New Travel Tool Links Commuters to Real-Time Traveler Information

Ann Brody Guy

Transit faces an ongoing crisis of confidence. Many commuters who might otherwise be eager to reduce their energy consumption, CO2 emissions, and stress levels by choosing transit have been so frustrated by late arrivals, mysterious mid-trip delays, and other time-wasting surprises that they prefer their cars — traffic jam or not.

If a perceived lack of reliability is the culprit for under-utilization of transit, it begs the question: Can better information change traveler behavior? If seamless, highly accurate transit information across multiple modes of transportation were instantly accessible to travelers before and during their trips, would they make different decisions?

Researchers at the California Partners for Advanced Transit and Highways (PATH), are seeking to answer that question with the Networked Traveler project, a study launched this August that blankets the entire US 101 commute corridor with real-time transit information — that is, information based on the actual GPS-identified location of the transit vehicles, rather than schedule-based arrival times — updated vehicle counts at transit stations, and real-time traffic conditions.

Wei-bin Zhang is the Project Manager and Transit Program Lead at California PATH. Zhang says the goals of the project are to reduce the wait time at stations (thus also reducing total trip time), eliminate the frustrations of passenger uncertainty, and assist travelers in choosing transit when the highway is congested. "At its core, this project is meant to be a congestion relief tool that will help balance demand across all dimensions of the transportation network," Zhang said.

Informed Choices

The data-rich software tool features a trip planner that uses real-time bus and train arrival times to find the fastest routes. It compares those with drive times based on live traffic conditions, and, for shorter distances, biking times.

It functions much like Google's trip planner, with a starting location and a destination, but the results page...
Woke-Up Call
PATHGeo in-transit services include regularly updated trip-duration times and alerts that tell travelers when their next train or bus is due and when their train is approaching the station, both where they are waiting and where they exit.

Alarms can be set to screen text, sound, or vibrate. "We designed the "your stop is approaching" ping as an aid for commuters who get absorbed in their work or music, as well as for people with hearing and vision disabilities and people traveling in unfamiliar territory," Liping Zhang said.

For driver safety, "geo-fencing" technology is used to prevent the cell phone application from functioning while a driver is in a moving automobile.

Options and More Options
For shorter trips, entering an urban segment into the trip planner will yield a bicycle option with estimated times that users can compare to transit and driving.

Project Manager Wei-bin Zhang concedes that sometimes driving will be the best option — for example, when traffic is close and a traveler is in a hurry. "The project's larger purpose is to allow travelers to make informed choices," Zhang said. The comparisons also include cost estimates. The Networked Traveler project also provides help for drivers already on the road. The "smart parking" feature

Caltrain

Data receiver at top of pole collects information about the number of cars parked in the Caltrain lot. It is linked to a freeway message sign at Millbrae Avenue on US 101 that displays the available parking at the Caltrain stations. Another linked sign shows a real-time comparison between staying on the freeway and exiting to take Caltrain.

"We are encouraging the public to consider using transit, even after they have begun their trip," said Greg Larson, project manager at the California Department of Transportation (Caltrans), which is supporting the project with the aim of developing tools that would reduce traffic congestion and alleviate traveler stress.

Regional Partners
Wei-bin Zhang said that the study's multi-agency cooperation was key to attaining real-time, region-wide data for multiple modes of transportation. "Getting data for all the parallel systems within this regional commuter corridor was critical to providing the quality of information that can build traveler confidence in the network," Zhang said.

Project partners include the Metropolitan Transportation Commission (MTC), San Mateo County Transit District (SamTrans), which operates Caltrain, Valley Transportation Authority (VTA), BART, and Muni already generate real-time information that is accessible to third-party application developers; SamTrans provides its bus data to the project.

What's Next
The field test is slated to continue throughout the fall. Researchers will analyze various sources of user input to learn which information is most likely to influence traveler behavior.

