Transit Customer Acceptance of Automated Fare Collection Systems

Peter J. Foote, Ross T. Patronsky, Darwin G. Stuart
Chicago Transit Authority

Abstract

The Chicago Transit Authority (CTA) inaugurated an Automated Fare Collection (AFC) system in Fall 1997. More than 1 million daily rides now utilize AFC to access CTA's bus and rail service networks. While this represents about three-fourths of all CTA riders, many have stayed with cash or tokens (though the latter are now being phased out); monthly passes have been fully integrated with the farecard technology.

This article provides a one-year perspective on customer reactions to, acceptance of, and problems with the new AFC system. It examines "before" and "after" shifts among the various fare media options available, and discusses major differences for bus and rail customers regarding ease of purchasing automated farecards and the resultant greater usage levels for rail as compared to bus. This article also reviews behavior in purchasing precoded, fixed-value farecards; buying variable-value farecards at automated vending machines (AVMs) located at rail stations; and recharging previously purchased farecards at those AVMs. Systemwide customer satisfaction surveys conducted in 1995 and 1997 found that satisfaction ratings, particularly among bus riders, significantly improved for several different fare-related service attributes. Transactions handled by rail station customer assistants, the CTA customer service hot line, and its AFC express unit desk, in dealing with customer questions/problems

regarding the new AFC equipment, are also discussed. Typical weekday complaint levels related to AFC—especially those involving refund requests—are quite modest, but require sustained levels of courtesy and quick response.

Introduction

In September 1997, the CTA completed implementation of an AFC system on both its bus and rail service networks. This \$106 million project required a 27-month implementation period, with much of the investment applied to refitting CTA's 141 rail rapid transit stations with appropriate automated turnstile and farecard vending machines. Implementation on the 129-route bus system involved integrating automated transit farecard readers with computerized cash and token fare collection equipment, which remained in service. The AFC system utilizes a credit-card-size farecard with a magnetic stripe that stores its monetary value, decreased electronically by the value of every originating ride or transfer used, and increased electronically whenever dollar value is added at an AVM.

This article summarizes the impact of the AFC system on CTA's customers over a period of 13 months following full implementation. In general, an effective July 1997 multimedia marketing campaign, followed by expanded and improved customer service operations related to fare collection, helped smooth the customer acceptance process. Since AFC represented one of the most dramatic changes in day-to-day usage of the CTA system in many years, much attention was given to facilitating the transition process. Several major shifts in key CTA job positions were required, including converting former rail ticket agents into customer assistants, and increasing the customer service staff to deal specifically with rider problems encountered in using the new AFC equipment.

Shift in Fare Media Usage

Figures 1 through 5 summarize both revenue and ridership shifts among fare media between October 1996 and October 1998. Monthly revenue and ridership by fare medium are indicated. While the primary objective of implementing AFC was to improve the efficiency of revenue collection, both from financial accountability and customer convenience viewpoints, customer-

switching to the new automated farecards was not mandatory. As a result, while AFC quickly became the primary means for fare payment on the CTA system, monthly passes, tokens, and cash also continued to represent major fare payment options. Though cost-per-ride savings were offered as a primary incentive to switch to farecards, cash and tokens (with the latter no longer offering a discount, but representing only an equivalent to cash) continued to be used by many riders.

Several major impacts are suggested by Figures 1 through 5. While unlimited ride passes were also equipped with magnetic stripes to be readable by bus and rail fare collection equipment, their price (\$88 for full-fare riders) was unchanged, and their usage level essentially also remained unchanged. With the 11 percent discount for tokens eliminated—and essentially transferred to farecards instead—tokens dropped quickly in popularity, from about 29 percent of all riders in October 1996 to only 9 percent in October 1998. Some token users have remained loyal to this fare medium as a result of habit, continued convenience, and/or unwillingness/apprehension regarding the new automated equipment. Cash fare riders have continued at a somewhat surprisingly high level: nearly 41 percent in October 1998 of all revenue collected, and about 20 percent of all rides carried. (Transfers received, when paid for by cash, accounted for another 22% of October rides.)

As Figure 4 indicates, cash-fare customers are primarily riding CTA's bus system, where they represent 24 percent of all bus riders carried (again, transfers paid for by cash accounted for another 25%). This, in part, reflects the distribution of neighborhood opportunities to conveniently purchase automated farecards. In general, while these are available at 525 food store and currency exchange locations throughout CTA's service area, as well as at all 141 rail stations and at CTA offices, many originating bus riders apparently still find the switch to prepurchasing farecards to be burdensome. Part of this burden may be financial, as the 1996 median household income of frequent CTA bus riders (\$30,114) was significantly lower than for rail riders (\$35,038).¹ It appears that the prevalued \$13.50 and \$16.50 farecards available at neighborhood groceries and currency exchanges are priced too high (too much initial cash outlay) for some.

