

**RESEARCH PROBLEM STATEMENT**

<b>DATE:</b> 09/06/2018	<b>PROJECT AREA:</b> Maintenance
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**TITLE:** Bridge Anti-icing System Using Energy Foundations (Driven Piles or Drilled Shafts)

**PROBLEM STATEMENT:**

Arkansas experiences sub-freezing temperatures. Consequently, bridges in AR develop hazardous conditions due to ice formation and "black ice" conditions. Although, applying de-icing solvents manually is one solution, it warrants adequate ARDOT personnel and equipment, and intensifies structural corrosion. However, other alternative approaches are available.

Two objectives need to be satisfied in developing a bridge deck anti-icing system: minimal operating cost and minimal increase in the system's capital costs. Energy foundations satisfy these two objectives for a bridge deck anti-icing solution. Deep foundations comprised of piles are required at many bridges to support bridge loads. In addition to supporting bridge loads, these same piles can be used as heat exchangers to transmit heat energy from the soil encasing the pile to fluid within a polyethylene circulation loop within the pile that leads to the bridge deck. Energy foundations take advantage of the higher ground temperature of the soil that encases the pile. Typically, soil temperature is approximately constant below 15 ft from the surface and therefore, is independent of the ambient temperature conditions.

**OBJECTIVES:**

- Compare alternative solutions used for bridge deck anti-icing.
- Survey State DOT's on the benefits derived from these anti-icing systems.
- Conduct an experimental investigation of a hydronic system with heat supplied using an energy foundation.
- Perform a numerical analysis to optimize the pile and system design.
- Evaluate the feasibility for implementing a hydronic anti-icing system using geothermal deep foundations in Arkansas.

**FORM OF RESEARCH IMPLEMENTATION AND RETURN ON INVESTMENT:**

A prototype of the system (shown in the attached slides as "Test Mat Configuration" ) will be built and evaluated over the winter season. Plans will be developed for ARDOT to implement the anti-icing system at a future bridge site. The investigators will conduct an economic benefits/cost analysis to examine bridge locations within Arkansas where this approach is advantageous.

**Estimated Project Duration:** 24 Months

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Standing Subcommittee  
Ranking

6/6

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Statement Combined with  
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