

TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (University or Contractor): __Kansas DOT__

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Project Number TPF-5(351)	Transportation Pooled Fund Program - Report Period: <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input checked="" type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 4 – December 31)	
Project Title: Self De-Icing LED Signals		
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Lead Agency Project ID: RE-0721-01	Other Project ID (i.e., contract #):	Project Start Date: August 15, 2016
Original Project End Date: August 2019	Current Project End Date: August 2019	Number of Extensions: 0

Project schedule status:

On schedule
 On revised schedule
 Ahead of schedule
 Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Total Percentage of Work Completed
\$240,000	\$4,158	

Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Completed This Quarter
\$4,158	\$4,158	

Project Description:

This pooled fund project will develop new self de-icing LED signals for highway signalized intersections and railroad signaling applications to solve a well-known problem of the existing LED signal light whose lens is too cool to melt snow and de-ice in wintry conditions. The self de-icing LED signals will adopt two novel architectures (Figure 1), including (a) “Heated Lens Lighting Arrangement” (non-provisional patent application No. PCT/US14/53503, filed on Aug 29, 2014) that uses a single high-power LED and (b) “Heat Arrangement of LED Arrays in Low Profile” (Provisional patent application filed on April 15, 2016) that deploys multiple LEDs. The heat generated by the LED(s) is harvested by the passive heat exchanger and stored to heat the lens for melting snow and de-icing in wintry conditions.

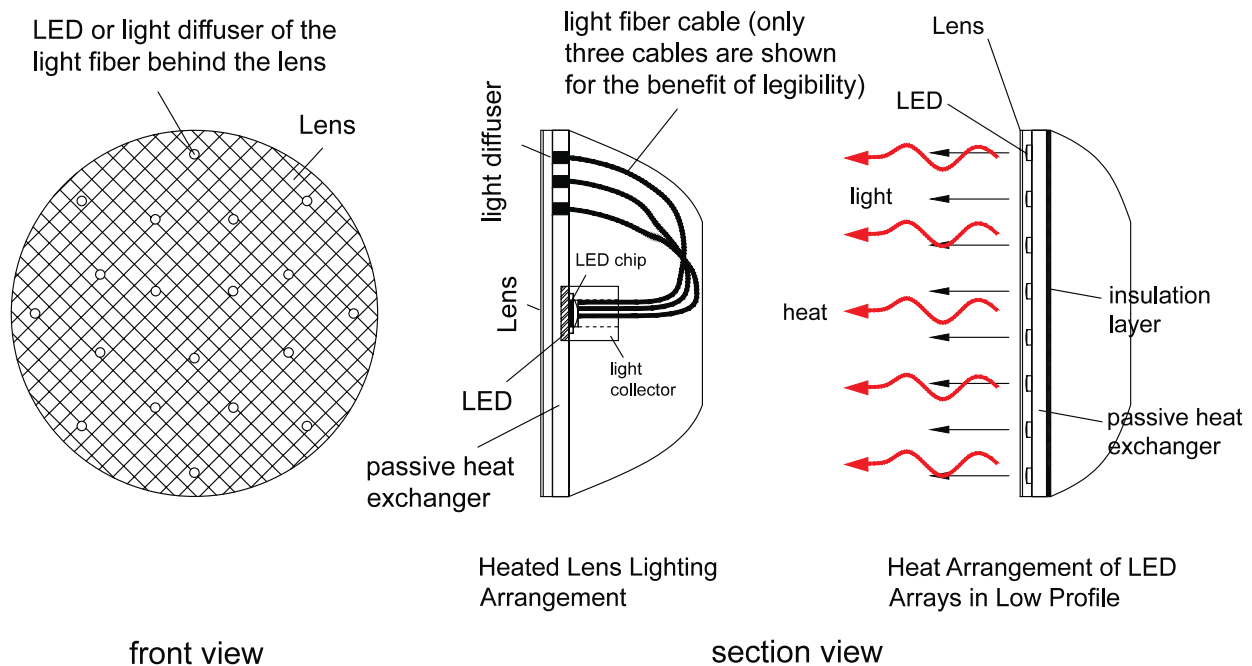


Figure 1 The concept of the self de-icing LED signal light, which adopts new architecture of “Heated Lens Lighting Arrangement” or “Heat Arrangement of LED Arrays in Low Profile”

Fully working prototypes of the self-de-icing LED signals are under development and tests in the laboratory. They will be tested in closed-course settings and then in field on highway intersection and railroad wayside or at-grade crossing signal lights. Each participating agency is required to provide support of three years of funding (\$20,000/year, totaling \$60,000) and will be guaranteed a field test site in each state for testing the custom-made prototypes catering to their specific needs of the new type of signals. The research team will work with each participating agency to identify the desired test site on highway intersections or rail track sections and the desired technical specifications of the prototypes.

