

Socioeconomic and Travel-Behavior Characteristics of Transit Pass Users

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A large number of transit systems have begun selling monthly transit passes during the last decade without the benefit of data on who buys transit passes, what effect buying a pass has on transit travel behavior, and how many bus trips per month are taken with a pass. This paper documents these characteristics of transit pass purchasers by using a large-scale data base collected after the introduction of a monthly transit pass in Atlanta, Georgia. The quantitative information presented can provide useful input to transit officials who are planning to start a transit pass program or who may want to evaluate and possibly modify an existing one. In general, the findings show that pass purchasers tend to reflect the characteristics of frequent transit users. Thus, those purchasing passes include relatively more women and minorities and those with lower incomes and fewer automobiles available. There exists, however, a large number of frequent transit users who have not bought a monthly transit pass. On average, the monthly transit pass was used to make about 52 one-way transit trips per month compared with the breakeven-price level of 40 one-way trips. Thus, significant savings can be realized by using passes compared with paying cash fares. Although two-thirds of the bus trips are made for commutation purposes, about two-thirds of the new trips taken after buying a pass were for nonwork purposes. Basically, this was because pass buyers were already frequent users of the system for traveling to and from work.

The changes in travel behavior that occurred after a monthly transit pass was introduced in Atlanta are evaluated and the socioeconomic characteristics of the pass users (prior to the start of the rail transit system) are described. Given the contrasting actions taken in different areas with respect to selling transit passes, information on who buys passes and why along with how frequently passes are used and for what purposes can be used as a yardstick by transit officials who may be planning to start a pass program or who are considering modifying an existing one.

The number of transit agencies selling monthly transit passes has grown significantly since the early 1970s. A survey of 241 transit agencies across the United States conducted in February 1981 by the American Public Transit Association (APTA) revealed that slightly more than 50 percent of the properties contacted sell a monthly transit pass (1,2). This is in sharp contrast to the very few properties that were selling passes in 1970 or the 36 major transit systems that had monthly passes available in 1975 (3).

This growing trend in the number of transit agencies selling passes has occurred in spite of recent actions in a few cities to suspend the sale of unlimited-use passes. For example, the Regional Transit Service of Rochester, New York, suspended (and eventually discontinued) the sale of its \$6.00 weekly pass in September 1980 because the rapid growth in the number of these passes sold was leading to an overall decline in revenue. The monthly unlimited-use \$24.00 pass continued to be sold, however (4).

On May 26, 1981, a judge of the Pennsylvania Common Pleas Court ordered the Port Authority of Allegheny County to eliminate all weekly, monthly, school, and annual pass discount programs (5). This action was allegedly taken in order to reduce revenue "losses" that result from selling reduced-price passes, thereby keeping to a minimum the then-proposed increase in regular cash fares. However, an injunction was obtained staying this order. Subsequently, a higher court ruled that the case be reconsidered and the matter is still before the courts.

Notwithstanding these actions, other areas continue to introduce new transit pass programs (especially those marketed through employers) or have even reduced the breakeven price of their monthly passes, as shown by Parody in a paper in this Record. For example, in Atlanta, the Metropolitan Atlanta Rapid Transit Authority (MARTA) reduced the breakeven price of its monthly TransCard from 20 to 17 round trips in July 1980, while in Boston, the Massachusetts Bay Transportation Authority (MBTA) reduced the breakeven level of its three most expensive monthly passes from 18 to 16 round trips in October 1981.

MARTA TRANSIT PASS PROGRAM

On March 1, 1979, MARTA introduced a monthly pass called TransCard that was valid for unlimited rides during a given month by a single individual (i.e., the pass is not transferable). The pass program was introduced at the same time that the regular transit fare was increased from \$0.15 to \$0.25. One of the objectives of the pass program was to help lessen the impact of the 67 percent fare increase on frequent users of the system as well as to act as a fare and transit integration instrument for intra-modal (i.e., bus to bus) and later intermodal (i.e., bus to rail) transit transfer users (6).

The TransCard was priced at \$10.00, reflecting a breakeven use rate of 20 round trips per month. (Subsequent to this evaluation the pass price was increased to \$17.00 in July 1980 when transit fares were increased from \$0.25 to \$0.50 and again to \$21.00 in July 1981 when fares were increased to \$0.60.) As further background information, it is important to note that MARTA has a single, flat fare (except for limited-service areas outside of DeKalb and Fulton Counties) and operates with a universal system of free transfers. Thus, unlike other transit systems that have reduced-fare or no transfer privileges, individuals who must transfer on the MARTA system do not save money on the cost of transferring by buying a TransCard. Convenience of transferring is increased, however, since a passholder does not have to obtain a transfer slip from the bus driver. In this sense, the pass acts as an integrated fare collection instrument.