Lead developer Liping Zhang said the team will use website metrics, survey data, and data from interactive windows on PATHGeo that ask users "Did you find this useful?" to study how and when people use the services and which services were likely to influence user behavior. Zhang said, "We hope to learn whether providing information that is both comprehensive and accurate can improve mobility, decrease traveler stress, and ultimately, help to decrease congestion on the roadways."
Structure of the BRT PAG

BRT Strategies

A BRT system may be implemented incrementally and with flexibility over time by implementing numerous strategies. BRT systems also may differ in their use of different technologies and infrastructure. The BRT PAG represents this incremental and varying nature of BRT system deployment by using the following strategies:

- Queue jumps
- Adding a busway
- Converting a (travel or parking) lane to a bus lane
- Intelligent Transportation Systems
- Transit signal priority
- Collisions warning and avoidance
- Lane Assist
- Precision docking
- Fare payment (off-board and on-board)
- Automatic vehicle location
- Passenger information (stop/stop and in-vehicle)

Stakeholders

A proposed BRT system can impact various stakeholders with their different perspectives and priorities. The BRT PAG considers the following stakeholders:

- Bus riders
- Bus operators
- Cities (local departments of transportation and revenue / finance)
- Businesses
- Pedestrians
- Cyclists
- Caltrans
- Drivers (local and through BRT corridor area)

Impacts

The impacts that individual BRT system strategies have on different stakeholders can be assessed according to specific measures of effectiveness such as travel time, service reliability, costs, and safety. For each relevant BRT strategy and stakeholder pair, there may be many impacts to consider.

Measurement Methods

Methodological approaches and the data used to assess quantitatively and/or qualitatively – these impacts are included on the BRT PAG:

- Before-and-after travel time studies and surveys
- Analytical and micro-simulation models
- Analogy (an estimate based on a synthesis and analysis of actual or similar operating experience)

Benefits and Costs

The BRT PAG includes quantitative estimates of the benefits and costs to stakeholders of BRT system strategies.
Review of Bus Rapid Transit Information Sources

Numerous reports and associated documentation from the BRT/ITS fields were reviewed from the following subject matter areas:

- BRT benefits and costs
- BRT planning and deployment
- ITS
- Automatic vehicle location
- Collision warning and avoidance
- Lane assist and precision docking
- Passenger information
- Transit signal priority

Construction of Tool

The BRT PAG is a Web-based tool using Microsoft’s Visio program as a platform. Access to the tool is simple and best viewed via Microsoft’s Internet Explorer browser.

The Bus Rapid Transit Performance Assessment Guidebook: A User Guide explains how everything is stored in the Main Matrix (Figure 1), from which the various impacts of BRT strategies can be investigated. The Main Matrix uses a "button" icon that users click to highlight each BRT system strategy/stakeholder impact pair that has a corresponding flowchart information page. Secondary or co-benefits such as emissions, ridership, and land use and development are also included in the Main Matrix. Once users have clicked a button, they are taken to the corresponding flowchart page.

Future Tool Enhancements

The BRT PAG can be improved to assist Caltrans more effectively by:

- Filling existing information and data gaps in the Flowchart Pages’ “Resource and Documentation” component especially for ITS strategies, e.g., collision warning and precision docking, once such strategies achieve actual BRT revenue service operation and quantitative impacts are measured and documented.
- Conducting follow-on case studies in which the BRT PAG is applied to specific corridors considered by Caltrans and local area transit agencies for BRT systems implementation; enhancing the tool based on feedback and lessons learned from such case studies.

The final report for this research is available online at: http://www.path.berkeley.edu/PATH/Publications/PDF/PBR/2010/PBR-2010-37.pdf

Three-Truck Automated Platoon Testing

Steven Shladover

PATH researchers recently completed three weeks of testing of an automated platoon of tractor-trailer trucks on a remote section of highway in Nevada. These tests were designed to show that automated vehicle following in a platoon could be done using dedicated short range communications (DSRC) for vehicle-to-vehicle coordination at its standard update interval, and to measure the potential fuel consumption savings associated with aerodynamic drafting.

