Tri-Met's Self-Service Fare Collection Program

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Self-service fare collection (SSFC) is a concept in which the passenger is responsible for payment of a transit fare and possession of a valid ticket or proof of payment. Checking of fares by transit vehicle operators at the time of boarding can thus be avoided, and transfers between buses or between buses and other modes can be made without delay, barriers, or complex equipment. Such a system is the key to the efficient operation of large surface transit vehicles such as articulated buses and light rail and offers a range of other benefits to both the transit agency and passengers. The Tri-County Metropolitan Transportation District of Oregon (Tri-Met) decided that SSFC would offer substantial financial and operating advantages compared with continuing the traditional farebox system. SSFC is expected to reduce Tri-Met's operating costs by about $2.1 million in the first full year of operations, increasing to about $6 million by 1990. Tri-Met's capital needs for the period 1981-1990 will be reduced by some $7 million, mainly through the more effective use of existing equipment. The Tri-Met SSFC program is designed around policy guidelines intended to minimize operational, legal, and financial risk. Existing fareboxes and monthly passes will continue in use. The program initially involves some 600 buses, which will be equipped with validators and single-ride ticket printers. SSFC is now scheduled to begin on September 5, 1982, at which time Tri-Met will introduce a new five-zone regional fare structure. A proof-of-payment ordinance will go into effect, and passengers will be free to enter or leave buses through all doors.

The Tri-County Metropolitan Transportation District of Oregon (Tri-Met) is responsible for providing transit service to a population of about 1 million in the Portland metropolitan area. It operates a fleet of about 580 standard and 87 articulated buses. A 15-mile light-rail line is under construction. Ridership, which has increased almost threefold since 1969, is currently 140 000 passengers per weekday. Fares are collected by the traditional North American method with a farebox on each bus for cash fares. Some 46 percent of fare revenue comes from monthly passes. There are three circumferential fare zones and two zone fares. No zone tickets are used. Fares are 65 cents and 90 cents. Transfers are free.

Although this fare collection system is generally perceived to work adequately at the current time, it nevertheless suffers from continuing minor problems with zone fares, fare evasion, fare disputes, and dollar bills. Much more serious, the traditional system of fare collection will impose major constraints on Tri-Met's plans to improve service and efficiency in the years ahead.

SELF-SERVICE FARE COLLECTION

Self-service fare collection (SSFC) is a concept in which the passenger is responsible for payment of a transit fare and possession of a valid ticket or proof of payment. Checking of fares by transit vehicle drivers at the time of boarding can thus be avoided, and transfers between buses or between buses and other modes can be made without delay, barriers, or complex equipment. To ensure that fares are paid, fare inspectors are assigned to check tickets, and a premium fare is charged to passengers without proof of payment. Such a system is the key to the efficient operation of large surface transit vehicles such as articulated buses and light rail and offers a range of other benefits to both the transit agency and passengers.

First developed in Europe some 15 years ago, SSFC has since become almost universal in western Europe and is now being adopted or considered by several North American transit agencies. Of some significance is the fact that no transit agency anywhere that adopted SSFC has ever subsequently discontinued it.

SSFC is the only type of fare collection universally applicable to all modes of transit, whether bus, commuter rail, or heavy or light rail. Since it is a concept of fare collection rather than a particular hardware configuration, the equipment requirements will vary according to the needs of the particular installation. Extensive experience has built up over the past 15 years concerning the equipment necessary to support SSFC operations.

The following North American agencies are introducing, or plan to introduce, SSFC:

1. Vancouver, British Columbia, has been operating a ferry line (Seabus) on which SSFC is used since 1977. Experience has been highly satisfactory, and SSFC may be extended to other parts of the transit system in the future.
2. Edmonton, Alberta, introduced SSFC on its first light-rail transit (LRT) line in 1980, experiencing major savings in operating costs. Fare evasion is reported to be less than 1 percent, and plans are being developed to expand SSFC to the whole transit system.
3. Calgary and San Diego introduced SSFC on their new LRT lines in the summer of 1981. Initial reports are highly favorable.
4. Many other cities in North America are now considering SSFC as an option to increase transit operating efficiency, particularly cities that also plan to build LRT systems or operate large numbers of articulated buses.

FARE POLICY STUDY

In 1978, the Tri-Met Board of Directors decided to construct an LRT line. The characteristics of this line, including unfenced low-level platform stations, often in the street right-of-way, made the installation of conventional barrier fare collection impossible. Onboard fare collection by using fareboxes would have required fare collection personnel on every car, increased dwell times, and substantially eroded the economic advantage of LRT. The LRT plan carried with it the implication that Tri-Met would switch to SSFC.