The majority of TransCards are sold at MARTA's Ridestore, which is located in the central business district. Passes are also available to the general public at about 20 other participating outlets and through the mail. At the time of the data collection and analysis reported in this paper, very few passes were sold through employers.

The locations at which transit passes are sold can have an important influence on the type of individuals buying a pass and thus on how often the pass is used. In this instance, virtually the entire transit-riding community--and in particular, those who are transit dependent--had access to a pass outlet. This is not always true, however. For example, transit passes that are sold only through employers (7) usually cannot be purchased by students or by lower-income transit dependents who work alone or for small firms (e.g., domestics and ser-

vice personnel). While these other programs minimize potential losses in revenue to the system, since frequent transit users may not be able to buy the pass, issues such as equity should be a consideration in their development.

DATA-COLLECTION PROCEDURES

To undertake this analysis, data on the characteristics of cash-paying and TransCard users were obtained through the use of a personally administered on-board bus survey. This approach avoids the problem of relatively low response rates associated with self-administered postcard surveys and the uncertainty associated with biased or disproportionate response rates from either pass or cash users or along any other market segment dimension (e.g., income). The questionnaire and accompanying evaluation plan were developed by Charles River Associates with input provided by the Transportation Systems Center (TSC) and MARTA (6). The survey was administered by MARTA personnel on a representative sample of bus routes equally divided by corridor of the city and over six time periods: morning peak, midday, afternoon peak, evening, and all day Saturday and Sunday.

The determination of the number of bus routes to be surveyed was based on the number of surveys that can be completed over a given time period and the total sample size required. The total sample size is a function of the accuracy desired and the eventual use of the data. To evaluate small changes in behavior by fare payment type (i.e., pass and cash users) and by different socioeconomic categories, a relatively large sample size was required. To achieve these objectives, a minimum total sample size of 4000 usable surveys consisting of 2000 TransCard and 2000 cash-fare users was determined (8).

The survey was conducted and supervised by MARTA staff over the period May 10 to May 31, 1979. Interviewers were instructed to administer the survey to every fifth boarder but to alternate between cash and TransCard users. Thus, the survey was stratified by fare payment type but was random for those within a fare category. By using these procedures, a usable sample of about 2400 cash and transfer boarders and about 2200 TransCard boarders was obtained.

Because it is desired to examine the characteristics of pass-purchasing and non-pass-purchasing individuals rather than those of transit boarders, it is necessary to weight the sample by the inverse of a respondent's transit-trip frequency. This is a procedure that is often neglected. By not carrying out this weighting procedure, the information obtained is biased toward the characteristics of frequent transit boarders rather than representing the characteristics of transit-riding individuals. This is true for any characteristic that is correlated with transit-trip frequency.

As an example of the bias introduced by not using this weighting procedure, mean transit-trip frequency without weighting for TransCard and cash boarders was determined to be 14.9 and 11.6 trips per week, respectively. However, after weighting, the mean transit-trip frequencies were reduced to 13.3 and 8.8, respectively. Note that the largest change was for those who paid cash since this group has a relatively wider and more skewed variation in transit-trip frequency (i.e., from 1 to 30 trips per week) compared with that of TransCard purchasers (i.e., from 10 to 30 trips per week).

SOCIOECONOMIC CHARACTERISTICS OF USERS OF TRANSCARD AND CASH

Various socioeconomic characteristics of those who

paid fares by cash or by using a TransCard are presented in the top half of Table 1. (Cash users include those who boarded and paid a cash fare as well as those who boarded with a transfer slip obtained by paying a cash fare on a previous bus.) The table lists the mean, standard deviation, sample size, and t-statistic that can be used to test the hypothesis that there is no difference between the means (i.e., $H_0: U_1 - U_2 = 0$).

The second column in Table 1 indicates whether the null hypothesis is accepted or rejected at a 95 percent level of confidence. As is readily apparent, the null hypothesis was rejected in almost all instances, implying that a statistical difference does exist between the characteristics of those who use TransCard and those who pay cash. In some instances, however, the difference is relatively small and yet is significant; this is due to the appropriate but relatively large sample size.

