Information Management

Data Archive
Multimodal Traveler
Information Management
Performance Measurement

Highlights

• Information management systems incorporate data fusion from multiple sources and/or agencies, integration of both real time and archived information, and in some cases, data visualization.

• MAP-21 will require greater use of real time and archived data to support development and monitoring of performance measures.

• Cost is a significant factor – development and maintenance costs vary widely, and benefits are not easily quantified.

Introduction

This factsheet is based on past evaluation data contained in the ITS Knowledge Resources database at: www.itskrs.its.dot.gov. The database is maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments by tracking the effectiveness of deployed ITS. The factsheet presents benefits, costs and lessons learned from past evaluations of ITS projects.

Intelligent transportation systems collect large amounts of data on the operational status of the transportation system. Archiving and analyzing this data can provide significant benefits to transportation agencies.

Archived data management systems (ADMS) collect data from ITS applications and assist in transportation administration, policy evaluation, safety, planning, program assessment, operations research, and other applications. Small-scale data archiving systems can support a single agency or operations center, while larger systems support multiple agencies and can act as a regional warehouse for ITS data.

The 2012 transportation reauthorization law Moving Ahead for Progress in the 21st Century (MAP-21) has set up new requirements for performance-based transportation decision making, including establishing performance measures and targets in seven national goal areas such as congestion reduction and system reliability. Public agencies are seeking real time and archived data to provide metrics and measurements of system performance.

Example uses of archived ITS data include:

• Incident management programs may review incident locations to schedule staging and patrol routes, and frequencies for service patrol vehicles.

• Historical traffic information can be used to develop predictive travel times.

• Transit agencies may review schedule performance data archived from automatic vehicle location, computer-aided dispatch systems and/or automatic passenger counting systems to design more effective schedules and route designs, or to manage operations more efficiently.

As information management and data archiving systems evolve they are moving from archiving information from a single source or system to more complex implementations. In order to provide support for regional operations across jurisdictional and agency boundaries, data fusion from multiple sources and/or agencies, integration of both real time and archived information, and data visualization are being incorporated.
Information management and data archiving from both infrastructure and mobile sources in data environments are also the foundation of the Real-Time Data Capture and Management track of the ITS Research Program.

The collection and storage of data on transportation system performance often occurs at transportation management centers (TMCs). The transportation management centers chapter discusses TMCs in detail. In addition, the transit management chapter discusses the archiving and use of transit performance data.

Benefits

Data archiving enhances ITS integration and allows for coordinated regional decision making. Traffic surveillance system data, as well as data collected from commercial vehicle operations, transit systems, electronic payment systems, and road weather information systems have been the primary sources of archived data available to researchers and planners. Often the benefits of the archived data systems are not easily quantified. The archived data provides information not previously available, and enables analyses of problems and solutions not possible with traditional data. As more advanced data analysis techniques develop and the efficiency of data reporting systems are improved, additional examples of the effectiveness of information management systems will become available. Methodologies for computing the benefits of information management must be developed.

<table>
<thead>
<tr>
<th>ITS Goal</th>
<th>Selected Findings</th>
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<tbody>
<tr>
<td>Customer</td>
<td>In Virginia, a web-based archived data management system (ADMS) was deployed to provide decision makers and other transportation professionals with traffic, incident, and weather data needed for planning and traffic analyses. An assessment of website activity indicated that 80 percent of the website usage was devoted to downloading data files needed to create simple maps and graphics. Overall, users were pleased with the ability of the system to provide a variety of data, but wanted more information on traffic counts, turning movements, and work zones, as well as broader coverage. (2008-00560)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td></td>
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<tr>
<td>Efficiency</td>
<td>In Portland, Oregon, the Tri-Met transit agency used archived AVL data to construct running time distributions (by route and time period) and provide enhanced information to operators and dispatchers. Evaluation data indicated that the reduced variation in run times and improved schedule efficiency maximized the effective use of resources. (2008-00587)</td>
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<tr>
<td>Productivity</td>
<td>The Iowa Department of Transportation (DOT) found that a project to make data reporting and analysis tools available to local law enforcement organizations resulted in an increase in officer-generated crash reports received electronically from 68 percent from 47 percent, allowing the agency to provide statewide crash data on a quarterly basis. At the beginning of the project, the available data was 1.5 to 3 years old. (2013-00882)</td>
</tr>
<tr>
<td>Productivity</td>
<td>A study using archived data at five study locations with a variety of seasonal traffic patterns found that in some situations, up to 75 percent of all days can be missing data at urban locations when calculating annual average daily traffic statistics with archived ITS data. This finding challenges conventional procedures for the calculation of annual average planning statistics. (2013-00873)</td>
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Costs

The costs to develop ADMS vary based on the size of the system and features provided. Based on limited data available from a study of six transportation agencies that have established ADMS, costs for one system was $85,000 and $8 million for another. Four of the six systems were developed jointly with a university. Typically, the state DOT pays for the development with the university hosting the system. Operations and maintenance (O&M) costs were in a closer range, $150,000 to $350,000; these costs were usually on an annual basis.

The University of Maryland hosts the Regional Integrated Transportation Information System (RITIS) which collects, archives, and provides data fusion and visualization for agencies in the Washington, D.C. region and beyond. The system costs about $400,000 a year to maintain and operate (in 2011). Costs for an agency to integrate their data within RITIS have varied depending on the system and effort required for integration from a low of $15,000 to a high of $300,000.
A study of the feasibility and implementation options for establishing a regional data archiving system to help monitor and manage traffic operations in Northeast Illinois estimated the cost for developing software to integrate data from multiple agencies in a region and produce both historical and real-time reports as ranging from $700,000 (low) to $1,000,000 (high) (2011-00221).