Figure 1. Average daily farebox revenue by month and fare type, 1996–1998

Figure 2. Average daily farebox revenue, October 1996, 1997, 1998

Figure 3. October monthly system ridership by fare medium, adjusted, 1996-1998

Figure 4. October monthly bus ridership by fare medium, adjusted, 1996-1998

Figure 5. October monthly rail ridership by fare medium, adjusted, 1996-1998

Bus riders paying by cash or tokens are issued an automated transfer card, if requested and with additional payment, which permits them to transfer to rail via the automated fare equipment. Because half of all CTA riders transfer between modes, offering bus-to-rail and rail-to-bus automated transferring opportunities is essential for efficient operations. It also allows many bus riders to "ignore" the AFC system, even though they may be missing an opportunity for cost savings on a per ride basis.

As indicated in Figure 5, the ready availability and convenience of AVMs for purchasing farecards at all CTA *rail* stations has been a primary incentive for switching to AFC. Use of tokens and cash on rail has consequently declined to only about 4 percent and 9 percent, respectively, by October 1998. (When using cash or tokens to pay for one ride at a time, rail riders may also pay for and be issued an automated transfer card to use for bus service.)

Another major incentive for rail riders to switch to AFC, in addition to convenience of farecard purchase, is that generally only one turnstile at each rail station is equipped to handle coins (no bills) or tokens. The other turnstiles handle farecards only, thereby providing "gentle persuasion" for switching to farecards—in order to avoid rush-hour lines at the one turnstile still accepting cash and tokens. This particularly applies, of course, at CTA's higher ridership rail stations, including all 17 in the central area, where four, eight, or more turnstiles are typically in operation, but only about one-fourth accept cash or tokens.

Monthly Farecard Sales Patterns

When purchasing farecards at AVM machines located at rail stations, CTA customers may either buy a new farecard or recharge an existing one. Promotional material and customer assistants encourage precharging of existing farecards, as this allows customers to retain whatever value may remain on that card and reduces CTA costs for the farecards themselves. In addition, two types of prevalued farecards, with a fixed value of either \$13.50 or \$16.50, were initially available at currency exchanges and food stores. Both of these farecards automatically offer a \$1.50 riding bonus; that is, the \$13.50 farecard actually gave \$15.00 in rides. AVMs also offer this bonus for multiples of

\$13.50 in farecard purchase. (On November 1, 1998, prices were adjusted so that a \$10.00 farecard purchase received a \$1.00 riding bonus. The intent was to offer a bonus at a more convenient price, requiring, for example, only a \$10.00 bill, or two fives.)

Figures 6 and 7 summarize comparative sales characteristics for these different farecard purchase and recharge options. A total of 69 percent of all farecard purchase transactions, and 78 percent of the value of those transactions, involve recharging at AVMs. Only 6 percent of farecard purchase transactions, and 14 percent of the value of those transactions, involve prevalued farecards purchased at neighborhood (nonrail) locations.

The average initial sales and added recharge value for AVM farecard transactions are relatively low—only \$6.58 for initial sales and \$5.49 for added value. The range of variation here is extensive, however, as indicated by the large standard deviation associated with these purchase values. The relatively low cash outlays for farecard purchase at AVMs also indicate that small numbers of CTA customers qualify for the prepurchase bonus of 11 percent (\$1.50 for every \$13.50 of farecard value).

Figure 6. Monthly farecard sales vs. transactions, October 1998

Figure 7. AVM farecard sales daily average, October 1998

Bus and Rail Fare Media Transactions

Figures 8, 9, and 10 and Table 1 summarize a typical weekday in October 1998 with regard to fare payment media. Originating fares, both full-fare and reduced-fare riders, are indicated. For transfers received, passes, and free rides, it is not possible to distinguish full- from reduced-fare riders, so combined totals are given. The bus and rail components of overall system ridership, on an average weekday, are also indicated. The relative proportion of system rides attributed to each of 10 different fare media is given, with bus vs. rail comparisons of particular interest.

