Customer Satisfaction and Response to AOS

Abstract

Passenger surveys were conducted in each of three successive springs in order to track passenger perception of changes in service quality during AOS implementation. In general, no improvement in passenger perceptions was observed relative to a high base level of satisfaction. In contrast, passengers indicated favorable impressions of the impact that individual AOS elements have had on the transit service that they receive.

Overview of AATA's Advanced Operating System

In 1997, the Ann Arbor (Michigan) Transportation Authority began deploying advanced public transportation systems (APTS) technologies in its fixed route and paratransit operations. The project's concept is the integration of a range of such technologies into a comprehensive system, termed the "Advanced Operating System" (AOS) to "smart buses", "smart travelers," and a "smart operation center" to benefit from timely and coordinated information on critical aspects of transit operation and maintenance. The prime contractor for the project was Rockwell, and providers of other integrated subsystems included: Digital Recorders Research of Triangle Park, North Carolina; Trapeze Software of Mississauga, Ontario; Prima Facie of King of Prussia, Pennsylvania; REI of Omaha, Nebraska; Red Pines Instruments of Denbigh, Ontario; and Multisystems, Inc. Cambridge, Massachusetts. Evaluator for the project was a team from the Urban and Regional Planning Program of the College of Architecture and Urban Planning, University of Michigan.

"The Smart Bus"

Central to the system is the deployment of automatic vehicle location (AVL) technology in order to provide continuous real time data on the location of transit vehicles. Each bus determines its location using global positioning satellite (GPS) technology; differential corrections are broadcast to the vehicles so they can calculate their locations within one or two meters. A Mobile Data Terminal (MDT) in each vehicle stores complete route schedules on an insertable memory card. The GPS system provides accurate time to the vehicles. Buses compare scheduled times and locations with actual locations to determine their schedule adherence. If a bus determines that it is running late, the driver is advised, and if necessary, the onboard computer notifies the Operation Center. The AVL also triggers an outside destination announcement and the internal next-stop signs and announcement. It also integrates location data with fare collection, electronic controlled engine data and ultimately, automated passenger counters,

The AATA network makes use of extensive timed transfers at four major transfer points. When a bus is running behind schedule, AOS enables digital bus-to-bus communications to improve the transfer between buses; the driver of the first bus can send a digital request (that includes the bus' location) to hold the second bus to ensure that a passenger will not miss a desired transfer.

Video surveillance is provided on board vehicles for security, as well as to help resolve any claims that may arise.

On the paratransit side, drivers receive their entire schedules and mark their arrival and departure times with date, time and location information as well as all the features above.

"The Smart Operation Center"

The AATA Operation Center collects and acts upon information provided by the transit vehicle and drivers. Each AATA bus has an 800 MHZ radio and onboard computer. The system minimizes voice transmissions by providing data messages that summarize vehicle status, operating condition, and location. Out-of-tolerance engine conditions such as oil pressure and temperature are reported in real time to the onboard computer, the Operations Center and the Maintenance Department.

Through the use of real time displays of vehicle location and schedule adherence reporting, dispatchers working at the Operation Center can manage the system and assist drivers by inserting overload vehicles in the system or recommending re-routing options. All changes to the route and schedule database are noted and automatically updated.

Onboard the vehicle, the driver has an onboard emergency system. When encountering a life-threatening situation, the driver covertly alerts the dispatcher, who immediately notes the vehicle's location on the system's center map and dials the appropriate agency. The system also allows the dispatcher to open up a central public address system inside the vehicle to monitor the situation. The system also supports responsive reporting of routine, non-life-threatening emergencies, such as passenger inconvenience.

For paratransit vehicles, reservations, scheduling, flexible integration with fixed-route, and after-trip information utilize Trapeze software. All of these elements are based on real-time information generated with the Rockwell TransitMasterTM software.

"The Smart Traveler"

The "smart travler" a person informed about his or her transportation options, as well as about current conditions relative to transit use. Inside the bus, next stop announcements, date, time and route are given to passengers utilizing the onboard public address system and a two line LED display. The driver also has the ability to trigger timed and periodic announcements for special events that can be made to support the system. Outside the bus, the current route information is announced to waiting passengers, and the destination signs are changed based upon the location. Kiosks will provide real-time bus location information at selected locations; ultimately this information will be provided to travelers at their home or workplace via telephone, cable television or internet.

Passenger Perceptions of AATA Service

During May and June 1999 a survey was conducted of AATA passengers on a randomly selected set of trips. This survey was part of the evaluation of AATA's Advanced Operating System (AOS), as well as one of an ongoing series of on-board surveys used to track changes in customer perception of AATA service.

