

2009 ITS Project of the Year Award

Finalist Project

Bluetooth Probe Data for Transportation System Management



System “probes” is a broad term used to describe the monitoring of a sample of transportation system users as they pass predefined checkpoints. To provide the most comprehensive assessment of performance, the ideal probes span multiple modes such as automobile, transit, and pedestrian facilities. Although the field of Intelligent Transportation Systems is nearly 20 years old, the use of probe data has been extremely limited. This

lack of probe data has created a huge challenge for professionals charged with managing system operation, when one of their fundamental performance indicators, travel time, was not readily measured. In 2008 the Indiana Department of Transportation (INDOT) pioneered the tracking of Bluetooth enabled consumer electronics.¹ Fundamentally, this technology enabled rapid, low cost, wide deployment of sensors that provide agencies with space-mean speed estimates over roadway segments. Historically, the type of data has only been available to agencies that could leverage market penetration of toll-tags and install relatively expensive roadside readers.

Since April 2009, Indiana has deployed over 50 portable and fixed Bluetooth Monitoring sites along 300 miles of Interstate Routes (I-65, I-465, and I-69), 100 miles of signalized arterials, and security screening points on Concourse B at the Indianapolis International Airport. On rural sections of I-65, sensor spacing is up to 80 miles, in denser signalized urban areas, sensor spacing is as close as 0.25 miles, and in the pedestrian oriented airport security line application, sensor spacing is approximately

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¹ Wasson, J.S., J.R. Sturdevant, D.M. Bullock, “Real-Time Travel Time Estimates Using MAC Address Matching,” *Institute of Transportation Engineers Journal, ITE*, Vol. 78, No. 6, pp. 20-23, June 2008.

500 ft. In critical regions subject to recurring highway congestion, sensors are monitored in real-time to facilitate traffic management decisions and update dynamic message signs with current travel delay. Indiana has aggressively documented their efforts^{2 3 4} resulting in rapid adoption of this technology on a national scale, as well as the emergence of several private sector vendors offering products and services.

Collaborating Organizations and Roles

- **INDOT:** Conceived of idea and initiated aggressive deployment to support traffic management.
- **Purdue University:** Sensor design and data processing algorithms.
- **Iron Mountain Systems:** INDOT's private sector system integrator that assembled real-time data collection software and implemented algorithms.

Project Lead: Indiana Department of Transportation in collaboration with Purdue University and Iron Mountain Systems

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² Haseman, R.J., J.S. Wasson, and D.M. Bullock, "Real Time Measurement of Work Zone Travel Time Delay and Evaluation Metrics," Transportation Research Board Paper ID:10-1442, submitted July 2009.

³ Day, C.M., R.J. Haseman, H. Premachandra, T.M. Brennan, J.S. Wasson, J.R. Sturdevant, and D.M. Bullock, "Visualization and Assessment of Arterial Progression Quality Using High Resolution Signal Event Data and Measured Travel Time," Transportation Research Board Paper ID:10-0039, submitted July 2009

⁴ Bullock, D.M., R.J. Haseman, J.S. Wasson, and R. Spitler, "Anonymous Bluetooth Probes for Airport Security Line Service Time Measurement: The Indianapolis Pilot Deployment," Transportation Research Board Paper ID:10-1438, submitted July 2009.