the property
- Control run-off so as not to create hazards
- Plan locations of trench drain box/s
- Be sure that drains will not freeze
- Connect drain to available storm sewer system, within code requirements; maybe a pond



SIM Installation Techniques

Summary: Three installation types for outdoor surfaces

1. Poured concrete
2. Interlocking concrete pavers
3. Asphalt



Images Courtesy REHAU

3. Typical Applications of SIM systems

Common applications

1. Sidewalks
2. Steps
3. Pool decks
4. Driveways
5. Ramps



Typical Applications of SIM systems

Sidewalks

- Private home



Typical Applications of SIM systems

Sidewalks

- Municipal building



- University (handicapped parking)



Typical Applications of SIM systems

Steps

- Residential installations



Typical Applications of SIM systems

Pool decks

- Facilitates winter access
- Tubing can also be used to **extract heat** from surface in summer, to cool the deck
- Same heat can be “pumped” back into the pool



Typical Applications of SIM systems

Driveways

- Under stained concrete



Typical Applications of SIM systems

Driveways

- Under stained concrete or pavers



Courtesy Klimatrol

Typical Applications of SIM systems

Driveways

- Under stained concrete or pavers



Typical Applications of SIM systems

Driveways

- For commercial applications



Typical Applications of SIM systems

Ramps

- Pedestrian and vehicle ramps



Typical Applications of SIM systems

Ramps

- Pedestrian and vehicle ramps



Typical Applications of SIM systems

Ramps

- Pedestrian and vehicle ramps



Typical Applications of SIM systems

Ramps

- Parking garage ramps



Typical Applications of SIM systems

Summary: Common application types

1. Sidewalks
2. Steps
3. Pool decks
4. Driveways
5. Ramps



4. Operating & Installation Costs

Example: 1,000 ft² ramp in Hamilton, ON

- Melting area 50' x 20' = **1,000 ft²** (92 m²)
- Annual hours of operation: **156 hours of snowfall**
- Number of events: **20 times** (assumption)
- Annual hours of idling: no idle
- Heat flux/load during operation: **150 Btu/hr-ft²**
- Fuel type: **Natural gas**
- Fuel cost: **\$0.30/m³**
- Efficiency of heat source: **95% AFUE** boiler



Operating & Installation Costs

Example: Annual Cost Estimate

- **30.3** million Btu/year x **\$8.70 CAD** per million Btu produced = **\$265/year**



Based on un-shown assumptions and estimates

Electrical costs for heat source and circulator not shown, but these are minor in comparison

Disclaimer: Predicting the weather a week in advance is difficult, so predicting an entire season with high accuracy is impossible. Therefore, every effort is made to explain assumptions based on known or assumed data, using historical averages.

Operating & Installation Costs

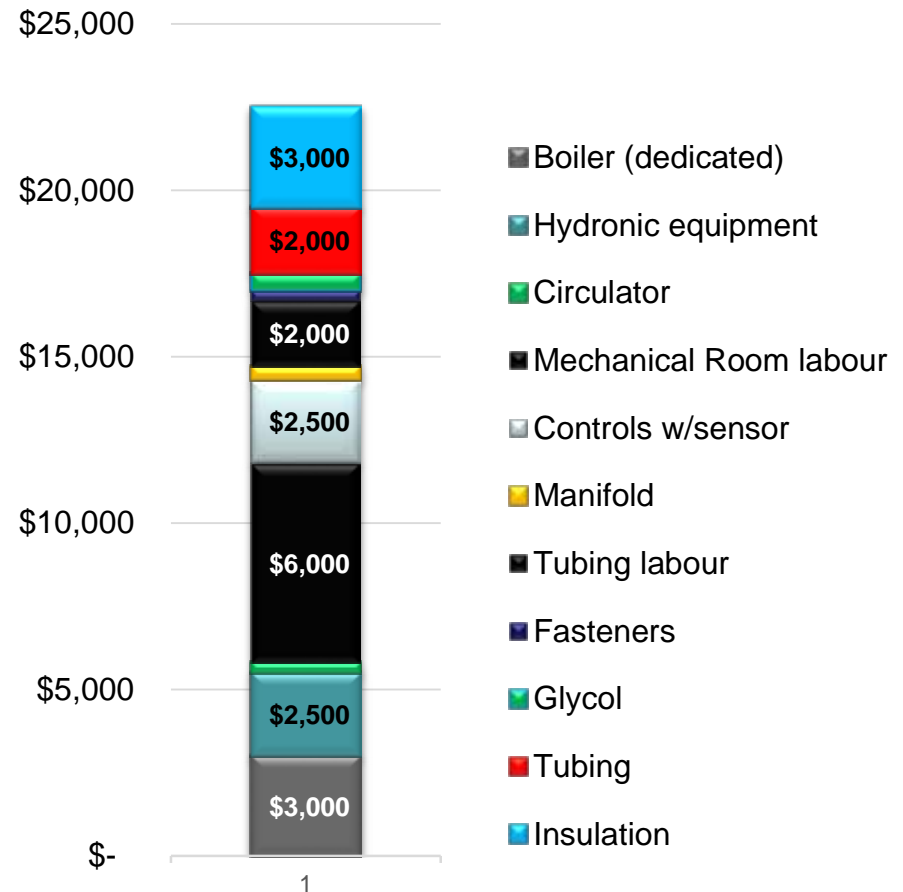
Example: 1,000 ft² ramp

These are the items required to build a hydronic SIM system with a dedicated 150,000 BTU/hr boiler (estimate)

Includes all items shown with labour (cost to contractor, without concrete)

Total Installed Cost = **\$22,500**
(\$22.50 per sq ft in this case only)

[Disclaimer: Ballpark values, not a quote!](#)



Summary

1. Benefits of SIM systems
2. Typical installation techniques
3. Common applications
4. Operating & installation costs

See article in *Modern Hydronics*, Fall 2017

SNOW AND ICE MELTING SYSTEMS



Without the heat that water may occur a long and on...
...the time to it could lead with your customers.

MELTING SNOW IS A BEAUTIFUL THING

BY LANCE MACNEVIN

As I write this it is hard to think about winter, but I am pretty sure it will return this fall. Now is the time to help customers prepare by equipping them with hydronic snow and ice melting systems.

Traditional methods of snow and ice removal include "mechanical" removal by snow blowers and plows, manual shoveling, and chemicals such as salt and sand. Sometimes, overhead infrared heaters are used over concentrated locations. If you are lucky, maybe a teen-ager will do it for cash.

However, shoveling takes huge effort and can cause health issues. Snow blowers and plows are expensive pieces of equipment that consume much fuel

and leave snowbanks behind, sometimes damaging landscaping. Salt and sand can damage both outdoor and indoor surfaces while creating environmental issues during run-off.

WHAT IS A SNOW AND ICE MELTING SYSTEM?

Modern hydronic technology can provide responsive and efficient solutions to these problems through snow and ice melting (SIM) systems. These systems have been used across North America in all climates for over 75 years. By heating the outdoor surfaces, snow and ice are melted and evaporated. These closed-loop systems include a heat source, circulating pumps, controls and

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http://www.mhi.org

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Benefits of Snow and Ice Melting Systems



For more information <https://plasticpipe.org/building-construction/index.html>

And <https://plasticpipe.org/building-construction/bcd-sim.html>