

# EXTERIOR APPLICATION

## DESIGN CONSIDERATIONS

To start melting ice or snow after everything is frozen requires a lot of power. The design data differs throughout the United States and has to be calculated for each location according to: freezing index of the area, soil type and loading conditions.

An on demand de-icing system may be favorable in places with few snowfall days. Areas with frequent snowfall may benefit from the thermal bed concept which is a low power de-icing system that is switched on prior to frost and kept energized all winter. STEP Thermal Bed system is designed for continuous duty on 24 volts and will melt ice or snow provided the substrate has been maintained heated. This maintenance heat keeps the ground temperature constant and reduces the expansion and contraction in substrates.

## FROST HEAVE

Wherever underlying soils are susceptible to frost, pavements will suffer damaging effects from frost heave and spring breakup. There are different techniques to reduce frost action, such as:

- Removing frost-susceptible soil and using thick base courses to spread the load during spring thaw.
- Providing adequate drainage for free water through ditching.
- Placing a layer of insulation in the embankment section to keep sub-grade soil temperatures above freezing.
- Maintaining the soil above freezing temperatures by placing heating elements in the upper soil or pavement section.

## MATERIALS AND METHODS

Horizontal weather-exposed surfaces that are sealed underneath shall be sloped for drainage to prevent ponding of water. All drains should have weep holes. Provide a method of drain protection to avoid ice buildup.

Appropriate insulation and drainage has to be defined for each project. The insulation shall have a high thermal resistance and be highly resistant to water absorption. Loss of R-value and structural integrity can occur if the insulation is unable to sufficiently resist moisture. When going from an insulated to a non-insulated pavement section, a transition zone is required to minimize the consequences of differential icing. Consult manufacturer for installation recommendations and insulation requirements.

The STEP elements are sealed in a vinyl enclosure and held down with tape or anchored with plastic pegs directly onto the substrate or insulation. Take care not to damage the heating panels when pouring the concrete.

To avoid cracks in concrete slab, expansion joints are required. Connectors and wires must be properly protected and must not cross the expansion joints.

## ON DEMAND SYSTEM

An on demand system can be switched on/off as required or it may have three design positions: off; idling and on. Design loads are based on air dry-bulb temperature, expected snowfall and moisture content.

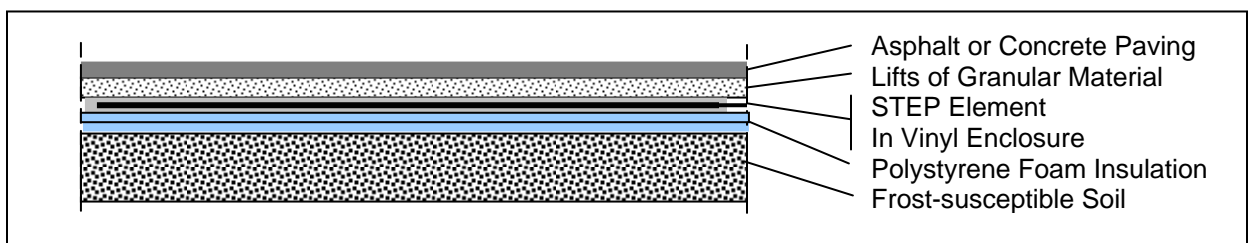
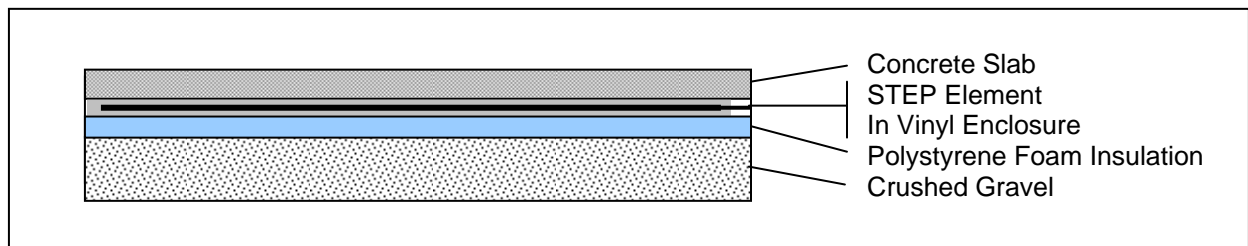
Environmental microclimates can have a significant impact on the system, including wind, temperature, relative humidity, snow moisture content, rate of snowfall, possibility of drifting snow, frost-susceptible soil, water table, etc.