The numerical findings of Table 1 are presented as concise summary statements below. In broad terms, the results indicate that those socioeconomic characteristics traditionally associated with frequent transit users are also associated with TransCard purchasers.

1. Age: no difference between those who paid cash and those who used TransCard;
2. Income: TransCard users have lower incomes than cash users;
3. Automobile availability: TransCard users are less likely to have an automobile available;
4. Sex: women are slightly more likely to be TransCard purchasers than are men;
5. Race: minorities are slightly more likely to be TransCard users;
6. Transfers: TransCard users make more transfers than cash users;
7. Bus work trips: those who use TransCard make about three more (one-way) bus work trips per week than those who pay cash;
8. Bus nonwork trips: TransCard users make about 1.3 more (one-way) bus nonwork trips per week than cash users;
9. Additional bus work trips: TransCard users made an average of 0.6 additional work bus trips per week, while cash users made no additional bus work trips; and
10. Additional bus nonwork trips: TransCard users made an average of 1.1 additional nonwork bus trips per week, while cash users made no additional trips.

Figure 1 presents a frequency distribution showing the percentage of those who paid cash and those who used TransCard in each income category. The distribution reveals that although those with the lowest incomes are only slightly more likely to purchase a TransCard, those with higher incomes are much less likely to buy a TransCard. On a relative basis, the highest percentage of TransCard purchases comes from those in the income group \$5000-\$10 000, which could be referred to as "the working poor." However, if other factors such as transit trip frequency are controlled for, income is not a significant variable in terms of describing a pass purchaser (9).

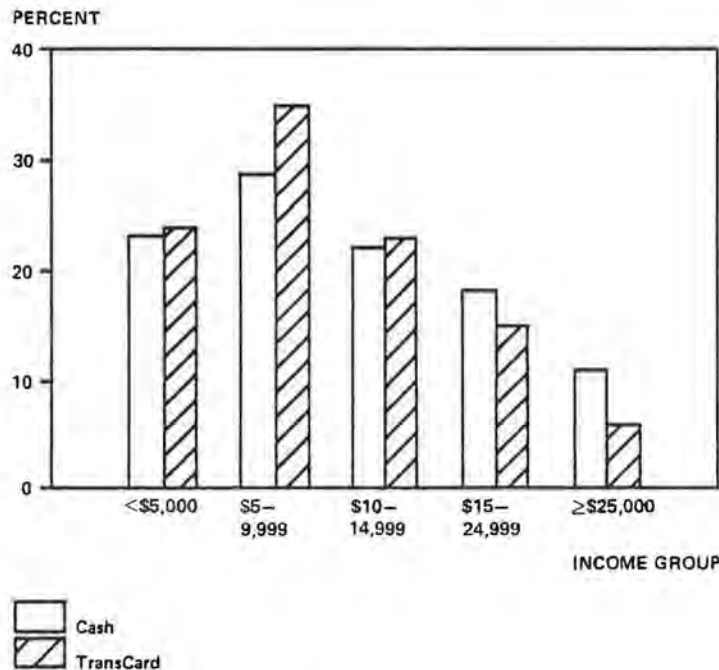
Because of the disproportionate sampling approach that was used, care must be taken in interpreting Figure 1. That is, although the survey sample contains roughly 50 percent cash boarders and 50 percent TransCard boarders, the population share of boarders is estimated at 83.1 percent cash and only 16.9 percent TransCard. (This estimate was determined by performing an independent count of fare payment type by boarders on a random sample of 385

Table 1. Socioeconomic and travel-behavior characteristics of those who paid cash and those who used TransCard.