The survey data reported in this study were collected from a survey of AATA's fixed-route bus passengers over three consecutive springs. Trips within each route were selected, and written survey questionnaires were distributed to all passengers. Approximately 110 to 120 trips were sampled in each year, with an average of ten responses per trip. Opinions and attitudes of passengers were first collected in the spring of 1997. This survey was conducted before AATA introduced the AOS. The second set of data was collected in the spring of 1998 during a period in which AATA had begun operating the AOS, although all parts of the system were not fully integrated by the end of the survey period. By the third survey period in the spring of 1999, the AOS achieved almost full operational status.

Results and Discussion

From the survey results, a snapshot of AATA ridership was obtained. Because of the randomization of routes and times, the three surveys should consist of a representative sample of AATA ridership. This demographic information is from 1999, but similar results were obtained from the previous surveys. Of the ridership, 43 % were male, 57 % female. The average age of all riders was 32.7 years. The mean household income of riders was $28,611, with 35.3 % reporting that they make less than $15,000 per year. At the other extreme, 6.8 % of riders report making greater than $75,000 per year. Key employment characteristics include 21.2 % reporting at least part time college, 48.2 % reporting at least part time employment and 7.1 % reporting at least part time retirement. At least 44.8 % of passengers report riding at least 5 days in the previous week. Riders also were asked about other transportation alternatives available to them; approximately one sixth of all riders reported having a car available to them for drive-alone use (Table 1). Almost 78 percent of passengers report making trips that require transfers. However, transferring passengers are more likely to appear in the survey sample, so this number undoubtedly overestimates the total proportion of passengers that make transfers.

Table 1: Alternative Travel Options Available to AATA Riders, 1999

Travel Option	Percent of Riders Indicating they Have that Option
Drive Alone	17.6%
Get a Ride	41.5%
Walk	37.1%
Bike	13.8%
No other Option	18.5%

Customer Response

In general some modest deterioration was observed in indicators of passenger satisfaction in the last few years (Table 2). The worst declines seem to be associated with passenger perception of on-time performance and transferring quality; but

statistically significant declines over the three years were also observed in the areas of bus cleanliness, convenience of bus stop location, and AATA service overall.

Table 2: Passenger Satisfaction with AATA Service, 1997 – 1999.
(1 = worst, 5 = best)

	1997		1998		1999	
Area	*Satisfaction Estimate*	*Sample Size*	*Satisfaction Estimate*	*Sample Size*	*Satisfaction Estimate*	*Sample Size*
Making transfers	4.21	1040	4.19	1157	4.04**	1086
Driver courtesy	4.25	1137	4.20	1212	4.15	1160
Information on bus routes and service	4.28	1130	4.26	1199	4.24	1136
On-time performance	3.89	1135	3.90	1207	3.71**	1161
Bus cleanliness, attractiveness	4.04	1134	4.05	1205	3.95*	1145
Convenience of bus location	4.18	1129	4.15	1197	4.04*	1156
Directness of routes	4.08	1122	4.05	1188	4.02	1136
AATA service overall	4.25	1125	4.25	1202	4.16*	1162

Statistically significant change 1997 to 1999
* with 95 percent confidence, ** with 99 percent confidence

Impact of AOS Elements

This modest decline in passenger satisfaction was despite the deployment of AOS, designed to improve service in a number of key areas, including on-time performance and transferring quality. But in contrast to these overall measures of satisfaction, indicators of impact of specific AOS elements were significantly more positive.

By the 1999 survey, most elements of the AOS were operational. Passengers were asked to rate aspects of the AOS in terms of their impact on the service the passengers receive (Table 3). These ratings ranged from 1 (“made a lot worse”) to 5 (“made a lot better”). These elements received quite high marks from passengers using AATA service.

Table 3: Mean Perceptions of Service Changes Related to AOS Elements, 1999
(1 = “Made a lot worse, 3 = “No effect”, 5 = “Made a lot better”)

AOS Element	Rating	Responses
Time Display	4.48	1075
Voice Announcements	4.39	1092
Visual Announcements	4.33	1060
Automated Transfer Requests	4.29	937
Pacing Information	4.03	965
Video Cameras	4.02	859

Passenger Perception of Safety

In contrast to the modest deterioration in passenger perception of service elements described above, passenger views on safety of using AATA have improved since 1997. Table 4 presents the mean values of responses to the question: "Please rate the following in terms of safety," where passengers indicated their perception of safety on a five point scale (1="Very Unsafe" and 5="Very Safe"). Statistically significant improvements were observed between 1997 and 1999 in perceptions of safety walking to and from bus stops, riding on the bus during the daytime, and waiting at the Blake Transit Center.

