ITS Technology Usage and Feasibility in Small Urban and Rural Transit—Executive Summary

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SURCOM RESEARCH SUMMARY

Abstract

The objectives of this study were to 1) identify what technologies are currently used by small urban and rural transit agencies; 2) investigate the influence of community, agency, and manager attributes on technology adoption; and 3) evaluate the changes in ITS adoption among small urban and rural transit agencies today as compared to 10 years ago. When comparing technologies usage today to that of 10 years ago, significant increases have occurred. Analysis showed that hiring managers with more education and encouraging them to attend conferences and interact with ITS vendors may influence adoption of technologies by transit agencies.

Introduction

Advances in computers, telecommunications, and information system technologies have led to the development of a wide range of applications that can improve the efficiency and quality of service for all forms of transportation, including public transit. These intelligent transportation system (ITS) applications have been widely applied to the highway system and are being used by an increasing number of small urban and rural transit systems throughout the United States.

However, many transit systems are being held back from full implementation of their ITS applications. This is often because of a lack of coordination and an unwillingness to change on the part of transit agencies. Some transit agencies also feel that ITS does very little to increase the efficiency of their operations. Identifying transit systems that have implemented ITS technologies and investigating their ability to coordinate different ITS applications will provide a better understanding of the issues and supply a benchmark for other transit agencies to work toward.

Through this research, transit system operators will become more familiar with ITS choices available to them and be able to quickly and systematically determine the potential benefits of each technology as applied to their individual operations. This technical assistance is necessary as the United States will see a doubling of its 65 and older demographic by the year 2030. Many members of this older demographic will demand efficient transit service as they switch from driving their own vehicles to relying on public transportation for their mobility needs.

ITS Usage Survey

The Small Urban and Rural Center on Mobility (SURCOM) developed an online survey instrument to distribute to transit agency directors. Surveys contained questions regarding technology use by agencies providing transit services in rural and small urban areas. The major goal of the survey was to collect data pertaining to technology adoption at the agency level. Most of the survey questions were based on previous research at SURCOM conducted by Ripplinger and Brand-Sargent (2010). Developing an updated account of technology adoption was another major goal of the survey, and comparisons can then be made to reflect changes in technology use during the past 10 years.

The survey was distributed nationwide via email to agencies in small urban and rural areas. An email

