Computer-assisted Scheduling and Dispatching Systems for Paratransit Transportation: An Assessment of Agency Readiness in Planning for Statewide Deployment

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Abstract

Computer-assisted scheduling and dispatching (CASD) systems have arguably shown to facilitate operational improvements and coordination in paratransit. However, the level of realized positive impacts depends on the specifics of each implementation plan and overall deployment strategy, as well as the attitudes of potential users. In addition, the concerns of paratransit providers about implementing new software given their level of technology readiness need to be addressed. This paper examines the state of practice and technology readiness of paratransit providers in the State of Illinois. It is shown that for most operators, implementing CASD systems would require developing new computer skills and training existing personnel.

Introduction

As populations in the United States age, the need for public paratransit services is increasing. Federal funding for such services has increased as well under the expectation that states will spend those transportation grants efficiently and effectively. Accordingly, transportation providers will need to consider whatever efficiencies can be gained through operational improvements and coordination with other providers. Both these objectives can be facilitated through the implementation of computer-assisted scheduling and dispatching (CASD) systems.

The deployment of such systems has shown measurable efficiency, effectiveness and quality of service gains and confirmed expectations that CASD systems provide improvements in dispatching, scheduling, on-time performance and increased passenger satisfaction (Alfa, 1986; Bennett, 1994; Stone et. al, 1994; Chira-Chavala et al., 1997; Pagano et al., 2002; Metaxatos and Pagano, 2004). However, the level of realized positive impacts depends on the specifics of each implementation plan and overall deployment strategy, as well as the attitudes of potential users (Kikuchi, 1988; Pagano et al., 2003).

With increasing numbers of local CASD system implementations, state departments of transportation have only recently realized the need for statewide strategies regarding future deployments of such
systems. In this regard, at the planning stage of statewide CASD deployment programs, the concerns of paratransit providers about implementing new software given their level of technology readiness need to be addressed.

This paper examines the state of practice and technology readiness of paratransit providers in the State of Illinois. It is shown that for most operators, implementing CASD systems would require developing new computer skills and training existing personnel.

**Methodology**

Nineteen agencies were chosen for on-site visits. They were located throughout the state of Illinois, and were chosen based on whether they received federal (5311) funding and the size of their fleet. At least two to three providers were chosen from each of the size groups. In addition, we considered the ways in which various organizations including hospitals, retirement homes, and taxi companies provided transportation service. We included a provider from each category.

We developed several survey instruments (see Pagano et al., 2003 for details) to determine the operations performed by each individual agency and how they were performed. First, a management survey was used to obtain information from the perspectives of the supervisors and other management personnel. This survey instrument included questions related to management’s familiarity with computers, their daily responsibilities, their opinions on service coordination, and their level of comfort with the idea of a CASD system.

Secondly, a dispatcher survey was created to evaluate the knowledge and skill levels of the call takers and schedulers within the agencies. These surveys included questions related to the scheduling and dispatching personnel’s day-to-day activities, their technical sophistication and enthusiasm toward a CASD program.

Finally, a technology survey was used to conduct an assessment of the agency’s use of technology. The computing facilities and other technology in each organization were inventoried, and the level of computer complexity used in each organization was noted.

**Analysis of Agencies**

**Agency Characteristics:** The fleet size ranged from 31 to 58 vehicles in large agencies, from 11 to 30 vehicles in mid-size agencies, and from 1 to 10 vehicles in small agencies. The average fleet size of all agencies surveyed was 16 vehicles, and the average number of trips dispatched per day was roughly 300.

Smaller agencies reported providing anywhere from 30 to 180 one-way trips per day, and only one or two demand responsive trips per agency per day. The larger agencies provided anywhere from 600 to 1000 subscription trips per day, with typically 25% of the trips being demand responsive. Medium sized operators had actually a very small focus on the transportation element of their business.
Services Provided: Subscription service and contract routes constitute the majority of service provided. Demand responsive service constitutes 25% of the typical providers’ business. All of the agencies provided service within one county or a neighboring county in their service area. Larger regional operators have a greater service area.

