



Global Positioning System (GPS) Data

OM
3



Photo: Courtesy of Western Transportation Institute

Description: A global positioning system (GPS) is a worldwide satellite-based navigation system that allow users with a GPS receiver or tracker to obtain location data. A GPS receiver, cell phone, or mobile computer with GPS capabilities can be used to log your current location, which is useful for resource mapping, mapping a crash scene, and similar activities. A GPS tracker is a device that can be installed on a vehicle to track its location at intervals; this data can be stored on the device itself or transmitted to a central database. These functions are useful for navigation systems, real-time traffic conditions (vehicle probe), and automatic vehicle location (AVL) (see [#RTM3](#)). GPS data is typically displayed using Geographic Information Systems (GIS) software (see [#TM3](#)). Third-party agencies provide GPS data that they have obtained and archived. Third party data is created using historical and real-time GPS data that is generated by cell phones, smart phone applications, and automatic crash notification systems (see [#ES4](#)). These devices capture information on location, time, and travel speed at intervals, which is then collected by private firms. [Third party GPS data](#) can provide agencies with a broad range of data to purchase.

Rural Transportation Critical Needs

- Crash Countermeasures
- Emergency Services
- Operations & Maintenance
- Rural Transit & Mobility
- Surface Transportation & Weather
- Tourism & Travel Information
- Traffic Management

Issues Addressed

- Resource Mapping and Monitoring
- Central Data Storage
- Icing of Roads
- Avalanches
- Maintaining Cameras
- Commercial Vehicles
- Prioritizing Snow Removal

Strategies Achieved

- Road User
- Road
- Vehicle
- Safety Culture
- Engineering
- Emergency Response
- Enforcement
- Education





Applicability

•GPS data can be used in a wide variety of transportation applications, including mapping resources or events, traffic information, and fleet management. GPS equipped vehicles can provide real time traffic information, while also allowing an agency to quickly dispatch emergency response vehicles or maintenance personnel when necessary. GPS provides a highly accurate record of location. In rural areas where cell phone coverage can be spotty, a GPS receiver or tracker is more effective at providing location information.

Partnerships

- Applications benefit from collaboration among numerous agencies, which may include:
 - Departments of Transportation (Federal, State, Local)
 - Metropolitan/Rural Planning Organization
 - Transit Agencies
 - Trucking Companies
 - Public/Private Service Agencies
 - First Responders

Key Components

- GPS Receiver or Tracker
- GPS Data Vendor Contract (third-party data)
- Computer
- Central Database
- Trained Personnel

Examples of Implementation

• Roadkill Observation Collection System - Montana

Montana State University in partnership with Federal Land Management Agencies conducted a study using [GPS receivers](#) to log road kill locations in order to determine where and when animal-vehicle interactions were taking place. This data was displayed on maps to determine clusters of road kill observations.

• Commercial GPS Data to Quantify Truck Performance on Rural Roads

Commercial GPS data was collected from multiple commercial trucking businesses in the Puget Sound region (Washington State). This data was used to monitor travel time and manage trucking fleets. This data was used by Washington State Department of Transportation to identify bottlenecks and truck travel times.

• Iowa Department of Transportation's Real-Time Traffic Conditions

Iowa Department of Transportation contracted with INRIX to obtain ["probe data" from fleet vehicles](#) equipped with GPS receivers like connected vehicles, delivery vans, and commercial trucks. This data was used to determine real-time traffic speed to inform travelers of traffic conditions.

• Drive Safe Pennsylvania

As a part of Pennsylvania's 2009 Strategic Highway Safety Plan (SHSP), [EMS vehicles were installed with GPS equipment](#) to quickly locate a crash and make dispatch more efficient. Furthermore, to improve crash data quality, local police were encouraged to use GPS to collect crash location data.





Implementation Considerations (Pro)

- A commercial GPS data vendor can provide large amounts of GPS data from multiple businesses (see Commercial Trucking Example above).
- Commercial GPS data vendors provide technical support and analyze data for an agency.
- GPS data can allow an agency to optimize dispatch of public works vehicles.
- GPS data can help improve response times for emergency vehicles.
- Provides ability to monitor and relay information from the vehicle to a central location in real-time.
- Can provide the agency with the ability to disseminate real-time traffic information.

Implementation Considerations (Con)

- GPS signal can degrade in areas with dense tree cover or canyons.
- Data providers have inconsistent data standards.
- Large amounts of data could require data clean-up for use.

Opportunities for Future Expansion

- Connected vehicles have a GPS tracker that is able to provide locational data to an agency, including real-time traffic information or the location of a crash (automated crash notification systems). As connected vehicles become more common, this will increase the available vehicle probe data.

Additional Resources

- *NCHRP Synthesis 301: Collecting, Processing, and Integrating GPS Data into GIS*, found here: www.trb.org/publications/nchrp/nchrp_syn_301.pdf
- *Applying GPS Data to Understand Travel Behavior*, found here: <http://www.trb.org/Publications/Blurbs/170873.aspx>
- *A Guidebook for Freight Transportation Planning using Truck GPS Data*, found here: http://www.wistrans.org/cfire/documents/CFIRE_0904_FinalReport.pdf





Useful Tip

Cellular phones can be used as a low-cost GPS tracker or receiver to obtain location data.

Cost Range

(Cost/financial information, where noted, is based on 2016 dollars (unless otherwise specified). Cost/financial information is estimated, and will vary based on size and scope of project, number of units, etc. In general, capital costs include initial purchase costs of hardware, software, and other required equipment. Maintenance and operations costs include staff time to operate, monitor and maintain systems; data collection; system upgrades; evaluation; etc.)



Capital Costs: The total capital costs for this tool are low (less than \$50,000) to high (\$100,000 to \$250,000), but will depend on the amount of GPS data needed. The cost of a GPS receiver for an agency to collect data is \$317. If an agency collects its own GPS data, it needs to consider the costs to train staff as well as the costs for data collection, data processing, and data updating. On-board GPS equipment used for automatic vehicle location (AVL) costs \$1,678 per vehicle¹. Third-party data will require a contract with an agency. The cost of these services is hard to estimate because cost will depend on the type and amount of data necessary for a project. Maricopa Association of Governments (Arizona) estimated the cost of INRIX traffic monitoring data to be \$850-\$1067 per mile².

Operations Costs: The maintenance costs for this tool are hard to estimate. An agency will need to consider the costs to obtain and update data, fees for third party data, and staff training costs.

This material is based upon work supported by the U.S. Department of Transportation under Cooperative Agreement No. DTFH6114H00021. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the Author(s) and do not necessarily reflect the view of the U.S. Department of Transportation.