Table 4: Mean Values of Safety Ratings, 1997-1999

Activity	1997	1998	1999
Walking to and from usual bus stop	4.25	4.30	4.41**
Waiting at usual bus stop	4.41	4.44	4.45
Waiting at the Blake Transit Center	3.97	4.13	4.08*
Waiting at Ypsilanti Transit Center	3.59	3.61	3.59
Riding on AATA bus in the daytime	4.53	4.49	4.61**
Riding the bus after dark	3.92	3.73	3.91

Statistically significant change 1997 to 1999

* with 95 percent confidence ** with 99 percent confidence

Real Time Information

The introduction of the AOS will allow AATA to disseminate real-time information of estimated arrival time at bus stops. Although this system is not currently operational, passengers were asked how receptive they would be to such information. There does appear to be a great deal of interest in arrival timing information this system could provide, however that interest lagged between 1998 and 1999. Most passengers, approximately 86 %, said this type of information would be useful or very useful in 1998, only 71% of passengers said this information would be useful in 1999 (Table 5). When given the choice of media to see this information (Internet, cable television, bus stop display, or over the phone) passengers were most receptive to having the information at bus stops. In both the 1998 and 1999 surveys, over 61 % of passengers said they would be very likely to use arrival time information if made available at bus stops. Other options for dissemination of real time information were less popular: 27.4% of respondents were "very likely" to use real time information posted on the internet; 33.3% on cable television; and 33.7 percent by telephone.

Table 5: Usefulness of Information about Bus Arrival Time

	Very useful	Useful	Somewhat	Not useful	N =
1998	55.8 %	30.1 %	11.0 %	3.1 %	1078
1999	43.6 %*	27.6 %	20.3 %*	8.4 %	988

* statistically significant differences ($p < .05$)

Satisfaction with Transfers

Because of the specific design of AOS to improve the coordination of transfers between buses, passengers were asked specifically about their satisfaction with AATA's coordination of the transfer. Table 6 presents the results, separated by passengers who make transfers and those who do not. Among those who make transfers, no statistically significant change was observed in perception of quality between 1997 and 1999, despite a modest improvement in 1998. Among passengers who do not report making transfers, perceptions deteriorated somewhat between 1997 and 1999.

Table 6. Level of satisfaction with transfers
(1 = Very satisfied, 4 = Very unsatisfied)

		1997		1998		1999		
Item	*Make transfers*	*Mean satisfaction rating*	*sample size*	*mean satisfaction rating*	*sample size*	*mean satisfaction rating*	*sample size*	*Sig*
Satisfaction with transfers	yes	1.86	730	1.78	733	1.87	802	*Not signi-ficant*
	no	1.82	152	1.91	135	1.97	105	*95% Confi-dence*
Sig		*Not significant*		*95% Confidence*		*Not significant*		

Directions for Future Improvment

Finally, passengers were asked to indicate in which areas service increases would make the greatest difference. The results were quite unambiguous (Table 7): To the extent that new service can be added, current passengers prefer such service on weekends by a significant margin. Many lines operate on an hourly basis during the weekend schedule; apparently the marginal benefit of additional service is seen to be greatest under those conditions.

Table 7: Which Option Would Most Improve Service For You?

Improvement	Respondents
More Sunday service	544
More Saturday service	535
More frequent weekday evening service	293
More frequent peak hour service	311
More frequent midday service	157
Later weekend service	539
Later weekday evening service	371

Conclusion

The inference from these mixed results is a matter of interpretation. Ideally the impact of an APTS deployment would be one that improves the transit experience. One would expect general satisfaction ratings to get better. This has not been the case with the introduction of AATA's AOS. But although general ratings of AATA's service have decreased since the introduction of the AOS, passengers have responded favorably to the individual elements of the system. However, the favorable impact passengers perceive regarding individual system elements is apparently too small to alter perceptions of the overall level of service provided by AATA.

In contrast, a steady improvement in passengers' rating of the safety of using the AATA system was observed between the three years. This improvement is plausibly an an outcome of deployment of the AOS, including video cameras on board buses.

Finally, it should be noted that any single survey is merely a snapshot of conditions at a given time, and thus should be interpreted carefully and in light of other trends. Studies such as this are never able to control external conditions including traffic and construction; variations in these elements undoubtedly affect survey results differently in different years. Nonetheless, it is hoped that regular monitoring of passenger perception of AATA service can help generate necessary feedback for efforts at transit improvement in Ann Arbor.

Appendix A: Survey Questionnaire for 1999 Survey