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Study examines automatic vehicle location and paratransit productivity [September 1996]

CUTR

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As part of its designation by Congress as a National Urban Transit Institute (NUTI), CUTR recently completed research that examined the relationship between automatic vehicle location (AVL) technology and para-transit productivity. The purpose of this study was to assess whether AVL systems contribute to improved paratransit system productivity through more efficient and effective scheduling and dispatching, vehicle monitoring, and driver accountability. Research in this study focused on the application of AVL at Zuni Transportation, Inc., a paratransit system in Miami, Florida.

Drivers contribute a great deal to the success and quality of paratransit programs. The overall productivity of a paratransit system is directly related to the ability of reservationists, schedulers, and dispatchers to convey accurate trip information and directions to drivers. Similarly, dispatchers and schedulers depend on feedback and self-reported information from drivers concerning where they are, what they are doing, who they are transporting, and other pertinent trip information.

AVL systems are computer-based vehicle tracking systems. Originally developed and used for military purposes, AVL technology is now being used to monitor the movement of vehicles in transit and paratransit fleets. Transit and paratransit companies can use AVL technology to monitor the real-time location of each vehicle. Real-time location information can then be compared to the scheduled location. This information can be applied to scheduling and dispatching to improve system efficiency and productivity. Vehicles may be rerouted or trips reassigned in real-time based on AVL data.

Customer satisfaction also may be improved with the application of AVL technology in transit and paratransit by providing accurate information on where a vehicle is located at a particular time so more accurate estimates on pick-up time may be given.

Paratransit productivity

AVL equipment and vehicle status message terminals purchased from AirTouch Teletrac were installed in 20 of Zuni's 53 paratransit vehicles. Data related to time and position of each vehicle were recorded via computer during a three-month test period in 1995. The actual location of vehicles was compared to the expected vehicle locations, based on manifests developed by schedulers. Three performance measures were chosen to represent system productivity:

- On-time performance: whether the vehicle arrives at the scheduled pick-up time and delivers the passenger at the scheduled drop-off time.
- Vehicle dwell time: the elapsed time from when the driver arrives

to pick up a passenger and leaves the pick-up location, as well as the elapsed time from when the driver arrives at the drop-off location and leaves after dropping off the passenger.

- Travel time: the elapsed time from when the vehicle leaves the pas-senger's pick-up location and arrives at the passenger's drop-off location.

Performance analysis

CUTR used the available data to determine differences among what was scheduled, what the driver recorded on his or her trip manifest (log), and what was recorded using the AVL equipment and captured in Detailed Event Reports generated by the AVL software.

On-time performance

On-time performance is most often measured in terms of a passenger being picked up and/or dropped off within a specified time "window." On-time performance also may be measured in terms of whether a passenger arrives at or before a scheduled appointment time. To measure AVL's potential contribution to measuring on-time performance, three performance indicators were calculated for each trip in the sample:

> (1) pick-up and drop-off data recorded by drivers compared with the scheduled times printed on the drivers' manifests,
>
> (2) AVL data recorded when drivers pressed the appropriate buttons on the status message terminal compared with the scheduled pick-up and drop-off times printed on the drivers' manifests, and
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> (3) driver-recorded data compared to AVL-recorded data, recognizing that drivers must press the correct status message terminal button to register the AVL information. Analysis of pick-up and drop-off data recorded by drivers on their manifests compared with scheduled pick-up and drop-off times revealed that, on average, drivers reported arriving 1 minute later than the scheduled pick-up time and 1 minute earlier than the scheduled drop-off time, well within the 15-minute pick-up window.

The second on-time performance indicator compared the pick-up and drop-off times recorded by the AVL equipment with the scheduled pick-up and drop-off times. On average, the AVL equipment shows that drivers arrived 8 minutes later than the scheduled pick-up time and 3 minutes later than the scheduled drop-off time.

The final on-time performance indicator analyzed the pick-up times recorded by drivers on their manifests with pick-up times recorded by the AVL equipment. This indicator showed the greatest range of results, from 27 minutes before to 2 minutes after for pick-up times, and from 24 minutes before to 52 minutes after for drop-off times. The range appears to support the notion that drivers may be recording information manually that reflects more positively on the actual performance.

Dwell time

The second performance measure analyzed was vehicle dwell time. Accurate information on vehicle dwell time is seldom collected, but could be valuable information for schedulers. For example, if schedulers know that a particular pick-up or drop-off location, such as a hospital, causes delays because vehicles have to wait for passengers, then the scheduler can build extra time into the schedule.

The average vehicle dwell time when picking up passengers was 5 minutes, with a range from 0 to 13 minutes for the sample. Similarly, the average vehicle dwell time when dropping off passengers was 4 minutes, with a range of 0 to 8 minutes. The short dwell times suggest that most passengers are ready to leave when vehicles arrive.

Ride time

The third performance measure analyzed was ride time. Many systems restrict how long a passenger may ride on-board a vehicle. The analysis revealed that the average ride time was 27 minutes, with a range of 15 to 50 minutes. This is valuable information when calculating costs on a per-hour basis or when determining potential system productivity (passengers per hour). This information was based on actual time recorded using the AVL equipment. CUTR collected and analyzed useful AVL data from the paratransit provider that suggests how AVL technology might be helpful for improving para-transit productivity.

Real-time applications

> Findings suggest that the particular AVL technology used in this application is not, in its present state, suitable for this type of application. (The AVL technology used was originally installed as a theft-deterrent and not specifically designed for the use in this application.) Nonetheless, this particular type of AVL technology does have a number of useful real-time applications to paratransit that could contribute toward improved paratransit productivity. Specifically, it could be used to:

- Monitor drivers. New and veteran drivers may be tracked and/or monitored to ensure that schedules are adhered to and drivers are where they are supposed to be.
- Determine vehicle location and estimated time of arrival (ETA). This information allows the dispatchers to determine exactly where a vehicle is and how far it is from its destination.
- Look up addresses and identify closest vehicle. AVL software may be used to look-up the locations of unfamiliar addresses and to identify the closest vehicle to a requested pick-up location.
- Document passenger no-shows. The ability to document passenger no-shows is enhanced by being able to show that the

paratransit vehicle was on time and at the requested pick-up location of a passenger who is a no-show.
- Monitor safety and security. AVL technology can be used by para-transit operators to improve the safety and security of vehicles, drivers, and passengers. Automatic vehicle tracking also makes it possible to monitor accidents and vehicle breakdowns in real-time.

This research project afforded an opportunity to examine the potential applications of one type of AVL technology to the paratransit field. Three major issues that were identified for other systems interested in implementing an AVL system: (1) determining whether there is a need for AVL, (2) selecting which AVL technology to acquire, and (3) implementing an AVL system. Paratransit companies introducing AVL technology into their operations should recognize that the implementation process probably will not be swift or easy. A checklist was developed as part of this study that outlines a variety of issues and questions that should be considered prior to, during, and after installation of an AVL system. Careful documentation of the implementation process and frequent sharing of information will help to improve implementation for systems that follow.

As stated by Jorge Azor, Vice President of Zuni Transportation, “The AVL paratransit productivity study was an eye-opening experience. With CUTR’s help, we learned how to get the most out of our investment and how to use AVL as a vital tool to improve service and manage our fleet.”

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