Reduced-fare riders (students, seniors, disabled) show a much lower rate of conversion to AFC fare payment (Table 1). Tokens still represent their primary means for originating rides, followed by cash, with farecards a distant third. Transfer cards, issued on bus only to cash-paying and token-fare riders, represent the primary type of "transfer received." In fact, they represent 22 percent of all rides carried, compared to transfers deducted from transit cards, at 10 percent. (Transit cards cover both originating fares and up to two transfers per journey.)

Figure 8. Typical 1988 system ridership by fare medium adjusted, October 1998

Figure 9. Typical 1988 bus ridership by fare medium adjusted, October 1998

Figure 10. Typical 1988 rail ridership by fare medium adjusted, October 1998

Processing of transfer cards on buses correspondingly represents the single most prevalent type of bus rider carried, at more than one-fourth of all bus boardings. Cash-paying customers represent the second largest type of boarding bus riders, at 24 percent, followed by full-fare originating transit card users, at 12 percent. For rail, 47 percent of all boarding passengers are originating full-fare transit card users—by far the prevalent type of rider on rail. Token-fare and cash payment represent only about 4 percent and 9 percent of all rail riders, as originating fare payment customers. Even on rail, transfer cards issued to bus riders represent a significant type of fare payment—in fact, at 14 percent of all boarding rail riders, this is the second largest type of fare media presented.

Bus and Rail Customer Service Transactions

In October 1997, just one month after full implementation of the AFC system (and three months after CTA's major AFC marketing campaign, which coincided with about 95% implementation), a random digit-dial customer satisfaction survey was conducted within the CTA service area.² A total of 44 different overall transit service quality features were investigated for both bus and rail riders, with a number of these either directly or indirectly involving fare

Table 1
(Supplement to Figures 8, 9, and 10)
Full-Fare and Reduced-Fare Rider Components of Originating Rides

	<i>Transit Card</i>		<i>Tokens</i>		<i>Cash</i>	
	<i>Full</i>	<i>Reduced</i>	<i>Full</i>	<i>Reduced</i>	<i>Full</i>	<i>Reduced</i>
Bus	11.6%	0.5%	4.6%	6.4%	19.5%	4.9%
Rail	46.8	1.6	2.8	0.8	8.3	0.8
System	22.8	0.8	4.0	4.6	16.0	3.6

Note: Percent of total average weekday rides.

payment. When compared with a similar survey conducted two years earlier,³ it was found that bus riders, in particular, significantly improved their ratings of several fare-related service attributes. As indicated in Table 2, ease of making transfers, as well as the cost of transferring, were both rated significantly higher, as were the cost of a one-way ride and the cost of a monthly pass. Curiously, even though rail riders converted at a higher level to AFC, their ratings of these same service features did not significantly improve.

The lower perceived cost of transferring (Table 2) reflects the fact that transfer costs are now only deducted from farecards when actually used, as compared to the prior possible purchase of transfers (and transfer cards) that are ultimately never used, because an intended bus is late in arriving or for other

Table 2
Changes in CTA Customer Satisfaction of CTA Bus
(November 1995–November 1997) (%)

<i>Attribute</i>	<i>1995</i>	<i>1997</i>
Value of service for fare paid	3.35	3.55
Cost of one-way ride	3.04	3.36
Cost of monthly pass	2.48	3.05
Cost of transferring	3.12	3.48
Ease of making transfers	3.64	3.79
($p < .05$)		

reasons. Perceived improvement in the cost of the monthly pass probably reflects a misinterpretation on the part of some bus riders of the automated fare-card as a kind of "pass," even though the cost of each ride is individually deducted, rather than allowing unlimited rides. Perceived reduction in the cost of a one-way bus ride most likely reflects the "bonus ride" associated with purchasing farecards in multiples of \$13.50. As noted earlier, the lower median household incomes of CTA bus riders may also be a factor in this increased perception and significance of modest fare reductions.

CTA's Customer Service Division was reorganized and expanded in early 1997 as part of a renewed emphasis on increasing customer satisfaction. Implementation of AFC as a major new technology upgrade for collecting fares from most CTA riders was initially viewed with some trepidation by this group. The group was concerned that, given the potential for even small rates of equipment failure, across a million or more fare transactions daily, the daily complaint rate would be extremely high. In anticipation of potentially large increases in both inquiries regarding how the AFC system works, as well as complaints regarding AFC equipment failure (incorrect amounts deducted from farecards, refunds requested, etc.) the customer service staff received special training in AFC operations.