Background

PATH has been researching truck automation for more than 10 years, and did a series of carefully controlled tests of fuel savings for a two-truck platoon in 2003. The current research is part of the Federal Highway Administration (FHWA) Exploratory Advanced Research Program (EARP) project, "Development and Evaluation of Selected Mobility Applications of V2V." In this project, which is funded by FHWA with Caltrans’ cost share, the PATH research team is working on three distinct applications that can enhance mobility through use of vehicle-vehicle and/or vehicle-roadside wireless communications using DSRC. In addition to the automated truck platoon, the other applications are cooperative adaptive cruise control and variable speed limits to avert traffic flow breakdowns. These applications can enhance mobility by increasing highway capacity and smoothing traffic flow disturbances, with resulting benefits in reduced fuel consumption and, potentially, emissions as well.

For the 2003 truck platoon tests, Caltrans purchased three Freightliner Century Class-8 truck tractors and one automated trailer.
PATH equipped two of them for automated driving, with an emphasis on close vehicle-to-vehicle coordination for vehicle following at short gaps. These trucks were tested on an unused runway at the former Crown Landing Naval Air Station in the California Central Valley near Patterson, California. The runway length of only 2.2 km limited the duration of each test run that could be done while cruising at highway speed. Despite this limitation, a good set of test data was obtained for trucks driving individually and in a two-truck platoon at gaps of 10, 8, 6, 4 and 3 meters. These results showed that during steady cruising at 90 km/h, the lead truck could save up to 10% of its fuel consumption and the following truck could save up to 13%.

The new truck platooning research was needed to demonstrate that string stability can be achieved with a three-truck platoon, in spite of the technical performance limitations of the trucks, and within the default DSRC communication update rate of 10 Hz. There have been some claims in recent years that this communication update rate is insufficient to support string-stable platooning, so it was important to prove those claims wrong. The third Freighliner truck from the 2003 project was equipped with the same automation capabilities as the other two trucks, and all three were supplied with new DSRC radios operating in the 5.9 GHz band, with the prescribed 10 Hz update rate. A schematic view of one of the fully-equipped trucks is shown on page 7.

Support from Nevada DOT

The basic debugging and low-speed testing of the trucks was conducted on the short test track at the Richmond Field Station, but it was not possible to test the trucks with trailers or at speeds above 40 km/h because of the limited track length. The Crown landing site was no longer available for use, and we searched hard, but ultimately in vain, for comparable sites in California that could be used for truck testing at highway speeds.

Fortunately, Nevada DOT (NDDOT) is interested in truck automation and is supporting a case study of truck automation for I-80 between the general areas of Reno and Salt Lake City. NDOT was sufficiently interested in the truck platooning technology that they offered use of a section of lightly traveled highway for testing the trucks, shown in a Google Earth view on page 8.

This section of Nevada State Route 722 (SR-722) to the west of Austin is straight and flat, and has an average daily traffic volume of only 60 vehicles, so NDOT was willing to provide traffic control to temporarily close the highway while the trucks were on their test runs, for intervals of up to ten minutes at a time.

NDDOT's Austin maintenance station provided three flaggers to close the highway during testing periods lasting up to ten hours per day, four days a week, and the University of Nevada, Reno, provided student flaggers for an additional two days a week so that the testing could continue outside the normal NDOT work hours.

The truck test scenario consisted of starting up from a stop, accelerating to a cruise speed of 87 km/h, and then decelerating to a stop at the end of the test section. The cruise speed level was chosen to avoid complications from inconsistent transmission gear shift speeds among the test trucks when they exceeded this speed, a temporary practical constraint rather than an inherent limitation of the general technical approach.

The testing began at gaps of 10 m between trucks and continued at that gap throughout extensive debugging. Only after the performance was consistent and reliable at the 10 m gap did the research team attempt shorter gaps. By the end of the three-week test period, we had data for vehicle following at gaps of 8 m and 6 m as well, so that we can compare the fuel consumption savings at these different gaps.

Additional highway-speed testing of the three-truck platoons is planned for next spring, providing opportunities for testing some shorter gaps, as well as operations including speed and grade changes and platoon join and split maneuvers.

LED display, indicating proper operation of communication and control systems.
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