PAVEMENT SNOW MELTING

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Abstract

The design of pavement snow melting systems is presented based on criteria established by ASHRAE. The heating requirements depends on rate of snow fall, air temperature, relative humidity and wind velocity. Piping materials are either metal or plastic, however, due to corrosion problems, cross-linked polyethylene pipe is now generally used instead of iron. Geothermal energy is supplied to systems through the use of heat pipes, directly from circulating pipes, through a heat exchanger or by allowing water to flow directly over the pavement, by using solar thermal storage. Examples of systems in New Jersey, Wyoming, Virginia, Japan, Argentina, Switzerland and Oregon are presented.

Key words: pavement snow melting, geothermal heating, heat pipes, solar storage, Wyoming, Virginia, Japan, Argentina, Klamath Falls.

Introduction

Pavement snow melting using geothermal hot water and steam has been demonstrated in several countries, including Argentina, Japan and the United States. These installations include sidewalks, roadways, bridges and runways. Most commonly it is done with a glycol solution, hot water or steam being circulated in pipes within or below the pavement, using either heat pipes or geothermal fluids, however, in one instances hot water has been sprinkled directly onto the pavement. This paper will attempt to present the general design requirement for a snow melting system and then give examples of those in operation using geothermal energy. The obvious benefits of these systems is that they eliminate the need for snow removal, provide greater safety for pedestrians and vehicles, and reduces the labor of slush removal.

General Design Criteria

The heating requirement for snow melting depends on four atmospheric factors: (1) rate of snow fall, (2) air temperature, (3) relative humidity, and (4) wind velocity (ASHRAE Handbook, 1995).

The snow melting system must first melt the snow and then evaporate the resulting water film. The rate of snowfall determines the heat required to warm the snow to 32ºF and to melt it. The evaporation rate of the melted snow from the pavement is affected by the wind speed and by the difference in vapor pressure between the air and the melted snow. Since the vapor pressure is determined by the relative humidity and temperature of the air, and as the pavement surface temperature is usually fixed, the resulting evaporation rate varies with changes in air temperature, relative humidity, and wind speed. Convection and radiation loss from the melted snow depends on the film coefficient and the difference in temperature between the surface and air. The film coefficient is a function of wind speed alone, and since the pavement temperature