U.S. Department of Transportation

Transit Management: Operations & Fleet Management

ITS Benefits, Costs, and Lessons Learned: 2014 Update Report

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Transit Management

Operations & Fleet Management
- **AVL/CAD**
- **Transit Signal Priority**
- **Maintenance**
- **Planning**
- **Service Coordination**

Information Dissemination

Transportation Demand Management

Safety and Security

Highlights

- Nationwide, transit signal priority systems have demonstrated travel time savings of 2 to 18 percent.
- Using mobile data terminals for pre-trip inspections can lead to significant decreases in in-service breakdowns due to the maintenance staff receiving more timely information on the condition of each vehicle.
- Coordinating demand response transportation across funding groups can increase the average number of passengers per revenue hour by up to 10 percent.

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.

In 2011, the public transportation industry in the United States provided 4.8 billion revenue miles of service, including 3.7 billion traveled on roadways. The roadway services carried 5.6 billion passenger trips and collected $6.1 billion in fares. Rail systems carried 4.6 billion passenger trips and collected $7.3 billion in fares [1].

The utilization of ITS for improving operations and fleet management in the transit industry has become widespread. Automated vehicle location (AVL), computer-aided dispatching (CAD), and transit signal priority (TSP) are all mature technologies. By 2010, over half of the fixed-route buses in the United States had AVL systems installed [2]. AVL data now provides the input into real-time traveler information systems and archived AVL data are inputs into the service planning and scheduling processes. The use of CAD and scheduling software have improved efficiency and reliability for both fixed-route and paratransit service. These tools have also improved the ability for transit agencies to coordinate their services. TSP is gaining in popularity as cities begin to recognize that improved bus service can encourage mode shift away from personal vehicles to transit, without large negative impacts to traffic traveling in the cross direction of bus routes with TSP.

Deploying ITS technologies for transit operations and fleet management can help improve service reliability; decrease running time; reduce bus delays at intersections, missed trips, and emissions; and allow for increased service without additional staff or vehicles.

By 2010, over half of the fixed-route buses in the United States had Automatic Vehicle Location (AVL) systems installed.

Benefits

A comprehensive TCRP report from 2010 on TSP provides a set of benefit ranges that may be experienced by an agency deploying TSP based on case studies from a few dozen cities. Transit travel time savings experienced were between 2 and 18 percent, with Los Angeles and Chicago seeing 7.5 and 15 percent decreases, respectively. Decrease in bus delay is heavily dependent on the priority guidelines set by the agencies, and thus has a wider range experienced by the cities examined for the report. Overall, agencies indicated that bus delay was reduced between 15 and 80 percent. Los Angeles had a 35 percent decrease in bus delay at intersections, while Oakland had a decrease of 5 seconds per intersection (2013-00847).

Similar results in transit travel time savings were also experienced on Staten Island in New York, where signal priority along a 2.3 mile corridor led to 17 percent transit travel time savings (2013-00856). As part of a pilot test in Minneapolis, Minnesota, the University of Minnesota demonstrated a new TSP algorithm that lead to travel time savings of between 2.6 and 6.4 percent (2012-00814). Figure 1 shows ranges of benefits for select entries in the ITS Knowledge Resource database at: http://www.itsknowledgeresources.its.dot.gov/. Benefits of TSP systems include travel time savings, reduced delay for buses at intersections, and reduced emissions.

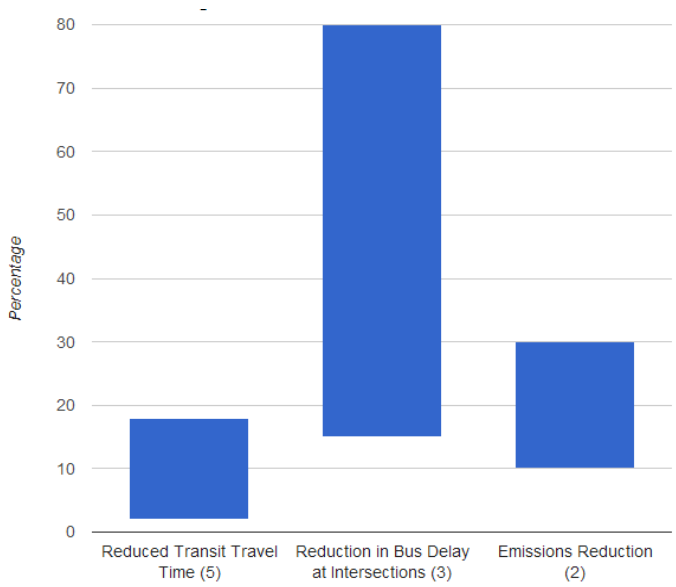

Figure 1: Benefits of Transit Signal Priority Systems (Source: ITS Knowledge Resources).