As indicated in the 15-month graphs given in Figures 11 and 12, calls to the CTA customer service "hot line" telephone number regarding AFC did increase dramatically. However, calls that represented either AFC inquiries or complaints reached initial levels consistent with other types of inquiries and/or complaints, but did not overwhelm CTA staff.

These two figures indicate that the peak number of inquiries regarding AFC/fares understandably occurred during its first "official" month, July 1997, and reached about 2,500 calls for that month. These calls generally declined on an ongoing basis over the following year, reaching a low of only 109 calls in July 1998. Other types of calls to the hot line center also regularly exceed 2,000 per month, including travel information requests (how do I get from A to B?), as well as general inquiries regarding various CTA matters (including service changes on specific routes) and overall complaints of several different types.

Figure 11. Calls to 1-888-Your-CTA by call type, March 1997–November 1998

Figure 12. Complaint calls to 1-888-Your-CTA by call type, March 1997–November 1998

As shown in Figure 12, the number of complaints (in general, refund requests) associated with the new AFC system was high in its initial month, at nearly 1,500, but then declined gradually to a low of under 450 in December 1997. Since then, however, complaints have gradually increased, to reach a new high of over 1,500 in July 1998. Reasons for these increases in AFC/fares complaints over the spring and summer of 1998 are not clear, though they again began to decline in the fall. For infrequent travelers, the one-year validity of farecards purchased at the onset of AFC implementation began to expire in mid-1998 and partially contributed to increased complaints. New users generated over the spring and summer could also be a major underlying factor.

During the fall and winter months of 1997 to 1998, AFC/fares complaints began to fall to a level consistent with the other two primary categories of CTA customer complaints, on-time performance and friendliness/courtesy of operators. For example, in February 1998, AFC/fares complaints were roughly only twice the volume (546) of each of the other two complaint categories. Prior to AFC, fare-related complaints were typically well below on-time and courtesy concerns.

A special unit, established to exclusively handle AFC refund transactions, was readily accessible at the main offices of CTA in downtown Chicago. Its activities were examined for a typical weekday in October 1998. Activity levels were also compared against a typical weekday for CTA rail customer assistants, who represent CTA's primary face-to-face interaction—along with individual CTA bus operators—with customers regarding fare payment.

In general, the AFC express unit deals with five different activities: processing fare discrepancy reports that are forwarded to them from rail customer assistants (meaning that the rail customer assistant was not able to resolve a fare discrepancy on the spot, being empowered to issue immediate replacement farecards, in denominations of \$3.60, \$10.00, and \$20.00), processing similar bus-fare discrepancy reports from bus operators and bus garage supervisors, handling walk-in refund requests, mailing refunds generated from all three previous sources, and handling phone calls regarding refunds or the status of prior refund requests.

Comparisons of customer interactions indicate that typical weekday activity levels at CTA offices regarding the most troublesome type of customer complaint related to AFC—requesting a refund—are quite modest: about 30 fare discrepancy reports (from bus and rail) handled daily, together with 25 walk-in refund requests, and 50 phone calls.

The daily volume of rail-fare discrepancy reports prepared by customer assistants was also examined. These involve all rail customer AFC discrepancy interactions, both those settled on the spot by the customer assistant as well as those forwarded to the AFC customer service express unit for follow-up. These figures again show that most customers experience AFC problems with the AVMs that take their cash and issue farecards. About 125 to 135 AVM incidents are handled per day, with 75 percent of these involving “lost value on farecard.” At rail turnstiles, only about 10 incidents per day are reported, with damaged farecard and double deduction of fare the most frequently reported malfunctions.

Customer assistants typically handle an average refund transaction of under \$10, for both AVM problems as well as turnstile malfunctions. The average refund handled at the AFC express unit is typically much larger, with walk-ins the highest at over \$25 per refund, and with somewhat lower levels associated with mailed check refunds, as well as with mailed replacement farecards.

As indicated in Table 3, these different levels of AFC-related customer transactions—with the CTA call center, AFC express unit, and rail customer assistants—together yield a manageable systemwide level of about 260 daily customer transactions. This converts to a daily “problem incidence rate” of about 2.3 per 10,000 AFC transactions.