Characteristic	Paid Cash		Used TransCard		t-Statistic ^a	Null Hypothesis
	Mean	SD	Mean	SD		
Age (years) (N = 2372, 2132) ^b	34.30	15.55	34.33	14.01	-0.07	Accept
Income (\$) (N = 1980, 1820)	12 007	8425	10 521	7284	5.8	Reject
Automobile available (N = 2431, 2191)	0.48	0.50	0.34	0.47	9.8	Reject
Sex (%)						
Male (N = 1015, 860)	41.6		39.2		1.7	Borderline
Female (N = 1423, 1337)	58.4		60.8		1.7	Borderline
Race (%)						
Minority (N = 1717, 1645)	70.4		74.9		3.4	Reject
Nonminority (N = 721, 552)	29.6		25.1		3.4	Reject
Total no. transfers (N = 2441, 2200)	0.740	0.782	0.897	0.816	-6.7	Reject
Bus trips per week						
Total (N = 1892, 2034)	8.86	5.59	13.26	4.69	-26.6	Reject
Work (one-way) (N = 2134, 2122)	5.85	4.50	8.77	3.60	-23.4	Reject
Nonwork (N = 2131, 2068)	3.22	3.67	4.46	4.66	-9.6	Reject
Additional work (one-way) (N = 2134, 2122)	-0.005	1.04	0.58	1.81	-12.9	Reject
Additional other (one-way) (N = 2131, 2068)	-0.013	1.18	1.06	2.54	-17.0	Reject
Total additional (one-way) (N = 1892, 2034)	-0.01	1.80	1.63	3.40	-19.1	Reject
Prior work (N = 2134, 2122)	5.85	4.52	8.19	3.79	-18.3	Reject
Prior other (N = 2131, 2068)	3.23	3.73	3.41	4.18	-1.47	Accept
Total prior (N = 1892, 2034)	8.87	5.64	11.63	4.67	-16.6	Reject

Note: Data from MARTA on-board bus survey (May 1979), calculations by Charles River Associates.
^a Between groups.
^b The first sample size is for the group that paid cash; the second is for the TransCard group.

Figure 1. Income characteristics of those who paid cash and those who used TransCard.



bus vehicle trips.) Therefore, it would be incorrect to infer from Figure 1 that there are more TransCard users than cash users (on an absolute basis) in the income range of \$5000-\$9999. Rather, the results presented are such that the sum of the five cash columns equals 100 percent as does the sum of the five TransCard columns.

Examining the age characteristics of those who pay fares by using cash or a TransCard reveals that relatively few TransCards are purchased by those who are either less than 16 or older than 65. Generally, we would expect these groups to contain fewer full-time workers. On a relative basis, passes are most popular with those in the groups aged 40-59. As one might expect, the data indicate that those without an automobile available are much more likely to buy a TransCard.

TRAVEL-BEHAVIOR CHARACTERISTICS FOR TRANSCARD AND CASH USERS

The travel-behavior questions of most interest consist of the number of transit trips made by cash users and TransCard users both before and after the introduction of the pass and the extent to which monthly transit pass purchasers increased the number of trips taken by transit. To this end, Table 1 lists the mean number of work and nonwork bus trips taken per week by cash users and TransCard users. For TransCard users, Table 1 also provides the mean number of additional or new one-way work and nonwork bus trips taken per week since the pass was purchased. For cash users, the change in the mean number of one-way work and nonwork bus trips per week since the time before the fare increase is also

listed. With this information it is possible to compute the number of work and nonwork bus trips per week that were made prior to the systemwide fare increase and introduction of TransCard that occurred on March 1, 1979.

As summarized in the statements presented above, those who purchased a TransCard increased their use of transit by 1.1 trips per week, whereas those who paid cash did not change their transit trip frequency. About two-thirds of the increased number of trips by TransCard users were made for nonwork trip purposes. This may be explained by the fact that since TransCard purchasers were already frequent users of transit for commuter work trips, they had

less opportunity to make even more work transit trips once they bought a TransCard. However, without a similar upper limit on the number of nonwork trips that can be made, those who bought a pass increased in both absolute and relative terms the number of transit trips made for discretionary or nonwork purposes.

Figure 2 shows that there is a strong relationship between the number of transit trips taken per week to or from work and whether an individual purchases a TransCard. Figure 3 shows a similar but less-pronounced relationship for nonwork bus trips per week.

Figure 4 depicts the total number of transit

Figure 2. Transit work-trip frequency characteristics of those who paid cash and those who used TransCard.

