

EVALUATION OF AN AUTOMATED BRIDGE ANTI-ICING SYSTEM

Bridges and adjacent highways experience different environmental conditions. Depending on bridge height, wind direction and other parameters, pavements are subject to moisture and quick changes in temperature. Without the benefit of residual ground temperatures to temper against the cold deck, surfaces may freeze first resulting in bridge deck de-icing needs that are different from nearby roadway surfaces. An icing event could expose drivers to hazardous conditions for an estimated 90 minutes before crews can respond to restore a safe condition.

This research project was developed and funded jointly by the NHDOT and the Vermont Agency of Transportation (VTrans) to evaluate the effectiveness of an automatic anti-icing system, also known as fixed automated spray technology (FAST). FAST systems anticipate the formation of ice and automatically deploy liquid de-icers to prevent the formation of ice. They also prevent the bond of snow to the deck, thereby improving snow clearing efficiency.



The 12'x16' pump house contains a 6,100-gal. chemical and a 300-gal. water tank, computer control equipment and an RWIS weather station to guide the system.

DE-ICING CHEMICAL

Cryotech CF7 was selected as the chemical de-icer to be used in the system. CF7 is at least 50 percent Potassium Acetate by weight with a freezing point of -76°F (-60°C) or lower. It is a clear, colorless, biodegradable liquid with a pH between 10.5 and 11.5. It contains no chlorides yet is effective at -26°C (-15°F). The storage tank was sized to accept 4,000-gallon tanker loads, the most cost effective purchase quantity.



INSTALLATION

The Boschung America FAST system consists of 56 Micro Spray nozzles on the I-89 Southbound bridge deck and roadway approach to the bridge, spaced at 15'. The nozzles are grouped into three spray zones along the roadway centerline, and spray sequentially from north to south (with the flow of traffic). Each zone is controlled by an electrically controlled valve unit, located on the median bridge rail. An 8 mm diameter polyethylene tube supplies the nozzles with deicing chemical.

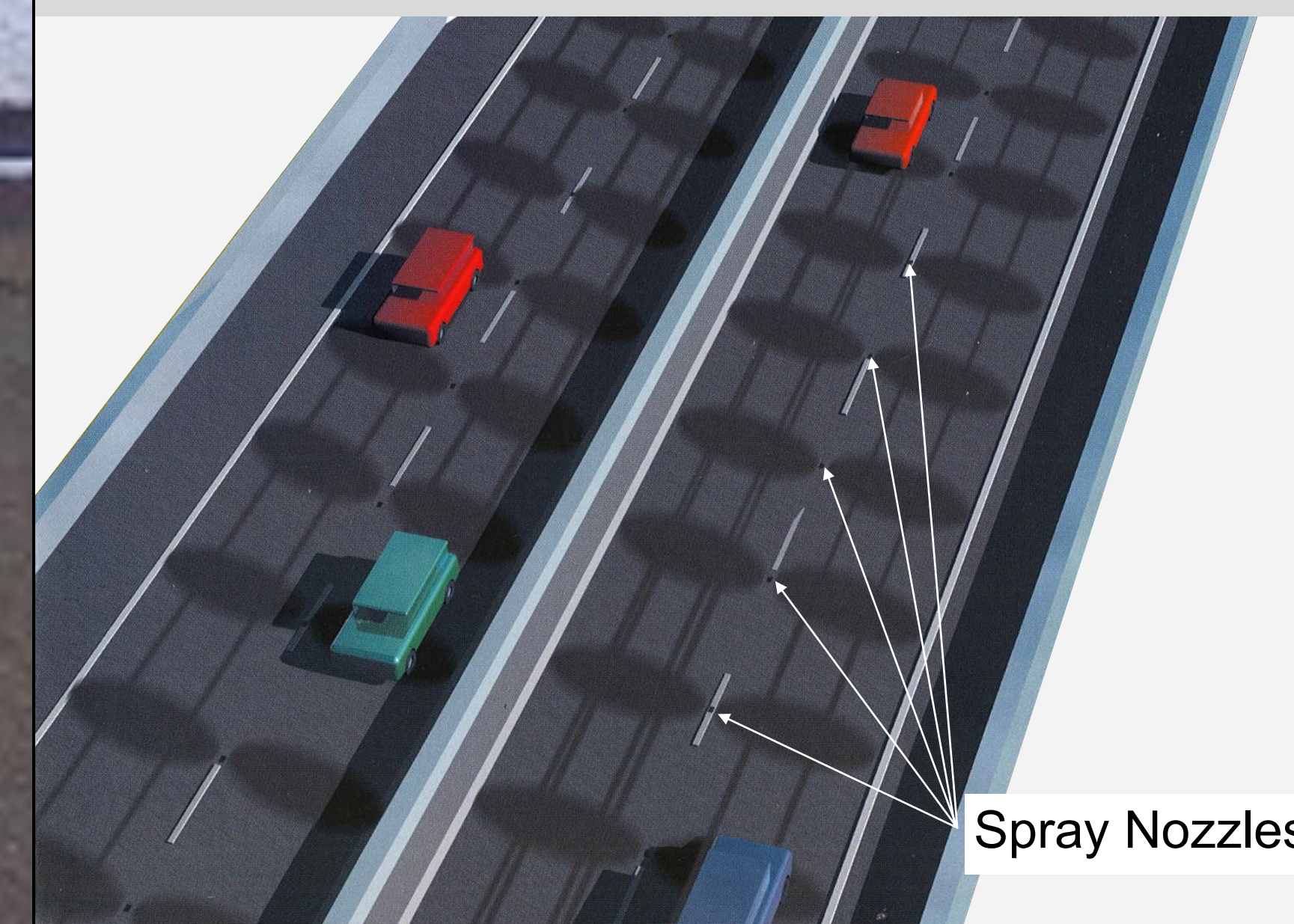
The system is controlled by a computer system and road weather information system (RWIS), located at the pump house near the abutment on the Vermont side. Active and passive pavement sensors communicate the deck temperature and projected freeze temperature to the computer. The system can be monitored and manually controlled remotely through a desktop computer at the NHDOT District 2 Maintenance Office located approximately nine miles away in Enfield. The system was placed into service in November 2006.

SPRAY NOZZLE

Boschung America Micro Spray Nozzles were new to the U.S. market during the selection process in 2004. They were less expensive and could be embedded within the two-inch thick asphalt bridge pavement without impacting the barrier membrane or concrete deck.



Micro-nozzles spray in a bow tie pattern at 15-ft. intervals. Traffic tracks chemical to treat entire deck.



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EVALUATION

Overall, the Boschung America FAST system functions well. Accidents are generally severe at this location, though they do not occur every winter. No accidents were reported on the southbound bridge during the observation period. The FAST system greatly improves driver safety.

The pre-emptive treatment of a deck eliminates the traffic exposure to an icy deck. While the system does not provide an operational cost savings, it is clear that the safety level at this bridge has been significantly elevated. Maintenance crews include the SB bridge when treating the adjacent roadways with sodium chloride. Given that each spray treatment with liquid de-icer costs 18 times the cost of treating with sodium chloride, FAST system treatments are reserved for filling the gaps between normal operations.

The NHDOT has continued to operate the FAST system since the end of the observation period in 2008. Operation of the system is relatively simple. The control PC at the District Office provides a history of how the system has operated and the relevant weather and pavement conditions. The Technical Advisory Group for the project recommended that the system be incorporated into the replacement deck design. Construction is scheduled for 2018.