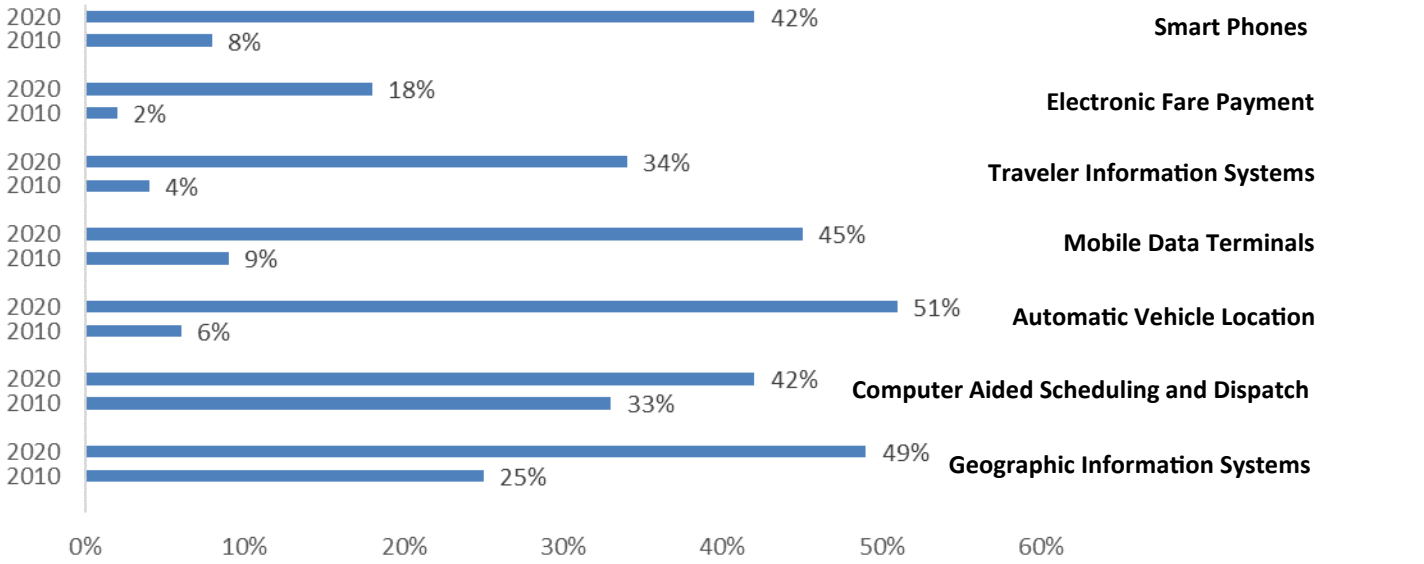

Figure 1. Technology Use Increases, 2010 to 2020

list containing approximately 1,800 valid email addresses was used to contact agency managers. The email list was specific to those agencies receiving either 5311 or 5307 formula grant federal funding. A total of 144 usable surveys were received from the email list, yielding an almost 8% response rate.

Agencies were questioned about their organization type with local government being the most common response with 48% reporting this type. Non-profit followed with 35% while only 3% of respondents indicated that their organization was operated for profit.

Technology Adoption

Technology use has increased significantly during the past 10 years among transit agencies. A study by Ripplinger and Brand-Sargent (2010) first calculated the number of agencies using specific technologies as shown in Figure 1 in the 2010 column. The 2020 column shows the specific technology use among survey participants in this current research. All seven of the technologies have seen significant increases in use during the past 10 years. The most prominent increases have occurred in automatic vehicle location (AVL) technology which showed an increase from 6% usage in 2010 to 51% today followed by an increase from 9% to 45% in the use of mobile data terminals (MDTs). Smart phone use also increased significantly, from 8% to 42%, followed by a usage increase from 4% to 34% in traveler information systems (TIS) technology. Finally, geographic information systems (GIS) saw an increase in use from 25% to 49%, and both electronic fare payment (EFP) and computer aided scheduling and dispatching software (CASD) saw significant increases in use during the same 10 years.

One of the most widely used technologies among transit agencies was traveler information systems (TIS). TIS are wide-ranging technologies that provide pre-trip or on-vehicle information. Websites, smartphone applications, and in-vehicle displays are some the most commonly used TIS technologies. About one-third of agencies indicated they currently use TIS. Eighty-seven percent of agencies that use TIS have an agency website; more than 70% use smartphone applications (Figure 2). About two-thirds of respondents indicated they use some form of social media while almost 60% use email to communicate to customers. Between roughly 25% and 40% of those that use TIS indicated they use the technology to communicate to customers via text message, variable message signs, in-vehicle displays, audible annunciators, and automated phone service.

Factors Affecting Technology Adoption

Survey results provide an understanding of the current state of technology use by rural transit agencies and the trends in technology adoption. It would be useful to understand why some agencies adopt a particular technology and why others do not. Differences in transit

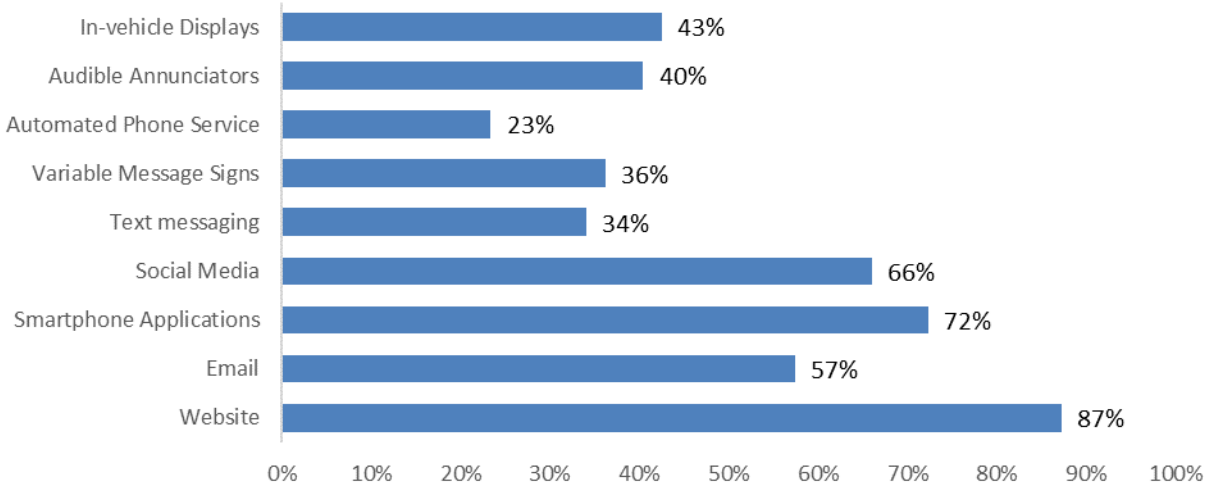

Figure 2. Types of Traveler Information Systems Used Among Agencies that Use These Technologies

agency characteristics or transit manager characteristics could be an essential determinant of technology adoption. This study developed a model to analyze the relationships between transit agency and manager characteristics and technology adoption, updating the previous work by Ripplinger and Brandt-Sargent (2010) with new data and an expanded number of technologies. Adoption was modeled for eight technologies: GIS, CASD, AVL, MDTs, TIS, EFP, Automated Passenger Counting (APC), and security systems.

