



INDOT Research

# TECHNICAL *Summary*

Technology Transfer and Project Implementation Information

TRB Subject Code: 55-03 Traffic Flow Capacity and Measurements  
Publication No.: FHWA/IN/JTRP-2002/19

June 2002  
Final Report

## **Improving Efficiency of INDOT Traffic Data Collection Using GPS Devices**

### **Introduction**

INDOT has utilized many new technologies to reduce travel delay, mitigate traffic congestion, and enhance public and employees' safety. Many projects are underway, including re-timing of most existing traffic signals and pavement maintenance and rehabilitation. INDOT engineers are frequently required to collect traffic data such as travel time, travel speed, and delay in order to evaluate system performance, prioritize alternatives of improvement, and conduct before and after studies.

Issues, such as safety, efficiency and cost, may arise associated with the current data collection methods. For the current manual or automatic data collection, it usually requires two operators, a driver and a recorder. The current methods also require much time for data processing and the resulting data files may not be reusable. With the global positioning system

(GPS) technologies, it appears that traffic data collection can be performed more safely and efficiently.

The objective of this study is to investigate the use of the GPS technologies to improve efficiency of INDOT traffic data collection, to enhance field operation safety and to reduce potential human errors. Primary emphasis is given to utilization of GPS receivers to acquire the traffic data so as to generate a reusable data file. This kind of data files is essential for providing INDOT traffic engineers with consistent information for assessing the performance of signal systems. Secondary emphasis is given to use of the GPS data files in specific transportation studies, such as travel time and delay studies, work zone studies and congestion management.

### **Findings**

In this study, the GPS technique was examined and a specific GPS device, AgGPS<sup>TM</sup>132 device was tested using the precisely known geographic points as references. A computer program, **GPS-Trek**, was developed for data collection and data processing. A huge amount of data was collected over the selected routes. Based on the results of analysis and field tests, a summary of the major findings are presented below:

The proposed GPS data collection system is inexpensive and cost-effective. It can improve the efficiency of traffic data collection, save manpower and enhance field operation safety. The AgGPS<sup>TM</sup>132 receiver can provide traffic data of high accuracy and consistency. The field data may exhibit gaps in "deep" urban

canyons. However, through interpolation and proper data screening for spurious effects these disadvantages may be limited. The removal of Selective Availability from the GPS signals considerably lessened the need for DGPS services. It was shown that the relative positional accuracy using a DGPS service is well below the 0.5 meter level.

The **GPS-Trek** consists of two components, one for data collection and the other for data processing. The program is free of personal interpretation during data collection and provides a consistent system of analysis. The data saved in the resulting files are versatile and reusable. The format of the data file is specially designed so that the data can be handled

efficiently. The data file can also be easily exported to Microsoft® Excel, allowing traffic engineers to utilize their own experience and judgment for data analysis and specific transportation studies.

A modified equation is presented to estimate the sample size requirements for field data collection. It is shown that in the filed tests, the modified equation can produce a realistic estimate of the minimum sample size. Generally, a minimum of three initial test runs should be performed. If possible, five initial test runs for 90% confidence or six for 95% confidence are required to reduce the potential errors.

## Implementation

The SPR-2392 research group proposes that the system developed in this study be considered as a standard method for INDOT traffic data collection and analysis. Workshops will be conducted to provide instruction for initializing and operating the system, running the **GPS-Trek program**, creating worksheets and generating graphical reports. Brainstorming sessions will be scheduled to explore use of the system and the highly accurate and dense data in highway inventory system.

Trials conducted during this phase of the study reveal that the analysis will be greatly enhanced if a state-wide traffic signal data base is being integrated as a layer under the existing

The proposed system can be readily used for various transportation studies. It bases its procedures on the existing INDOT highway digital map, resulting in a great saving in terms of manpower and time by avoiding the need to create a high resolution base map. The system also allows us to mark land marks during data collection or data processing. As a result, it is possible for us to provide graphical reports, such as vehicle trajectory and speed profile that are required in the Manual of Transportation Engineering Studies and get a full picture of traffic performance on the test route.

base map. The by-product of this research is an improved state route database. Further studies are needed so as to reveal how to imbed the traffic positional data into the state route data base on a regular basis and address issues at the management level.

It is proposed that this feasibility study lead to possible implementation and new test trials to be conducted in one or more INDOT districts. Experience gathered during these trials will lead to improved and more detailed manuals of operation of the GPS data collection system.

## Contacts

*For more information:*

### **Dr. Shou Li**

Principal Investigator  
Indiana Department of Transportation  
Division of Research  
P.O. Box 2279  
West Lafayette, IN 47906  
Phone: (765) 463-1521  
Fax: (765) 497-1665

### **Dr. Karen Zhu**

Co-Principal Investigator  
Indiana Department of Transportation  
Division of Research  
P.O. Box 2279  
West Lafayette, IN 47906  
Phone: (765) 463-1521  
Fax: (765) 497-1665

### **Prof. B.H.W. van Gelder**

Co-Principal Investigator  
School of Civil Engineering  
Purdue University  
West Lafayette, IN 47907-1284  
Phone: (765) 494-2165  
Fax: (765) 496-1105

### **Purdue University**

Joint Transportation Research Program  
School of Civil Engineering  
West Lafayette, IN 47907-1284  
Phone: (765) 494-9310  
Fax: (765) 496-1105