PROJECT SUMMARY

Texas Department of Transportation

0-6872: Use of Geothermal Energy for De-icing Approach Pavement Slabs and Bridge Decks, Phase 1

Background

Bridge deicing during winter conditions is critical to ensure roadway safety, mobility, and productivity. However, the current deicing methods for bridge decks are energy-intensive, corrosive to the bridge and substructure, and potentially dangerous to the environment. Geothermal energy is a reliable and green energy source that can provide power year-round and is independent of external weather conditions. Current estimates from the US Department of Energy shows that geothermal energy has the potential to satisfy more than four-fifths of our nation's energy needs. Thus, a variety of projects worldwide have investigated the potential to harness geothermal power for generating additional energy at a given location for various operations.

What the Researchers Did

As a part of the Phase 1 of this project, the research team conducted a comprehensive synthesis study of geothermal bridge and pavement deicing and underground thermal energy storage technologies currently used in the state of research and practice. The research team collected and reviewed worldwide literature on bridge and pavement deicing using geothermal energy. Particular focus was on borehole thermal storage, a means to store thermal heat in the summer and use it for deicing in the winter, which works well with the Texas climate conditions.

The main report for Phase 1 (0-6872-1) documents the literature review findings and provides recommendations for utilization of geothermal energy for bridge pavement and deck deicing in Texas. In addition, the research team performed a numerical analysis based on the finite element method to study and address the feasibility of utilizing borehole thermal storage for bridge and pavement deicing applications. The potential applications of this technology for both new pavement/bridge construction and maintenance of existing pavement/bridge structures were studied.

What They Found

Geothermal energy has been widely used worldwide in various civil engineering applications, including bridge and pavement deicing (Figure 1). A few successful full-scale geothermal heated bridges in various parts of the world were reported and demonstrated geothermal energy's value as an efficient and reliable method for bridge deicing. A geothermal heated bridge was constructed and operated in Amarillo, Texas, in the late 1980s, which showed the potential of using geothermal energy in Texas.

Research Performed by:
University of Texas at Arlington

Research Supervisor:
Xinbao Yu

Researchers:
Anand Puppala
Nan Zhang

Project Completed:
8/31/2018

There have been many advances in this technology in recent years and a proper investigation of this method for use in local Texas conditions can result in an optimized geothermal solution—one that can be used to retrofit the bridge infrastructure in critical locations of the state.

What This Means

Geothermal energy is a viable and reliable energy source for heated bridges. Geothermal energy has great potential for geothermal deicing of both new and existing bridges in Texas. Ongoing research in Phase 2 of the project is critical to the potential application of geothermal-based deicing technology to the existing bridges.

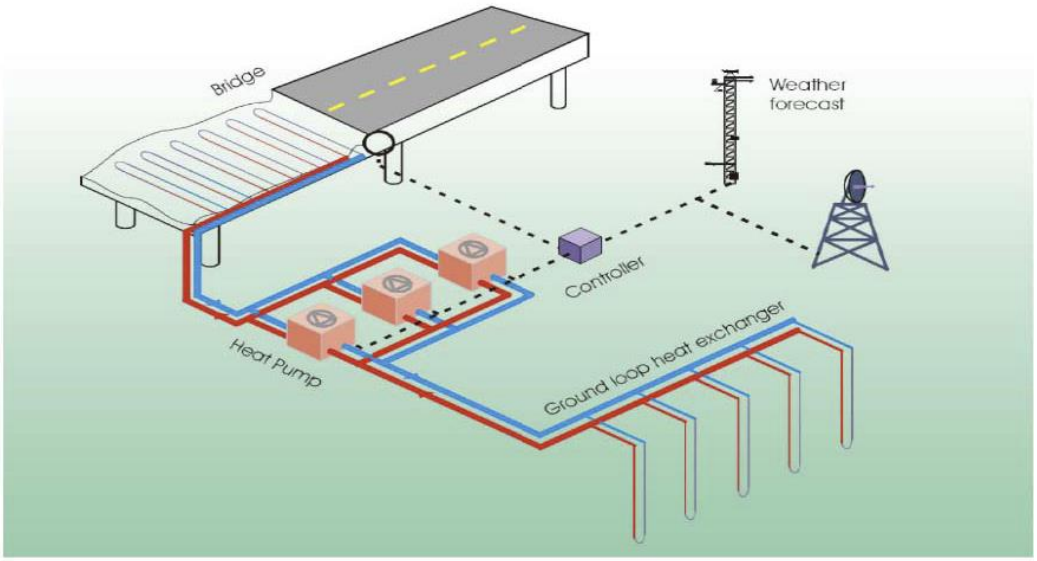

Figure 1. Schematic drawing of a geothermal bridge deicing system

Figure credit: Spitler, J. D. (2000). *GLHEPRO—A Design Tool for Commercial Building Ground Loop Heat Exchangers.* Proceedings of the Fourth International Heat Pumps in Cold Climates Conference, Aylmer, Québec.

For More Information

Research and Technology General Information:
(512) 416-4730

Research Supervisor:
Xinbao Yu, UT Arlington (817) 272-1243

Technical reports when published are available at **http://library.ctr.utexas.edu.**

Research and Technology Implementation Office
Texas Department of Transportation
125 E. 11th Street
Austin, TX 78701-2483

www.txdot.gov
Keyword: Research