Designs should provide drainage plans for run off. Drainage strategy should focus on minimizing water accumulation which could result in ice buildup or other safety hazard.

The insulation is laid in single or multiple layers over a subslab or directly over the soil. When going from an insulated to a non-insulated pavement section, a transition zone is required to minimize the consequences of differential icing; e.g. wing insulation. Conform to building codes, trade practices and manufacturers' specifications.

### • Application of STEP WARMFLOOR over extruded polystyrene foam insulation

- Install a low water absorption and high compressive strength insulation, e.g. "Styrofoam Freezermate" (single or multiple layers), over the prepared subgrade using conventional road building equipment and techniques.
- Make sure that the insulation is properly butted together to avoid the transfer of heat / cold migration and transfer of moisture.
- Lay the STEP elements in vinyl enclosure onto the insulation and hold with tape to prevent displacement of elements.
- Pour the concrete as usual. Do not add sand over the heating elements as this will trap the heat and impede heat flow.



## THERMAL BED CONCEPT

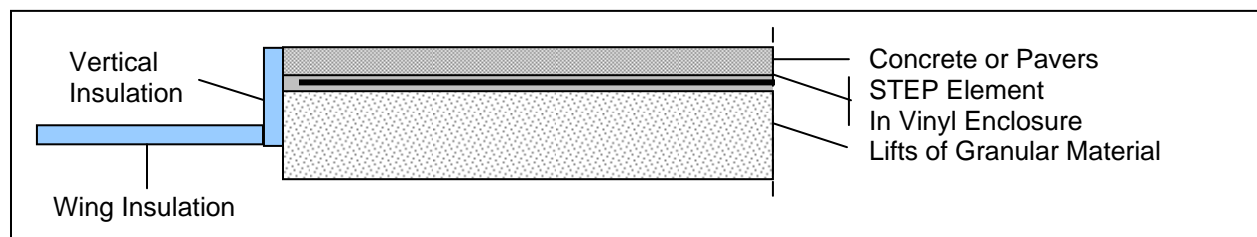
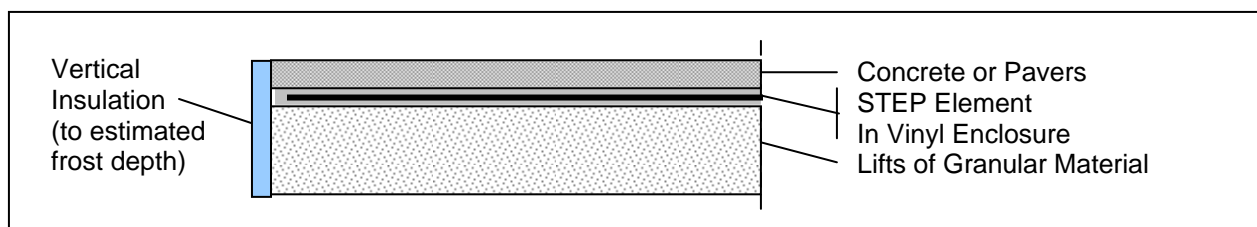
The thermal bed concept relies on maintaining a frost-free area under the protected surface to allow the earth's stored energy to provide the bulk heat required for the snow or ice event. The design and installation of this type of system is very heater dependant and involves calculations to ensure the correct application and sizing of the system.

A vertical and wing configuration allows placement of insulation that will reduce frost penetration and reduce excavating and backfilling.

It is recommended that the perimeter insulation strip be placed on a slight slope grading away from the structure to encourage drainage.

### • Application of STEP WARMFLOOR using vertical and wing insulation

- Place a low water absorption and high compressive strength insulation, e.g. "Styrofoam\*Hi" or equivalent, vertical along the walls of a trench or foundation to protect against frost penetration.
- Care should be taken to prevent vehicles and heavy equipment from bearing directly on the vertical insulation.
- Make sure that the insulation is properly butted together to avoid the transfer of heat / cold migration and transfer of moisture.
- Lay the STEP elements in vinyl enclosure onto an even layer of granular material and hold with tape to prevent displacement of panels.
- Apply subsequent lifts, pavement or soil layers taking care not to damage the heating panels.



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## VERTICAL INSULATION CONSTRUCTION METHOD