Conclusions

The following conclusions were drawn from the examination of “before” and “after” shifts in available fare media options:

- Though AFCs are technologically advanced, and somewhat intimidating (at least at first) for many transit riders, careful implementation

Table 3
Summary of Daily AFC-Related Customer Service Transactions

<i>Customer Service Group</i>	<i>AFC-Related Customer Service Transactions</i>	<i>Average Number of Weekday Customer Transactions (October 1998)</i>
Customer service call center	<ul style="list-style-type: none"> • Inquiries • Complaints, problems, refund requests 	10 52
Customer service AFC express unit	<ul style="list-style-type: none"> • Bus FDRs^a • Rail FDRs^a • Walk-in refunds 	19 12 25
Rail station Customer assistants	<ul style="list-style-type: none"> • AVM problems, refund requests • Turnstile problems, refund requests 	131 11
Total = 260^b		
Typical <i>overall</i> number of AFC equipment weekday operations, October 1998	<ul style="list-style-type: none"> • Rides processed^c • Farecards issued or revalued, AVMs 	1,053,700 92,500
Total = 1,146,200		
AFC customer problem incidence rate = 2.3 per 10,000 transactions		

a. Fare discrepancy reports.

b. Some double counting among categories is likely.

c. Bus farecard processing units, rail turnstiles.

Note: Not included are other AFC equipment servicing and maintenance operations, which otherwise did not result in customer farecard revenue loss or related complaint, such as miscellaneous repair of inoperable turnstiles.

and effective marketing can result in their successful inauguration and being well-received by customers.

- The keys to successful implementation of an AFC system are convenience of purchase and ready availability of AVMs for flexible-price purchasing of farecards. This was clearly reflected in the much lower acceptance of AFC farecards by CTA bus riders, whose access to AVMs was more limited.
- Implementation of CTA's AFC system was an important component, involving several fare-related service attributes, in improved overall customer satisfaction between 1995 and 1997.

- Even within well-designed and implemented AFC systems, cash is likely to still be a significant fare medium, if allowed. Customers who prefer cash are generally not price sensitive,⁴ and may also be relatively infrequent riders who, partially through unfamiliarity with the equipment, continue to prefer cash.
- Customers readily accept the idea of recharging farecards already in their possession. This allows them to retain whatever value may remain on a farecard, and also helps the transit operator reduce the costs of printing, encoding, and issuing new farecards.
- Major technology advances such as AFC will likely produce a whole new area of customer inquiries, problems, and complaints. While this new area of customer interactions may become more frequent than others (such as complaints over on-time performance and operator courtesy), it need not overwhelm the staff.
- AFC can significantly increase both the flexibility and control necessary to more readily allow multiple fare options. In fact, CTA recently introduced several pricing revisions in its fare structure that involve adjusting downward the farecard purchase price at which a 10 percent bonus is awarded, and lower priced 30-day passes that become effective on the first day of use.
- AFC can also facilitate fare policy innovations designed to increase ridership and/or revenue. For example, CTA recently implemented a discounted University Pass Program (U-Pass) for full-time university students at 14 different colleges and universities within its service area. The program relies on AFC technology to uniquely encode each U-Pass farecard with school and student serial number and specific term/semester validity dates.
- AFC allows a major leap forward in the quality of ridership data available for service planning and analysis (by bus route, rapid transit line and station, time of day, fare media utilized, etc.). Such improvements continue to be actively employed by the CTA planning staff to facilitate operations.

Endnotes

1. Northwest Research Group, *Customer satisfaction survey of Chicago Transit Authority riders*, Chicago Transit Authority, December 1997.
2. Ibid.
3. Northwest Research Group, *Customer satisfaction survey of Chicago Transit Authority riders*, Regional Transportation Authority, December 1995.
4. Multisystems, *Stored-value farecard pricing survey and ridership/revenue model*, Chicago Transit Authority, December 1995.

About the Authors

PETER J. FOOTE is a senior transit research analyst in the CTA's market research department. He has been engaged in transportation research since joining the CTA in 1987, where he has been project manager of a wide variety of customer-focused on-board, telephone, and mail surveys. He is active in the Transportation Research Board's (TRB) Marketing and Fare Policy Committee.

ROSS PATRONSKY is manager of data services and development at the CTA, and is responsible for reporting and analyzing ridership. He has devoted more than 20 years to the transit industry, including stints in Madison, Wisconsin, and Ann Arbor, Michigan. He holds master's degrees from the University of Michigan, and has been active in the Chicago Chapter of the American Statistical Association.

DARWIN G. STUART is manager of market research at the CTA, where he has been responsible for a variety of system planing, corporate planning, and market analysis activities. He has also worked as a private transportation and transit planning consultant and has been active with TRB committee and research panel efforts. He holds a doctorate degree from Northwestern University.