The online versions of the factsheets feature interactive graphs that contain all the data points included in the ranges. Here, each metric has a number after the text, representing the number of data points used to create the range; no number means only there was only one data point.

The use of scheduling software to support transit operations can save multiple weeks' worth of labor for service planners. In Chattanooga, the switch from manual run-cutting to using software to generate multiple run-cutting scenarios that are compared by the service planners saves two weeks of labor for each of their semi-annual service revisions. The software can also generate the new materials needed for passenger information, such as schedule leaflets, saving even more staff time (2011-00713).

The maintenance department of a north central Pennsylvania demand-response service provider attributes a 69 percent decrease in in-service breakdowns to using mobile data terminals (MDTs) for pre-trip inspections by drivers that are uploaded daily, instead of a two-week lag with paper inspection logs (2011-00710). Washoe County Transportation experienced a 50 percent reduction in missed trips due to mechanical problems.

Switching from manual run-cutting to using scheduling software that provides multiple run-cutting options can save up to 4 weeks of staff labor per year.

Costs

The cost of deploying an AVL system for a vehicle fleet ranges from $10,000 to $20,000 per vehicle (2009-00190). Cellular or radio communications costs also need to be considered when deploying AVL systems because it is used for

location “polling”. TSP emitter costs can range from $50 to $2,500 per vehicle, with TSP detectors ranging from $2,500 to $40,000 depending on whether or not the existing signal controller is new enough to have TSP added or if new signal controllers need to be installed (2013-00286, 2008-00155).

Costs for scheduling and run cutting software vary widely by vendor, system size and types of transit services the agency provides.

Lessons Learned

The transit industry tends to deploy customized solutions to meet each specific agency’s needs. However, there are many lessons learned from other projects that can be generally applicable to the development and deployment of transit information dissemination systems. Below is a sample of lessons learned:

- **Allow one agency to be in charge of the procurement process when implementing ITS technologies designed to coordinate services between urban and rural transit systems.** Having a lead agency in the procurement process can ensure consistency in purchases and delivery of products and services (2012-00637).
- **Specify in the procurement solicitation that the AVL supplier use the transit operator's preferred base maps.** Accurate and complete base maps are critical. An AVL supplier must demonstrate that an AVL system can accept frequent map updates easily (2012-00637).

Case Study – Mobility Services for All-Americans (MSAA) Coordination Simulation Study

The concept that coordinating demand-response services across agencies and funding sources results in better and more efficient services is widely accepted. However, quantitative analysis on the benefits of coordination was lacking. This study simulated three levels of coordination using actual trip data from two rural demand-response transit agencies in North Carolina and South Carolina (2013-00888). The authors utilized the funding sources to categorize trips into three groups: Medicaid, aging-related (Aging), and other.

The simulation tested three coordination scenarios: Some Coordination, More Coordination and Full Coordination. Some Coordination only coordinates trips within each of the three funding categories. Passengers with trips classified as “Aging” can only ride on vehicles assigned to the Aging group and with other Aging passengers. Passengers in the Medicaid and Other groups are assigned with similar restrictions. More Coordination simulates the effect of a Medicaid brokerage model, where Medicaid trips are scheduled separately from all other trips (Aging and Other trips and vehicles are combined). Full Coordination allows any trip from any funding category to be scheduled on any available vehicle.

The analysis used scheduling software to automatically optimize scheduling of trips. The results show a reduction in both total revenue distance and total revenue hours ranging from 7 to 13 percent when comparing the Some Coordination scenario to the Full Coordination scenario. Additionally, the average number of passengers served per revenue hour increased by approximately 10 percent. These efficiencies gained from greater coordination of trips would allow the agencies to serve a greater number of passengers without needing to increase their staff or number of vehicles.

References

[1] Dickens, Matthew and John Neff. *2013 Public Transportation Fact Book, 64th Edition*, American Public Transportation Association. Washington DC. October 2013.

[2] US Department of Transportation, “2010 ITS Deployment Statistics: Transit Management”, http://www.itsdeployment.its.dot.gov/TM.aspx

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