



Caltrans Division of Research,  
Innovation and System Information

# Research



# Results

Transportation  
Safety and  
Mobility

**MAY 2013**

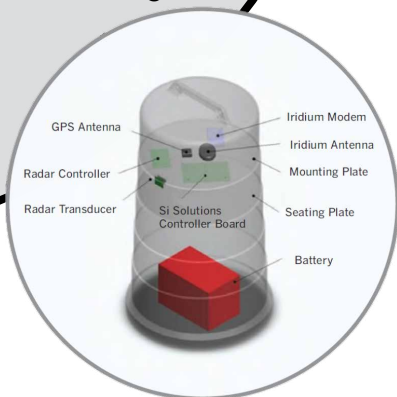
**Project Title:**  
iCone Deployment

**Task Number:** 2250

**Completion Date:** June 30, 2012

This project evaluated the effectiveness of portable traffic monitoring device technology to enhance the safety, security, and efficiency of highway work zone operations.

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## Evaluating iCone Traffic Sensors for Work Zone Operations

Improving the safety of work zones with flexible and reusable portable traffic monitoring devices

### WHAT IS THE NEED?

Roadside construction and maintenance work zones affect safety and mobility. One of the main concerns for Caltrans employees and contractors is speeding motorists, but having law enforcement present in every work zone to deter speeders is cost prohibitive. In addition, work zone lane closures can cause traffic queues with associated delays. To promote safety and highway efficiency, it is important to monitor traffic speeds in work zones, provide motorists detour information, and notify traffic managers of projected delays. Yet, to address these concerns, it is not feasible to embed fixed instrumentation in all work zones.

Portable traffic monitoring devices (PTMDs), such as the iCone, offer a flexible, less expensive alternative to monitor lane closures. Weighing about 60 pounds, the iCone can be easily placed in work zones on short notice.

It transmits real-time traffic information to a web server, where the data can be viewed by traffic management personnel via a web browser. The iCone consists of a durable, waterproof barrel that contains a computer chip, circuit board, GPS device, radar sensor, and networking capability.

### WHAT WAS OUR GOAL?

The goal was to evaluate the effectiveness of PTMDs to monitor traffic during lane closures, gather data for work zone safety-related research projects, and accurately measure speed in various scenarios.

### WHAT DID WE DO?

Caltrans, in partnership with the University of California, Berkeley Partners for Advanced Transportation Technology (PATH),



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deployed iCones in various lane closures in the San Francisco Bay Area (Caltrans District 4) to test their operational effectiveness to remotely monitor traffic behavior and make adjustments as necessary. The researchers also conducted a more quantitative test of five iCones along I-80 to compare their speed measurement accuracy to that of conventional inductive loop sensors.

Another study evaluated the effectiveness of automated, radar-activated signage to slow traffic through work zones to increase worker safety. Six iCones were employed to measure the average speed of vehicles traveling through various work zones.

This project also procured two permanently mountable units that are currently installed on the San Francisco–Oakland Bay Bridge. The units monitored traffic speeds around the “S-curve” detour, where traffic incidents had increased because of the unfamiliar roadway geometry.

## WHAT WAS THE OUTCOME?

The iCones are easy to install. To monitor traffic speed, the operator places the unit in the selected location, positions the arrow on the top toward the oncoming traffic, and then switches it on. Retrieving information from the website also works well. The portable units are generally accurate in monitoring traffic speeds and queue lengths in temporary work zones in District 4. The iCones are also effective in slowing traffic through work zones by sending data to automated signage.

The five iCones that were evaluated for measuring speed gathered fairly accurate information from the outermost lanes of the six-lane freeway, which were closest to the units. However, they tended to underestimate vehicle speeds in the innermost lanes that were furthest from the iCones. The vehicles in the closer lanes also tended to block the radar transmitter’s view of the further and faster lanes, so the units tended to select sample targets from the nearest lane, resulting in this lane being more represented than others.

Because of this behavior, iCones are most effective when measuring speeds across roadways of only one or two lanes.

## WHAT IS THE BENEFIT?

The iCone is an effective tool for rapidly acquiring information about traffic in and around work zones, without investing in permanent infrastructure. The unit is portable, easy to set up, and affordable. It can provide valuable information to lane closure managers, resident construction engineers, maintenance supervisors, and transportation researchers about traffic speed. This information can be used in conjunction with signage and enforcement to increase safety for roadside workers. It can also be used to mitigate congestion caused by lane closures by advising managers in real time when congestion traffic queues are happening.

## LEARN MORE

To view the evaluations:

[www.dot.ca.gov/research/researchreports/reports/2012/path\\_icone\\_report\\_april\\_2012\\_w\\_tech\\_doc\\_&\\_discl\\_pgs.pdf](http://www.dot.ca.gov/research/researchreports/reports/2012/path_icone_report_april_2012_w_tech_doc_&_discl_pgs.pdf)

[www.dot.ca.gov/research/researchreports/reports/2010/saic\\_final\\_california\\_6-14-2010.pdf](http://www.dot.ca.gov/research/researchreports/reports/2010/saic_final_california_6-14-2010.pdf)

## IMAGE



An iCone transmits vehicle speeds to a changeable message sign.