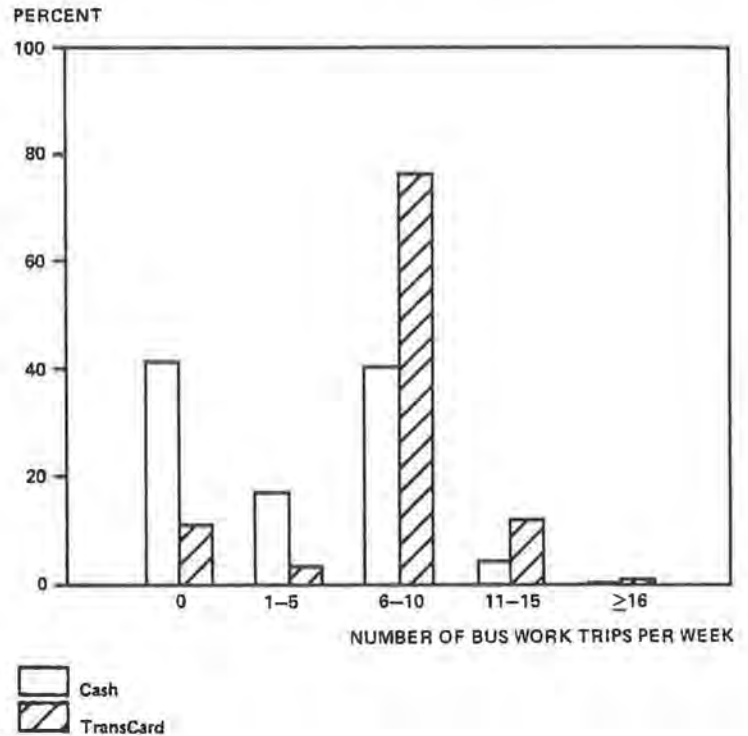
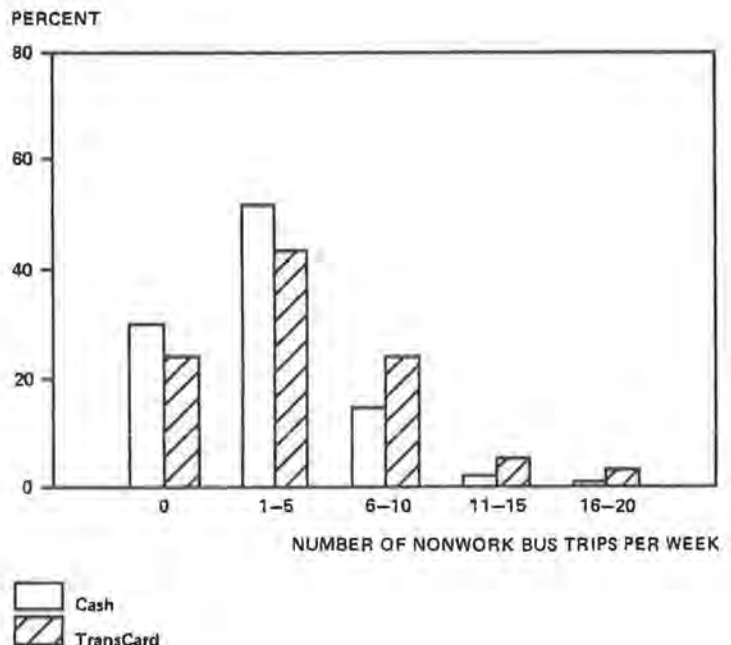


Figure 3. Transit nonwork-trip frequency characteristics of those who paid cash and those who used TransCard.



trips made per week for those who paid cash and those who used TransCard. It is readily apparent from Figure 4 that TransCard use becomes significant only when the number of transit trips taken per week equals or exceeds 10. (Note that 85 percent of those in the 6-10-trip/week group make exactly 10 transit trips per week.) By comparing Figures 2 and 3, it is obvious that a transit pass has its greatest appeal to regular work-trip commuters.

In addition to showing that the vast majority of those who used TransCard make the same or more than the breakeven number (i.e., 10) of transit trips per

week (mean equals 13.3 trips per week), it is also apparent from Figure 4 that a large number of them make many more than the breakeven number of trips per week (and presumably per month) but continue to pay cash fares. Although these individuals appear to be heavy users of the system, they are clearly not taking advantage of the TransCard to save money or to offset the impact of the fare increase. This same finding is illustrated in Figure 5, which presents the percentage of transit users who purchased a pass according to the number of total transit trips taken per week before the pass went on sale.

Figure 4. Total transit trip-frequency characteristics of those who paid cash and those who used TransCard.

