



Sun-dried bridges

An in-depth look at MoDOT's solar deicing plan

The Missouri Department of Transportation (MoDOT) is boldly going where no other state department of transportation has gone: solar.

In December 2009, the department entered a contract with Pave Guard Technologies Inc., Lee's Summit, Mo., to install solar-warming systems on two bridges located on Rte. 10 on either side of Excelsior Springs, Mo. Rather than spend critical time researching and studying the solar-heating concept and how it would work on a bridge, MoDOT decided to jump right in.

"This is a bold step for us," said Dennis Heckman, MoDOT's state bridge engineer. "We wanted to move ahead with trying this exciting technology, but we didn't want to tear up a good bridge just to put in the solar system. The two pilot bridges are scheduled for deck replacements in 2010, so they presented a perfect opportunity for us."

The bridges are being fixed as part of MoDOT's Safe & Sound Bridge Improvement Program, which is repairing or replacing 802 of the state's worst bridges by the end of 2013.

In addition to being scheduled for repairs, the bridges had enough land next to them for

placement of the solar panels. And, as luck would have it, the land configuration will enable the panels to face south so they can catch the prerequisite sun. The area also is fairly free of trees and shade and accessible to electricity—necessary requirements for the systems to operate. Pave Guard will install chain-link fences around the panels to provide security.

The concept

Corey McDonald developed the idea for using solar power to keep ice and snow off of roads and bridges after traveling through a harrowing snowstorm in 1996 and seeing the accidents caused by slick pavement. Ten years later, he and his partner, Ed Smith, started Pave Guard Technologies to market the concept of capturing solar energy through panels and using the heat source to keep surfaces free of ice and snow.

"It's clean, environmentally safe, dependable and capable of withstanding wear and tear," said McDonald. "Our solar system acts to produce an effect with a minimum of waste or effort, which in turn provides a cost savings."

The warming system that Pave Guard will install on the two Missouri bridges operates much like radiant heating works in a home's floor. Tubing is installed in the bridge deck, through

which a heated solution is pumped to keep the deck from freezing. The energy to heat the solution is provided by solar panels mounted near the bridge site.

Excess energy produced by the panels when the heating system is not in use can be sold back to local utilities. Utility companies have become more interested in buying electricity from customers because it gives them "green credits" and helps reduce the need for constructing new power plants. Connecting the solar system to the local power grid also will provide a backup power source if problems should arise.

The contract

McDonald came to MoDOT with the idea of using its solar solution, and after several meetings, the department decided to take a chance on the technology. Under the contract, signed in December 2009, Pave Guard will design, make and install the solar-warming system on the two bridges. The systems come with a five-year warranty, and the company is required to provide MoDOT with an operating manual.

MoDOT will pay \$183,000 for the two systems, though the amount will be paid out in installments as Pave Guard meets certain milestones. The bridge re-decking projects will be bid in February, and the first step in installing the solar systems will take place when the bridge contractor begins placing the new decks. At the same time, the contractor will install the tubing for the solar systems. The contractor is expected to finish fixing the bridges by August, at which time Pave Guard will install the solar-warming systems. The systems are to be operable by November.

McDonald said the best time to install an outdoor radiant heating system is before freezing temperatures return in late fall.

"Spring, summer and fall are the ideal times to install," McDonald said. "You can take advantage of the energy produced by the system right away."

Heckman said while the cost is significantly more expensive up front, some of the expense will be offset because MoDOT will be able to sell the electricity generated back to the local utility on days when there is no

snow and ice. How much revenue that generates is still unknown and will be watched closely.

"We'll be able to tell right away if the systems are generating electricity, but the first real test on how effective the systems are will come when we get ice and snow," Heckman said.

The benefits

Heckman calls the standard water,

salt and chemicals used to melt ice and snow off of bridges "liquid death" because they are so corrosive.

"Unfortunately, what's good for treating ice and snow is highly damaging to roads and bridges," Heckman said. "That's why the idea of solar energy as a deicing tool is so attractive."

MoDOT typically uses snowplows equipped with salt spreaders as the main way to remove snow and ice from



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Once the systems are operational, MoDOT will be looking to determine if the systems are turning on early enough to be effective and whether the heating effect is strong enough to melt any ice and snow that builds up on the bridge.

bridges. Because those plows still have to cross the bridges as part of their snow-clearing runs, the real benefit to using solar energy, according to Heckman, comes more from preventing damage to the bridge over the long run than it does from reducing plowing.

"We can usually see salt damage on a new bridge in just a few winters," Heckman said. "If we can find a cost-effective way to keep bridges clear without using salt and chemicals, we can extend their life and provide greater value to Missouri taxpayers."

If everything goes well, the system also will help to reduce maintenance costs that result from the salt, water and chemical damage that come in the wake of keeping paths clear for travel. In addition to extending the life of the bridges, the solar concept also could play a role in saving lives and reducing injuries by keeping travel ways free of slippery ice and snow and eliminating black ice.

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The test

The solar system is fully automated and activates when the temperature drops to 38°F. The waterproof solar panels are designed so they will not freeze over. In addition, the system continues to generate power on cloudy days by capturing energy from ultraviolet rays in the earth's atmosphere.

Once the systems are operational, Heckman said, MoDOT will be looking to determine if the systems are turning on early enough to be effective and whether the heating effect is strong enough to melt any ice and snow that builds up on the bridge.

"We'll be checking the systems and asking, 'Are they turning on early enough? Are they getting warm enough to be effective?' Those are the critical questions that will have to be answered right off the bat," Heckman said. "Then, we'll be monitoring to see if the concept is cost effective for us. If the results are positive after two winter cycles, we'll consider adding solar systems to other bridges."

The future

McDonald said radiant outdoor heating has often been viewed as a luxury, but he shakes that assumption. He estimates his solar-warming concept will almost double the life of the bridges. If that estimate is accurate, Heckman said, the system could prove to be quite cost effective.

McDonald said the system has been successful in other uses, including sidewalks, driveways, parking lots and intersections prone to serious accidents during the winter months. He expected the technology, which has been in use for more than 25 years, to only grow in popularity.

"I think this is going to take on a life of its own," McDonald said. "I'm excited about the opportunity to install this system on bridges, and I'm elated that MoDOT is the first state to incorporate our technology. Being a Missouri native, I'm proud to say my home state embraced our concept."

Heckman said MoDOT is already

receiving national interest in the project.

"I think there will be a lot of states looking to see how this idea pans out and how well the system works for us," Heckman said. "One of the values we live by at MoDOT is to take risks and accept failure because that helps us get better at what we do. We're hopeful this endeavor will prove productive and profitable for everyone involved and will serve as a model for other states to adopt."

Missouri Highways and Transportation Commissioner Rudy Farber agreed. "Using solar power to keep bridges free of ice and snow is a very innovative move for us," Farber said. "This indicates the department is forward-thinking and willing to be inventive."

Still, Heckman cautioned, wide-scale use of solar power on roads and bridges is still years down the road, if it comes at all. **R&B**

Information for this article provided by the Missouri DOT.

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