All agencies provide a call taking and scheduling procedure. Typically, for the subscription service, the run sheets are developed a week in advance. The demand response calls are dealt with differently (see Pagano et al., 2003 for details). Agencies reported having, on average, two new customers per week. The process often generates a lot of unnecessary and duplicate paperwork.

Reporting, Scheduling and Dispatching: A closer look at the way agencies perform their operations revealed three types of operations. The first type, the most complex, uses CASD software to carry out all operations. Basically, operators fill out the screens, and the system then inserts the schedule and dispatches the run. This is done in batch mode for subscription trips and “on the fly” for demand-responsive trips. Contact with the drivers is maintained through radio and/or mobile phones. Report generation is a button-click away, since all the information is stored in the CASD system’s database and all the necessary reports are built into the system. Currently there are only two agencies that were visited that were using this type of system, and one of them is a taxi service.

The second type uses both computers and manual processes. Computers are mainly used for storing information about customers, trips, and vehicles. Scheduling and dispatching are done manually. Reports are generated easily since the data is stored in electronic format. However, some reports, that require summarized data or span longer periods of time, might take more time to prepare because there are no readily available reports built into the system. Communication with drivers is mainly done with two-way radios and mobile phones or payphones.

In the last type, operations are performed manually. In this case, operators take the same information, but use ledgers or “run” sheets to store client information. At the end of each day the scheduler/dispatcher uses this information to generate drivers’ manifests, which will be picked up by the drivers the next day. Reports usually take longer to prepare. The process created a large amount of overlap and redundancy. However, communication methods are the same as in the previous two cases.

Billing: Primary billing is a significant issue for transit agencies. Some operators work only with one or two sponsors (funding agencies), while others have as many as thirty. Handling billing manually is manageable for the first category, though a computerized system would make it more efficient and perhaps more accurate. For the second category, billing must be an automated process. Some operators bill manually, keeping ledgers and possibly using word processors or spreadsheets to send them. However, most of them use accounting applications or billing modules of CASD software.

Advance Notice Requirement for Scheduling: All providers preferred to receive requests at least one day before travel was needed, although most were flexible with this policy if short notice trips could be fitted into the day’s departures. Larger agencies tended to discourage last-minute requests, suggesting
that in more populous areas, the level of demand was fast approaching what operators can meet with their existing equipment and scheduling systems.

All but the smallest organizations reported having multiple phone lines available to handle more than one customer call at the same time. The larger organizations typically had a holding or queuing system for the calls. A few of the smaller systems reported having only one line available, with one of those having no voice mail or any way for the operator to return a missed call. Most offices with computers available typically had most non-driving employees using computers at some point in their workday.

**Technological Preparedness**

**Software Used:** All but one organization reported at least one computer in use at the office. The highest number reported was twenty in the largest operator, with a typical operator using two or three computers. Most offices with computers had some form of computer networking available. Word processing and spreadsheets are the most commonly used applications.

**Computer Support:** Small providers typically had no specific arrangements for external computer support, often relying on an informal network or volunteers to handle computing needs. The larger operators tended to have some sort of contracted support available, which was either through their corporate office or through a licensed software/hardware distributor. Ten out of the nineteen agencies had access to either one or two in-house computer experts who could address most support needs, or were able to contact a neighboring college student for further assistance. None of the interviewees reported any trouble getting computer support when needed.

**Computer Skills/Expertise:** Most of the agencies used computers for billing and reporting, at the very least. Three managers reported that employees had very minimal computer skills. For the rest of the agencies, the managers were generally satisfied that the employees’ skills matched current job requirements, and a few were very complimentary of their employees’ skills. The general feeling towards the future implementation of a CASD system is positive, because most are willing to attend further training sessions in order to become familiar with computers and the system.