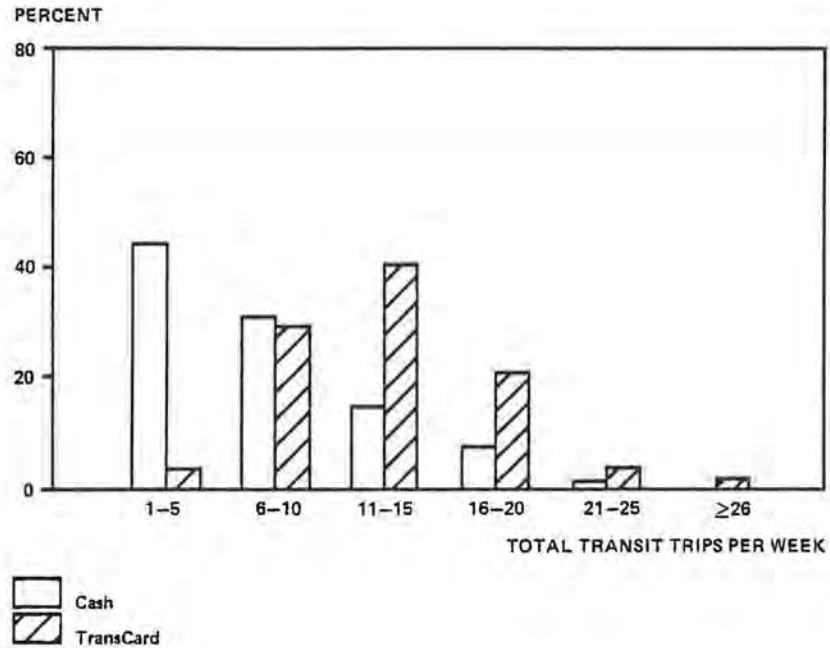
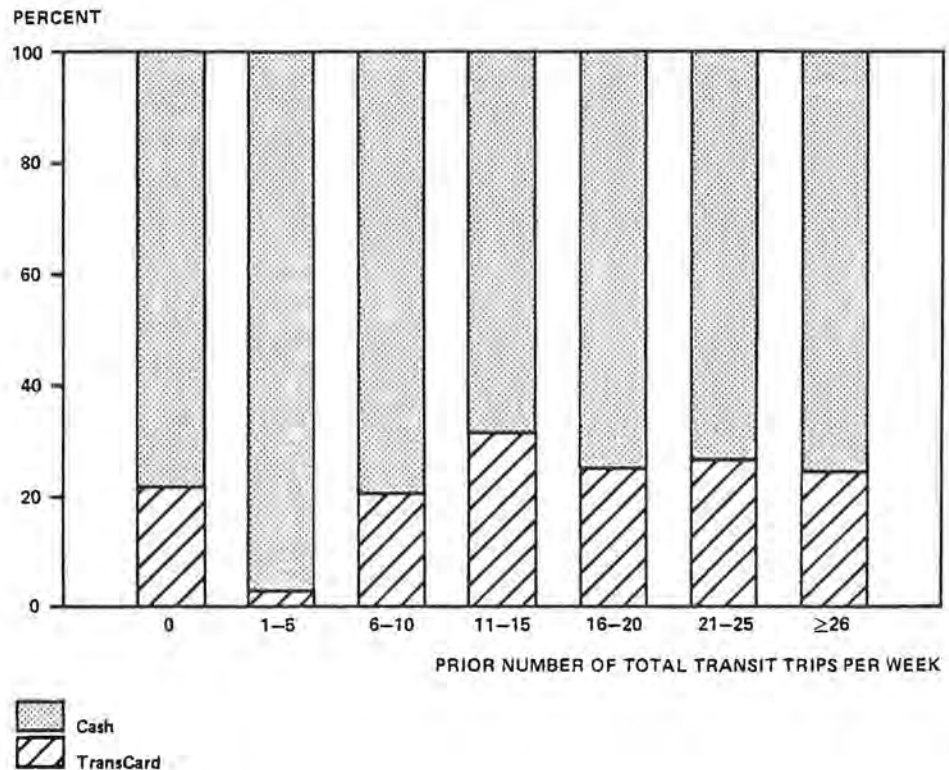


Figure 5. Percentage of transit users who buy TransCard by prior number of transit trips per week.



Typically one would have expected, a priori, that pass penetration rates would increase as prior transit trip frequency increases.

TransCard purchasers who are less than 40 years old were much more likely to increase, on an absolute basis, the number of work trips per week taken by transit compared with TransCard users who are 40 and older. For the age group less than 16 years old, this is in part because these individuals tended to make fewer work trips per week compared with other age groups before purchasing a pass. Changes in work trip transit trip rates by TransCard purchasers were not found to be significantly different by income categories.

