

Transportation
Safety and
Mobility

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Project Title:
Bluetooth/Wi-Fi Travel Time
Measurement System

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Task Manager:
Joe Palen
Senior Materials and Research Engineer
japalen@dcn.org

Measuring Travel Time Using Bluetooth Readers

Bluetooth readers reduce costs for measuring traffic flow

WHAT WAS THE NEED?

Travel time is a key consideration for most travelers when deciding if and when to embark on a trip and which route to use, especially when passing through areas with known congestion, where travel time can vary widely. Caltrans has been collecting speed, volume, and occupancy data at vehicle detection stations for several decades. Recently, it began using this data to derive travel time information and placing it on roadside changeable message signs and the Internet. Motorists have come to rely on this real-time travel information.

Currently, travel time is extrapolated through a complex algorithm of calculating the average traffic speed between points and then estimating the time needed to travel between the points. The sensors used to detect speed require accurate calibration to generate reliable data and are expensive to install and maintain. In addition, many areas do not have enough functioning traffic detectors or have gaps in sensor coverage. Caltrans needs an affordable and reliable travel time measurement system that can be quickly and easily deployed anywhere. Bluetooth technology has the potential to generate accurate travel time with minimal deployment costs.



Installing Bluetooth readers typically takes no more than 5-10 minutes per site. If the reader contains a battery-powered unit, it can be mounted almost anywhere.



WHAT WAS OUR GOAL?

The goal was to develop a simple, inexpensive system using Bluetooth technology to accurately and reliably measure real-time travel flow along roadways to inform motorists of travel times and help reduce congestion.

WHAT DID WE DO?

Caltrans developed a methodology that uses the unique electronic signatures of Bluetooth devices carried by travelers or built into vehicles to measure a motorist's actual travel time. Bluetooth readers installed on the roadside pick up the device's signature as the vehicle passes by and stores it in a database so that it can be reidentified at another point on the roadway. To protect personal privacy, the database does not associate the electronic signature with any person or institution. After the travel time is determined, the information has no more value and is deleted from the database. The Bluetooth reader was designed to use solar power so that is not dependent on an installed power source, offering greater versatility for placement.

During testing, the Bluetooth readers were typically mounted directly to roadside signal controller cabinets, which provided both power and back-haul communications. The readers measured travel time for a variety of roadway types, from 10-lane urban freeways to 2-lane rural roads.

WHAT WAS THE OUTCOME?

The Bluetooth reader was able to reidentify 5% to 10% of the passing vehicles between any two points, yielding a statistically valid representation of the true travel time. Reducing travel time is the primary incentive for high-occupancy vehicle (HOV) lanes. The field test data showed that the travel time was measured so accurately that it is possible to calculate HOV travel time savings compared to the adjacent non-HOV lanes.

For the next generation, the researchers will add flexible solar panels that wrap around light poles to simplify the installation. Wireless communications using cell phone modems will also be included to make the Bluetooth readers self-contained devices that do not require connections for either power or communications. This design approach enables the readers to be quickly installed at any location.

WHAT IS THE BENEFIT?

Motorists rely on real-time travel information to determine departure times, routes, and whether to take advantage of public transportation. Providing travel time data can reduce congestion and help use roadways more efficiently. Bluetooth technology offers reliable and accurate data to calculate travel time, and readers can be quickly and easily installed. The Bluetooth readers can be used in harsh environments where it has been difficult and expensive to set up other forms of round-the-clock traffic detection. They also allow Caltrans to measure travel times on signalized arterial roadways, which has not previously been possible.

LEARN MORE

For more information about the research:
www.dot.ca.gov/research/operations/bluetooth_web_page/intro.html



Posted travel times on changeable message signs is popular with the traveling public.