



Caltrans Division of Research,  
Innovation and System Information

# Research



# Results



Maintenance

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**Project Title:**  
Obstacle Detection in Extreme  
Weather

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## Preliminary Investigation of Thermal Infrared Camera-based Obstacle Detection for Snow Plows and Tow Trucks

Evaluate the effectiveness of commercially available thermal infrared camera-based obstacle detection in improving safety and efficiency in snowplow operations

### WHAT WAS THE NEED?

Heavy snowfall and dense fog reduces driver's visibility. California Department of Transportation (Caltrans) snowplows often operate in heavy snowfall to keep roads open. In addition, emergency tow trucks operated on Bay Area bridges by Caltrans, must respond to collisions in all weather conditions including the dense fog often encountered in the San Francisco Bay Area. In both conditions, pedestrians are more likely to be present on the highway. For example, vehicle occupants may exit their vehicle after a collision while waiting for the emergency tow truck.

### WHAT WAS OUR GOAL?

The goal is to review existing applications of infrared (IR) cameras for advanced driver assistance and their pros and cons under low visibility conditions, such as dense fog, for potential incorporation into Caltrans operations.

### WHAT DID WE DO?

This Preliminary Investigation (PI) reviewed the leading IR camera-based obstacle avoidance and driver assistance technologies. The assessment included:

- Conduct a survey of other state Department of Transportations (DOTs), other knowledgeable individuals, or organizations to determine challenges to support maintenance activities on roads under low visibility conditions and the measures currently adopted to tackle these challenges.



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- Identify and summarize published literature and perform a review of existing research on the application of IR cameras for advanced driver assistance and its pros and cons under low visibility conditions, e.g., dense fog. This PI developed a list of commercially available IR camera-based obstacle detection hardware for driver assistance.
- Literature review included assessment of IR camera technologies (hardware) as well as the software that use such images to automatically detect obstacles and inform the driver of their existence. This PI summarizes the state of suitable technologies and the commercially available hardware/software solutions for obstacle detection in low visibility conditions with emphasis on IR imaging technologies.

## WHAT WAS THE OUTCOME?

Seventeen state DOT personnel responded to the survey questionnaire. The survey determined that heavy snowfall and dense fog are the most commonly reported causes of low visibility conditions from responding DOTs. The following are mitigations and safety measures employed by DOTs when encountering low visibility conditions:

- Use low visibility condition detection systems to warn the traveling public and lower the speed limit using message signs
- Add and/or improve maintenance vehicle headlights and fog lights with new LED lights
- Slow down or pause operations
- Add more/better street lighting

Moreover, this PI identifies gaps and provides recommended next steps. The resulting document informs the Caltrans Division of Maintenance regarding adoption of the latest technologies to improve safety in operations taking place under low visibility conditions.

## WHAT IS THE BENEFIT?

The PI includes a conclusive discussion on whether IR-based Advanced Driver Assistance System (ADAS) systems have potential to improve safety in operations taking place in poor visibility conditions. It also includes a list of ADAS products that use IR cameras for obstacle detection, including a tabulation of the important specifications for each product.

## LEARN MORE

To view the evaluations, contact:  
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