There was no difference between white women and black women in the mean number of additional trips made and only a very small, insignificant difference between white men and black men (t -test = -0.385). Thus, race is not a significant factor in the change in work transit trip rate for those who used TransCard.

With respect to sex, the results are mixed. The difference in the mean number of additional work transit trips between white women and white men who used TransCard is not significant (t = -1.23), while the difference in means is significant (t = 2.62) between black men and black women who used TransCard. Although the absolute difference is slightly larger between black men and women, the statistical significance is due primarily to the larger number of blacks in the sample. For those who paid cash, only white women exhibited a net decrease in the number of work bus trips per week. The three other groups all increased by about similar amounts the number of new bus work trips taken per week.

Those who purchased a TransCard and who had an automobile available made more new transit trips per week for work than those who did not have an automobile available (t = 2.0). Basically, those who used TransCard without an automobile available tended to take transit more often to begin with and consequently were less likely to make more work trips by transit even given an opportunity to do so (i.e., by buying a pass). However, as TransCard users without an automobile available were not similarly constrained when it came to nonwork bus trips, they made more additional trips per week for nonwork purposes compared with those who did have an automobile available.

WHY PURCHASE TRANSCARD

A number of studies have indicated that individuals purchase a monthly transit pass either for convenience or to save money (7,10). More than likely, the combination of both factors is important and the relative importance between the two factors is probably a function of the number of transit trips an individual typically makes and the breakeven price of the pass. However, the data indicate that relatively few individuals purchase a pass and make fewer than the breakeven number of trips strictly for the convenience of using a pass.

The first and second reasons that were given by those who used TransCard for purchasing a pass are listed below:

Reason	First Reason (% responding)	Second Reason (% responding)
Save money	56.2	16.9
Convenience, no need for cash	28.4	43.8
Allows stopovers	4.8	4.7
Easier, faster to board bus	4.5	9.8
Pay once a month	2.3	7.5

Reason	First Reason (% responding)	Second Reason (% responding)
Easier to transfer	1.9	9.8
Other	1.7	2.1
Offset fare increase	0.2	2.5

The most frequent response given was to save money (i.e., compared with the alternative of paying separate cash fares). This is a logical reason, since, as determined from Figure 4, about 70 percent of those who have a TransCard make more than the breakeven number of bus trips per week. (About 95 percent of the TransCard users report making the same or more than the breakeven number of bus trips per week.)

Although the singular response "convenience, no need for cash" was stated by 28.4 percent of the respondents, many of the remaining reasons could be encompassed under a broad definition of convenience (i.e., easier to board bus, pay once a month, easier to transfer). Thus, convenience is certainly a popular (second) reason for buying a pass.

Purchasing a pass to offset the impact of the fare increase was given as a reason by very few of the respondents. Although this reason might be considered a subset of saving money, it apparently has little salience in its own right.

For those with an annual household income less than \$15 000, the responses given are fairly uniform, to save money being the predominant reason, followed by convenience. However, as income increases, convenience becomes a more frequent response and correspondingly, saving money declines in importance. In fact, of all the socioeconomic variables examined, the only instance in which convenience was given as the most frequent response for buying a TransCard was for those with household incomes in excess of \$25 000.

WHY NOT PURCHASE TRANSCARD

Just as it is useful from a marketing perspective to understand why individuals purchase a pass, it is also useful to examine why cash users do not purchase a pass. The reasons that cash users gave for not purchasing a TransCard are listed below:

Reason	Percent Responding
Do not ride MARTA enough	61.64
No opinion	12.13
Other	7.06
High initial cost	7.05
Have not taken time	4.00
Outlets are not convenient	3.36
Do not know where to buy it	2.53
Would lose it	2.24

More than 60 percent of those who pay cash responded that they do not ride MARTA enough. This is by far the predominant response; "no opinion" and "other" rank second and third. The distribution of responses by income categories reveals a modest positive relationship between income and the response "Do not ride MARTA enough." Conversely, high initial cost is a relatively more frequent response for those with low incomes and declines in importance as income increases. This may be one reason why some who are very frequent transit users continue to pay cash fares. The barrier of high initial cost is borne out by MARTA's observation that a fair number of passes are purchased well into the middle of the sale month, presumably because only at that time has the individual accumulated the up-front funds for the price of the pass. If the purchaser is a frequent transit user, he or she will still save money,

even though the pass will not be used for the entire month (9). [As a further means of lessening the impact of a fare increase on low-income transit users, MARTA introduced a weekly pass in July 1980 when fares doubled from \$0.25 to \$0.50 (11). Other methods of mitigating the impacts of a fare increase on the poor were evaluated in a separate study by Charles River Associates (12).]

