

# Development of a CO<sub>2</sub> Heat Pipe for Hydronic Heated Bridge Decks

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## Abstract

Heated bridges using hydronic systems with PEX pipes embedded in the concrete deck are often used to remove snow and ice. In practice, State Department of Transportations (DOTs) are often resistant to use the hydronic heating due to its risk of pipe leaks. This paper concerns the design and tests of copper CO<sub>2</sub> heat pipes that can be used in the heated bridge to avoid the leak hazard and improve heating efficiency. A single heat pipe is developed using a sealed copper tube filled with pressurized CO<sub>2</sub> at constant room temperature. The single CO<sub>2</sub> heat pipe is designed and verified in the lab to work for the temperature range provided by working temperature of extracted fluids from an underground geothermal well and freezing temperature during snow events. The system is tested inside an environmental chamber and demonstrates its superior heating performance as compared with its counterpart. CO<sub>2</sub> heat pipes have a great potential to improve significantly heating efficiency and minimize the environmental impact of geothermal heated bridges.