Results are shown in Table 1. The table provides estimated odds ratios for adoption of each of the eight technologies. Odds ratios for dummy variables provide a way to compare whether the probability of adoption is the same for two groups of agencies. For example, in the GIS adoption model, the odds ratio for fixed route is 2.46. This result indicates that the odds of adopting GIS is 2.46 times greater for fixed-route agencies. An odds ratio below 1.0 would have meant they are less likely to adopt. For variables that are not dummy variables, the odds ratio represents the estimated change in the odds of adoption with a one-unit increase in the variable. For example, the odds ratio for education in the GIS model is 1.44, which indicates that as education (measured on a 1-6 scale) increases by one, the odds of adoption increase by 44% (or are 1.44 times greater).

Agency size, measured in ridership, and interaction with vendors at conferences were most often found to be associated with technology adoption. Other variables were found to be statistically significant in some of the models.

Ridership was found to be positively related to technology adoption. Agencies that provide demand-response services were found to be more likely to adopt CASD, and fixed-

Table 1. Estimated Odds Ratios from Binary Logit Models of Technology Adoption

Explanatory variable	GIS	CASD	AVL	MDT	TIS	EFP	APC	Security
Ridership (100,000s)	1.03	1.04	1.05	1.09**	1.13**	1.09***	1.11***	1.53**
Demand-response	2.00	6.55**	1.71	2.32	1.18	0.62	0.19*	5.27
Fixed-route	2.46*	1.19	2.16	1.02	2.35	3.40	0.67	1.75
Nonprofit	0.48	1.88	0.78	1.12	2.74*	0.33	0.18	0.40*
Education	1.44**	1.18	1.48*	1.35	1.05	2.00**	1.06	1.14
Years in transit	1.00	0.99	1.00	0.98	0.98	1.04	0.99	1.03
Conferences	0.99	1.11	1.36**	1.16	1.16*	0.84	1.28*	0.99
Vendor	1.22	1.77	6.03***	4.71***	3.63**	32.62***	14.15***	1.16
State help	1.50	1.36	2.63*	2.14	0.70	0.32	0.36	2.01

*Statistically significant at the 10% level, **Statistically significant at the 5% level, ***Statistically significant at the 1% level

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route providers are more likely than non-fixed-route operators to use GIS.

Among manager characteristics, education appears to have some relationship with adoption. More educated managers were found to work for agencies that were more likely to use GIS, AVL, and electronic fare payment. The number of national conferences attended was also found to be positively related to technology adoption. Interaction with vendors at conferences or meetings was found to have the strongest association with technology adoption.

Summary and Conclusions

Levels of adoption of commonly used ITS technologies by transit agencies were found to be between 30% and 50%. For example, GIS was being used by nearly half of survey respondents. AVL and CASD technologies were being used by a similar number of agencies. Smart phones were used by more than 40% of survey respondents. When comparing technology use today to that of 10 years ago, significant increases have occurred. TIS technology use has increased from 4% in 2010 to 34% among survey respondents today while use of EFP increased from 2% in 2010 to 18% today. The most substantial single technology increase was seen in AVL use, climbing from 6% among survey respondents in 2010 to 51% today.

Econometric analysis showed that hiring managers with more education and encouraging them to attend conferences and interact with ITS vendors may influence adoption of technologies by transit agencies. Results did not show that help from state DOTs or transit associations has been effective in encouraging technology adoption. This may suggest that help received, while useful, was not a contributing factor to adopt certain technologies.

Results also showed that different types of agencies are more likely to adopt technology. For example, larger agencies are more likely to use most types of technology. They are more likely to find them beneficial. Finally, results can be used to identify which agencies could potentially benefit from certain technology adoptions. Agencies expected to use technology that do not can be identified as ones that may benefit from adoption while agencies that adopt technologies, but are not expected to based on their characteristics, could be studied to determine potential benefits from technology use.

References

Ripplinger, D. and B. Brand-Sargent. *Technology Adoption by Small Urban and Rural Transit Agencies.* Upper Great Plains Transportation Institute, NDSU,2010.