The investigative approach for the proposed project is divided into the three stages. Work in Stage 1 is underway that focuses on laboratory development and tests. Work in Stage 2 will focus on testing the three prototypes in a closed-course setting, for example, mounted on the roof of the University of Kansas engineering complex and powered by the signal controller cabinet. Work in the third and final stage will involve field testing of the developed prototypes on identified highway signalized intersections and rail track sections. On-site demonstration of the prototype signals will also be held for project partners and state DOTs to initiate the implementation process. A final report will provide all relevant data and results along with plans for implementation of the self-de-icing LED signals in affected states.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

This pooled fund project was officially kicked off on Aug. 15, 2016. Two tasks were completed before August 2016. An expert panel meeting was held in early March. Discussions were held on desired specifications of the prototype signals and possible field test sites as well as the field evaluation of the prototypes. A provisional patent of “Integrated Illumination, Heating, Ventilation, and Air Conditioning” was filed on April 15, 2016, which covers the invention of “Heat Arrangement of LED Arrays in Low Profile” deployed in the self de-icing LED signals.

Other tasks have also been completed in this quarter of Aug. 15, 2016 – Sep. 30, 2016 or have been started. In Aug 2016, six states (Kansas, California, Michigan, New Jersey, Wisconsin, and Pennsylvania) have officially participated in this research for field tests and evaluation of the prototypes. Necessary equipment, components and materials are being procured to develop and build the prototypes and test for their thermal and lighting performance to meet all requirements. Appropriate color LED modules, which are not available in the market, were designed in-house and custom-made with the aid of the industrial partner. Three preliminary prototype signals (Red, Yellow, and Green) have been developed in house, each deploying 26 custom-made color LEDs mounted in an array via “Heat Arrangement of LED Arrays in Low Profile”. They are under laboratory testing for improvements. The second type of signals that deploy a single high-power LED and multiple optical fibers via “Heated Lens Lighting Arrangement” are under development in house. For the second type, appropriate high-power color LED modules are not available in the market; thus, are designed in house and under development with the aid of the industrial partner.

Anticipated work next quarter:

Starting from Oct. 01, 2016 till Dec 31, 2016, we are planning to conduct the following tasks.

1. Develop the second type of signals that deploy a single high-power LED and multiple optical fibers via “Heated Lens Lighting Arrangement”. Custom make appropriate high-power color LED modules, which are not available in the market, with the aid of the industrial partner.
2. Design and custom make new lenses, housing, light collector, and accessories for the self de-icing LED signal lights.
3. Start to make fully working prototypes of different types of self de-icing LED signals with all of the new materials, devices and accessories, and continue to test them in laboratories in Stage 1.
4. Prepare to test the fully working prototypes in closed-settings in the first quarter (winter) of 2017 in Stage 2.

Significant Results:

As of Sep 30, 2016, we have achieved the following significant results.

- This project was launched in Aug 2016 with six participating states (Kansas, California, Michigan, New Jersey, Wisconsin, and Pennsylvania) and an initial budget of \$240,000. Maryland is expected to officially join the study by the end of this year with additional contribution of three years funding.
- An expert panel meeting was held in early March. Discussions were held on desired specifications of the prototype signals and possible field test sites as well as the field evaluation of the prototypes.

- A new provisional patent of “Heat Arrangement of LED Arrays in Low Profile” was filed in April 2016.
- Necessary equipment, components and materials are being procured to develop and build the prototypes and test for their thermal and lighting performance to meet all requirements.
- Appropriate color LED modules, which are not available in the market, were designed in-house and custom-made with the aid of the industrial partner.
- Three prototype signals (Red, Yellow, and Green) have been developed in house, each deploying 26 custom-made color LEDs mounted in an array via “Heat Arrangement of LED Arrays in Low Profile”. They are under laboratory testing for improvements.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None.