Unsurprisingly, respondents with higher levels of computer expertise were more likely to have a higher level of acceptance of new systems. Those who reported a low level of computer expertise tended to also think negatively about CASD systems, and were also less favorable toward attending training sessions. Of the 19 agencies surveyed, eleven reported a strong disinclination towards implementing CASD.

**Managerial Computer Expertise:** Implementing a CASD system is a complex undertaking, which in most cases results in re-engineering the call taking, scheduling, and dispatching processes. Completely (or significantly) changing such processes requires management support (sometimes called executive sponsorship) to result in a successful transition. Therefore, it is important to understand management’s capacity to support change.
To evaluate this capacity to support change, managers were asked whether they had overseen computer system implementations, and if they did, what was the outcome. Sixty percent of the interviewees had overseen or participated in implementations related to computer systems, but only half of these were convinced that they could successfully manage any other implementation. The remaining 40% have never overseen any such implementation. For those who have overseen implementation, they expressed problems with the software that was installed.

Of all the operators surveyed, 30% would be able to manage an implementation, and 70% would need some external guidance in order to guarantee success. This support could either come from either IDOT or a third party (university, consultant, etc.).

**Hardware and Software Needs:** Paratransit software is expensive. Agencies using CASD systems often lease it because they do not have sufficient funds to buy it outright. Considering the potential funds available, they were asked how would they spend these. Not surprisingly, of the agencies having a CASD system, most would purchase software or would invest more in hardware. If the funds were to be spent on software they would invest in the same software they have (or upgrades). One agency customized Microsoft Outlook for the use of scheduling, maintenance, and billing. It was quite useful to them.

Other agencies would use the funds as well, but it was not clear how they would spend the money, nor did they seem interested in purchasing a CASD system. Among these, several expressed their interest in CASD systems. They also asked for help and guidance from IDOT (or external entities) since they did not have enough expertise.

**Technology Assessment**

The level of technological sophistication varied widely among agencies. The more sophisticated agencies used computers not only for constructing driver manifests and customer information, but also for services provided by the agency such as counseling services and maintenance. At the other end of the spectrum were the less sophisticated agencies. Since transportation of people with disabilities and the elderly is such a small component for the majority of these agencies’ day-to-day activities, computers were rarely used. Most of the records were kept manually and frequently updated.

Based on a technology assessment inventory (Pagano et al., 2003, Appendix IV), an evaluation of an agency’s ‘technology readiness’ was made to assess the need to upgrade the hardware, if CASD systems will be installed. The technology readiness was scored on a number of attributes related to the surveyed operator’s technological capabilities including: (1) number of computers used in the agency, (2) computer configuration (RAM, HDD, drives, monitor, etc.), (3) operating system, (4) networking capabilities (existing network), (5) internet capabilities (modem, high speed), (6) available peripherals (printers, scanners, etc.), and (7) overall technological preparedness. The scoring procedure used factor analysis the details of which we omit because of space limitations. Three categories of readiness were then identified: poor, fair, and good.
Agencies classified as ‘poor’ need major hardware upgrades because the existing one is either outdated or must be used for other purposes. Agencies with a ‘fair’ score need upgrades such as operating systems, network cards, and new monitors. Agencies given a ‘good’ score are technologically up-to-date needing only minor changes (proper network configurations, setting up servers, etc.) prior to deploying the CASD software. It is interesting to note the high positive correlation between operation size and technological sophistication. Most of the agencies (except for two) that fall in the ‘good’ category have more than 300 trips/day. The two exceptions have between 100 and 300 trips/day.

Conclusions

This paper presented findings from a survey of operators and revealed the following themes: (1) For most operators, implementing CASD would require developing new computer skills and training existing personnel; (2) Most agencies providing paratransit services in rural areas are not centered around transportation; (3) Reporting is the bane of paratransit agencies; (4) CASD implementation should allow data sharing between CASD systems and legacy accounting systems; and (5) CASD system installations must be preceded by computer upgrades. Before a successful statewide deployment of CASD systems is attempted, these issues that impact the daily operations of interested paratransit providers should be addressed.

References