CONCLUSIONS

This paper has examined the socioeconomic and travel-behavior characteristics of both pass-buying and non-pass-buying transit users. While the findings indicate that those who purchase a monthly transit pass come from all socioeconomic groups, they also show that passes tend to be purchased more often by those who have characteristics typically associated with frequent transit users. Consequently, pass purchasers include relatively more women and minorities and those with lower incomes and fewer automobiles available.

Pass purchasers are very astute in determining the costs and benefits of buying a pass. Of those who bought a pass, 95 percent made the same or more than the required number of trips to break even. The average number of trips taken per month by pass users was about 52 compared with the breakeven-price level of 40 one-way bus trips. Thus, few individuals buy a pass and pay more to travel than if they had used cash fares. Two-thirds of the trips taken with the pass were made for commuting to and from work.

Somewhat ironically, those who were very frequent users of the transit system before the pass was introduced made fewer new trips by transit compared with the marginal transit users who also purchased a pass. Equally surprising was the fact that pass penetration rates increased very little as transit-trip frequency increased beyond the breakeven point. Some evidence exists to indicate that the lump-sum, up-front cost of the pass prohibits certain low-income transit riders from buying it.

On average, those purchasing a pass increased the number of bus trips taken per week for work by 0.6 and by 1.1 for nonwork trip purposes. If the concurrent increase in the price of gasoline is factored out, transit tripmaking by non-pass-buying individuals declined by about 2.5 percent following the 10-cent fare increase.

Consistent with the findings above on how often a transit pass is used each month, the majority said that they purchased a pass to save money. Given that 30 percent of the pass purchasers make the same or less than the breakeven number of transit trips per week (and thus do not save money compared to paying cash fares), convenience was the second most frequent response given for purchasing a pass. Only those with incomes exceeding \$25 000 cited convenience factors more often than saving money as reasons they purchased a monthly transit pass. These latter results can be useful in devising promotional material aimed at different market segments. Other information presented in the paper can be used as a yardstick by transit agencies who may be reevaluating their own pass programs or considering implementing one.

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REFERENCES

1. Transit Fare Summary--Fare Structure in Effect on February 1, 1981. American Public Transit Association, Washington, DC, 1981.
2. Transit Fares Climb Again, 45¢ Average. Passenger Transport, Vol. 39, No. 17, April 24, 1981, p. 1.
3. W.R. Hershey and others. Transit Fare Prepayment. UMTA, Aug. 1976.
4. Rochester Suspends Pass Sales in Wake of Decreasing Revenue. Passenger Transport, Vol. 39, No. 38, Sept. 26, 1980, p. 6.
5. Judge Orders PAT Fare Changes. Passenger Transport, Vol. 39, No. 22, May 29, 1981.
6. Atlanta Integrated Fare Collection Demonstration: Annotated Data Collection Plan. Charles River Associates, Inc., Boston, MA; Transportation Systems Center, Cambridge, MA, Aug. 1979.
7. Jacksonville Transit Fare Prepayment Demonstration. Charles River Associates, Inc., Boston, MA; Transportation Systems Center, Cambridge, MA, Final Evaluation Rept., 1982.
8. L. Doxsey. Atlanta Survey Sample Size Selection. Transportation Systems Center, Cambridge, MA, March 1979.
9. Atlanta Integrated Fare Collection Demonstration. Charles River Associates, Inc., Boston, MA; Transportation Systems Center, Cambridge, MA, Final Evaluation Rept., June 1982.
10. Bureau of Management Consulting. The Ottawa Bus-Pass System--An Examination of Effects. Urban Transportation Research Branch, Transport Canada, Montreal, Sept. 1977.
11. D. Sollner, ed. The Evolution of MARTA's Fare Collection System. Service and Methods Demonstration Program, UMTA, April 1981.
12. Atlanta Transit Pricing Study: Moderating the Impact of Fare Increases on the Poor. Charles River Associates, Inc., Boston, MA; Transportation Systems Center, Cambridge, MA, May 1981.