

Innovating Winter Driving Safety with Signal Heat Tape



By Utah Department of Transportation

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Benefits Statement

Utah Department of Transportation's (UDOT) heat tape solution for LED traffic signals enhances safety by ensuring visibility during snowfall, reducing the risk of crashes and protecting maintenance workers. The heat tape saves time by allowing remote activation to clear snow, preventing traffic disruptions without needing to place intersections in four-way flash mode. Cost savings come from lower maintenance expenses and utilizing existing infrastructure, leading to more efficient operations. This energy-efficient system addresses safety concerns while minimizing operational costs, benefiting both motorists and maintenance personnel.

In this case study you will learn:

1. How UDOT's heat tape solution for LED traffic signals improved visibility during snowstorms, reduced crashes and protected maintenance workers from hazardous conditions.
2. How the remote activation system allowed for quick, localized responses to snowfall, preventing traffic disruptions without needing to place intersections in four-way flash mode.
3. How UDOT's implementation utilized existing infrastructure and promoted energy efficiency to reduce operational expenses and environmental impact.

BACKGROUND

Since the change to LEDs, traffic signals can become snow packed, making it impossible to see the lights – a significant safety issue. Almost 100% of the energy of LED traffic signal lights is visible light, whereas incandescent bulbs offer 80% of heat loss and only 20% visible light. As a result, LEDs do not produce heat to the traffic signal lens or face of the traffic signal display. Therefore, LEDs do not provide a “melting” element to traffic signals in the northern climates that experience snow and ice conditions like incandescent lenses typically do. 39 states and over 70% of the population of the United States are located in snowy regions that receive at least five inches of snow each year and the issue of snow buildup in LED traffic signals is a problem that several states around the country deal with each winter as winters can bring heavy, blowing snow storms.

UDOT’s current method to clear snow off the signal face is to use a toilet brush on an extension handle to scrub snow out of the head or to scrape the faces with an ice scraper while up in a bucket truck. Technicians and drivers are placed at additional risk when workers are doing aerial work during times of poor visibility and slick road conditions.

For years UDOT has been looking for solutions to this safety concern. UDOT also uses snow scoop visors, cone-shaped covers, and angled covers with mixed results. We have developed a solution using heat tape that can be turned on and off remotely using our centralized traffic signal central system using forecasts from our internal meteorologists.

TSMO PLANNING, STRATEGIES AND DEPLOYMENT

UDOT brainstormed for a solution and assembled a Quality Improvement Team to search for solutions to this problem. The diverse team involved engineers from traffic signal operations, maintenance and design as well as electricians who maintain the field devices, others with a strong electronics background and consultation with our meteorologists. Utilizing a partial vendor-provided solution, UDOT developed an approach that utilized our vast ITS network already in place with simplified operations, maintenance and upkeep, and done in a way to greatly reduce unneeded energy and prolong the lifespan of the tape, thus helping us be more environmentally conscious.

The heat tape currently used is custom cut to fit the traffic signal visors. Using spare conductor wires in the signal cabling, the heat tape is installed on the underside of the visors. In the signal cabinet, a relay interface is used to join the spare wires connected to the heaters and AC power from the power pedestal. Two wires are then connected from a terminal strip on the back panel inside the cabinet to the relay. This provides the interface with the signal controller. Custom user logic is programmed in the controller, which maps the heaters to a special function output. When this special function is enabled remotely via UDOT’s central traffic management system, the heat tape turns on.

To go one step further, intersections are grouped via specifically defined regions (Areas) that may be impacted by a particular storm. Having intersections split out this way allows users at UDOT’s Traffic Operations Center to enable heat tape at multiple locations with a single command, rather than having to enable the heat tape at each individual location. This technique also allows the various regional areas to be turned on independently, so the heat tape doesn’t get activated statewide if there’s only a localized storm affecting only northern Utah, for example.

COMMUNICATIONS PLANNING AND EXECUTION

UDOT has instilled a culture of innovation over the years and has encouraged all employees (at all levels) to innovate and to submit their ideas. We tested and vetted several other options first and found a solution that worked best with a high degree of certainty (heat), but was done in a way where the maintenance upkeep was greatly minimized (e.g. bypassed the need for temperature/humidity probes). Once we had done the research, gaining support from all levels at UDOT was easy to do.

In regards to our local partners, we do have a strong collaboration with them and jointly share and operate our traffic signal central system and ATMS network so government agencies can provide a seamless and integrated transportation network to the traveling motorists. Since the Department implemented our first phase, some of our local partners have expressed interest in following suit on this project. Every quarter we meet with our local municipalities and this project has been a discussion item at least two times we have met. In addition, this technology has been showcased to other DOTs (including Wyoming and the country of Japan) and the instructions/procedures on how to implement this technology has been sent to several other DOT's outside of Utah.

OUTCOME, BENEFITS AND LEARNINGS

The heat-tape has been installed at over 140 intersections in Utah. The biggest impact of the project is enhanced safety for both those traveling and those maintaining our roadways and signals. There is also an operational benefit to the heat tape, where previously if the signal head lens were covered in snow and we are aware of it, we would remotely place the intersection in a four-way flash for safety reasons until a technician can clear the snow from the signal head. The four-way flash would negatively impact traffic mobility for both the traveling public as well

as our snow-plows clearing the road of snow.

The heat-tape project improved safety in several ways. First, it helps make signal head indications visible to the traveling public. We are aware of at least one fatal crash that can be attributed to the driver's inability to see which indication was lit up due to snow pack. Second, technicians don't have to be in traffic or in a bucket truck cleaning snow and ice off the signals when the roadway is slippery and wet. Third, the project utilized the existing communications network and traffic signal central system, advanced controllers and spare wires that were already in place.

Signal heads are now more visible for those driving our roadways. In addition, our signal heads are strategically placed in the center of the lanes so if lane lines are not visible due to snow motorists know where to drive to be in the middle of the lane. Keeping the signal heads visible during snowy weather helps keep vehicles in their lane so the vehicle detection system operates better. Also, it's no longer necessary to flash the intersection red/red remotely for safety reasons when the signal heads get packed with snow/ice.