Table 2: System Costs of Archived Data Management Systems.

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Source</th>
<th>Min</th>
<th>Max</th>
<th>Cost ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMS</td>
<td>Washington State TRAC System and Caltrans PeMS</td>
<td>$85,000 (initial R&amp;D)</td>
<td>$8,000,000</td>
<td>2008-00173</td>
</tr>
<tr>
<td>Statewide Electronic Crash Data Collection System</td>
<td>Vermont, Virginia</td>
<td>$1,105,000</td>
<td>$2,272,209</td>
<td>2013-00280</td>
</tr>
<tr>
<td>Regional Data Archive</td>
<td>Northeast Illinois Regional Data Archive (estimate)</td>
<td>$700,000</td>
<td>$1,046,000</td>
<td>2011-00221</td>
</tr>
</tbody>
</table>

Table 3: Selected Archived Data Management Costs.

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Source</th>
<th>Min</th>
<th>Max</th>
<th>Cost ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Costs</td>
<td>Illinois Regional Data Archive (estimate)</td>
<td>$42,400</td>
<td>$46,400</td>
<td>2011-00221</td>
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<tr>
<td>Operations and Maintenance</td>
<td>Virginia ADMS</td>
<td>$150,000</td>
<td>$350,000</td>
<td>2008-00174</td>
</tr>
<tr>
<td></td>
<td>University of Maryland RITIS</td>
<td>$400,000</td>
<td>$400,000</td>
<td>2011-00220</td>
</tr>
<tr>
<td>Software Development</td>
<td>Illinois Regional Data Archive (estimate)</td>
<td>$700,000</td>
<td>$1,000,000</td>
<td>2011-00221</td>
</tr>
<tr>
<td>Training</td>
<td>Caltrans PeMS</td>
<td>$350,000</td>
<td>$350,000</td>
<td>2013-00291</td>
</tr>
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Lessons Learned

The SafeTrip-21 Initiative demonstrated the feasibility of alternative approaches to collecting and using traffic data. In some cases, applications demonstrated new sources of traffic condition data. In other cases, applications made use of traditional data in new ways. The SafeTrip-21 Initiative highlighted, for example, how the mass-market availability of GPS-enabled smart phones complements traditional fixed sensors as a new data source, as well as offers the potential to deliver personalized travel information (2013-00649). Among the lessons learned are:

- **Use new and traditional data sources to enhance traffic models and to help solve problems related to mode shift and travel demand.** Traffic model development can benefit from integrating traffic probe data with other data sources for both freeways and arterials. Several SafeTrip-21 tests showed that ITS technology is capable of collecting the data needed by traffic and transit operations agencies to collaborate and better understand mode shift and travel demands across modes.

- **Consider procuring traffic data and information, rather than building in-house data collection systems, to reduce costs.** Agencies have traditionally procured hardware, software, and systems that allowed them to collect, analyze, and produce traffic data, which likely proved to be a laborious effort. An emerging alternative is to procure data and/or information services as a more cost-effective, resource-efficient alternative to developing the data and/or end product internally.

- **Explore the potential of new consumer devices, applications and services for collecting new traffic data and combining it with traditional traffic data to be used in new and innovative ways.** For example, cell phone GPS systems can alter the way traffic data is collected by leveraging the existing cell phone infrastructure to collect traffic data and transmit traffic information directly back to drivers.

- **Assess traffic data and information services carefully to ensure the quality and quantity of data and information needed.** The ability to deploy a traveler information concept is only as successful as the availability, timeliness, and accuracy of its data sources. Also, practical concerns of transportation professionals should govern their acceptance of new traffic data services and devices.
Case Study – Regional Integrated Transportation Information System (RITIS)

A major traffic accident on the Washington, D.C. Capital Beltway can cause traffic backups and delays, as well as secondary incidents for hours. There are four major transportation agencies and countless emergency management groups that can respond to traffic incidents, but in early 2003 there was only limited automated data sharing. Maryland, Virginia and D.C. transportation agencies and the Metro transit system approached the University of Maryland’s Center for Advanced Transportation Technology Laboratory (CATT Lab) for help coordinating traffic around the Beltway.

“It turns out the agencies were collecting more data than we thought they did, but they weren’t doing a good job managing their data,” said Michael Pack, CATT Lab Director [1]. Each DOT had a different system from a different vendor, so the data came in a variety of formats.

The Regional Integrated Transportation Information System (RITIS) is an automated data sharing, dissemination, and archiving system that includes many performance measure, dashboard, and visual analytics tools that help agencies to gain situational awareness, measure performance, and communicate information between agencies and to the public. RITIS automatically fuses, translates, and standardizes data obtained from multiple agencies in order to provide an enhanced overall view of the transportation network.

Participating agencies are able to view transportation and related emergency management information through innovative visualizations and use it to improve their operations and emergency preparedness. RITIS also uses regional standardized data to provide information to third parties, the media, and other traveler information resources including web sites, paging systems, and 511. There are three main RITIS components including, real-time data feeds, real-time situational awareness tools, and archived data analysis tools.

CATT Director Michael Pack explains the success of the RITIS system:

- Give everyone a real reason to want to collect data and support your programs.
- Provide data fusion of information from different sources and systems so users have a more complete picture of the transportation system than they would have just using their own resources or archives of individual systems.
- Provide easy, free access to all of the data (or as much as you legally can) to everyone.
- Develop interesting, fun, useful applications for the data that make people aware of what you are doing.

This results in others seeing the benefits of the transportation data services and gaining a better understanding of how ITS benefits the transportation system and responds to real time events (2011-00583).

References


All other data referenced is available through the ITS Knowledge Resources Database, which can be found at http://www.itsknowledgeresources.its.dot.gov/.