



Caltrans Division of Research,
Innovation and System Information

Research

Notes

Traffic Operations

AUGUST 2022

Project Title:
Self De-Icing LED Signals

Task Number: 2954

Start Date: September 1, 2015

Completion Date: June 30, 2022

Task Manager:
Jerry Kwong
Transportation Engineer, Electrical
jkwong@dot.ca.gov

Self De-Icing LED Signals

Develop multiple prototypes of a new type of self de-icing LED signals for highway signalized intersections and railroad signaling applications.

WHAT IS THE NEED?

Signalized intersections with snow-covered traffic signals must be treated as four-way stop controlled intersections. However, this practice increases delay and decreases intersection performance and may not be able to prevent fatal accidents in inclement weather. The drivers of vehicles cannot read the snow-clogged LED signal lights and safely come to a complete stop. In inclement weather, the wind direction dominates the snow patterns that affect the buildup and accumulation of snow and ice in the signal hoods. As a result, highway intersections often have snow-covered LED signals on only one or two approaches. This means that all of the other approaches will continue to obey the traffic signal, and so the four-way stop driving practice will not be followed. This will put those drivers who are unable to see the signal faces, in a potentially hazardous situation resulting in dangerous crossing collisions.

WHAT ARE WE DOING?

This proposed project will develop multiple prototypes of a new type of self de-icing LED signals for highway signalized intersections and railroad signaling applications and validate them using the field tests. The concept — “Heated Lens Lighting Arrangement” — has been thoroughly tested in 2014. A non-provisional patent application (No. PCT/US14/53503) was filed on Aug 29, 2014.

The self de-icing LED signal light is designed as a swappable system with the existing LED and incandescent signal lights to avoid the high cost of replacing an entire system with new equipment. By design, the self de-icing LED signal light does not alter the functions and sizes of the existing signals. No extra



DRISI provides solutions and
knowledge that improves
California's transportation system

installations other than “re-lamping” are needed. There is no need to change anything outside of the signal housing, e.g., additional wiring or increased electric power capacity of the signal controller cabinet. Manual labor to sweep the snow and ice off the lens or paint chemicals on the lens to prevent their buildup is no longer needed. Thus, replacing the existing “cool” LED signals with the self de-icing LED signals can gain an annual overall user cost saving of approximately \$28.10/signal light over a service life of 11.4 years, with a payback period of 4.51 years. Given the potential number of signals that can be swapped out with the new ones, the potential payoff for practice is huge. For example, a large community such as New York City with 12,460 signalized intersections may save 8.4 million dollars/year.

WHAT IS OUR GOAL?

The self de-icing LED signal light is aimed to solve a well-known problem of the existing LED signal light that does not generate sufficient heat in the forward direction towards the lens of the signal necessary to melt snow and ice. Snow and ice can easily accumulate on the lens within the signal hood in wintery conditions and block light to the drivers of vehicles or locomotive engineers. This can decrease the performance of signalized intersections and railroads and also result in collisions in inclement weather conditions. This is a problem in the snowy regions in North America for which a viable retrofit has not been developed or tested.

WHAT IS THE BENEFIT?

The new self de-icing LED signals have two significant benefits, including (i) safety and performance efficiency and (ii) overall user cost savings, which are expected to transform the use and operation of the existing signal lights in snowy regions in North America. Once validated in this proposed project, the self de-icing LED signal light is expected to be a viable retrofit to the existing “cool” LED signal lights and other obsolete energy

inefficient incandescent signal lights installed at the highway signalized intersections and railroad wayside and at-grade crossings. Additionally, the self de-icing LED signal light is expected to extend into other rail applications (e.g., commuter or light rail), or in other surface transportation applications including airport taxiway/apron lighting and seaport applications located in cold weather zones. Although the self de-icing LED signals are targeted for colder weather regions, they can certainly be installed in warmer climate where they may see only a limited number of cold weather days.

WHAT IS THE PROGRESS TO DATE?

During this quarter of the project, the accomplishments are as followed:

- Continued collection of the ongoing field test data.
- Completed final report.