In 1979, in the course of developing the Five-Year Transit Development Plan, Tri-Met investigated various possible fare policies, including the continuation of the traditional farebox system and all practical alternatives, including SSFC. These studies examined possible alternative forms of SSFC, how it might be introduced, and alternatively how the existing fare collection system could be modified to meet Tri-Met's future needs.

It was concluded that the choice lay between a succession of palliative measures that at best could minimize the constraints that the traditional system of fare collection places on transit operations, particularly with LRT, or alternatively a bold and probably controversial move to SSFC that would put in place a new system of fare collection able to accommodate any future modes or fare structure that Tri-Met may adopt.

It was also concluded that the early implementation of SSFC would accomplish the following:

1. Improve operation of the bus system, particularly in peak periods and with articulated buses;

2. Ameliorate a variety of fare problems, which would include disputes involving drivers, forged passes, and dollar bills clogging the farebox, and the need to augment the fare zones;
3. Realize the financial benefits expected from SSFC at an earlier date;
4. Provide an opportunity to prove this relatively untried system of fare collection before completing design of the LRT line; and
5. Stand a good chance of attracting funding under the Service and Methods Demonstration Program of the Urban Mass Transportation Administration (UMTA).

At about this time, UMTA had also concluded that SSFC might have considerable benefits in the United States and had made provision for an SSFC demonstration project. But although several transit agencies had expressed interest, none was anxious to be first.

REASONS FOR SSFC

Project Development Studies

The first step toward implementation was a series of project development studies leading to an implementation plan. The purpose of this plan was to provide a focus for all aspects of the project--what are the pieces, how do they fit together, and what areas require further study? The preliminary plan provided a basis for determining what equipment was required, what possible fare structures should be accommodated by the equipment, what legal questions remained to be resolved, the logistics of fare inspection, and public information and marketing. It was discovered that the procurement of equipment had the longest lead time and hence should assume the highest priority.

During the development of this plan, a better understanding developed of the pervasive and generally beneficial effect SSFC would have on the whole Tri-Met system. In general, two kinds of benefit were identified--nonquantifiable benefits, such as increased passenger convenience, reduced driver stress and work load, or improved system security, and quantifiable benefits, such as savings in bus hours or increases in revenue to which a dollar amount can be attached. Realization of many of these benefits requires additional action by Tri-Met beyond the implementation of self-service, such as the procurement in the future of buses with double doors, the rescheduling of lines to capture time savings, and the deployment of high-capacity equipment on lines on which this equipment is warranted.

Advantages of SSFC

Speed-Up of Existing Bus Operations

Part of the SSFC program calls for retrofitting the rear doors of buses to permit passengers to enter through them. This will reduce bus loading time, particularly at busy stops such as transit centers and during the peak period. Retrofitting for rear-door boarding will provide two door streams on standard buses, enabling them to better match the loading speed of the five door streams on articulated buses. Eventually Tri-Met expects to specify buses with double doors on all new procurements.

Effective Operation of Articulated Buses

SSFC enables Tri-Met to derive the fullest benefit from articulated buses. For instance, on the Mall the traffic signals operate on a progression. If a bus can load quickly, it can travel down the Mall and catch each of the traffic signals. However, if the loading time is more than about 15 s, the bus will miss each signal. Thus, a few seconds' increase in loading time is multiplied several times by the delay at each traffic signal. If the articulated buses are operated without self-service, they will not only accelerate more slowly, a characteristic of these vehicles, but will also load more slowly. In doing so, they will also delay all other buses using the Mall, leading to a substantial loss in total system capacity. With self-service, however, the articulated buses will load faster than the standard buses, and Mall capacity will be preserved and probably increased.

In addition, self-service permits the effective deployment of articulated buses on the heaviest inner-city routes. Such routes, generally characterized by large numbers of passengers loading and unloading, are traditionally considered unsuited for articulated buses in the United States, mainly because they are used without SSFC. However, these routes are also those on which the improved productivity and greater schedule reliability that articulated buses offer can be deployed to the greatest economic benefit.

Improved Schedule Adherence and System Productivity

For example, a bus running late will pick up an additional passenger load. This in turn will make the bus later still, thereby destabilizing service. With SSFC and boarding through all doors, late buses will not incur the same proportionate delay, and so there will be less tendency for service to destabilize. In addition, the greatest effect of faster operation of both articulated and standard buses will occur during the peak periods when current loading delays are most noticeable. If buses can be operated faster during peak periods, the capacity of the system is increased. Since the total fleet is sized for the peak hour, an increase in fleet capacity during the peak would permit the same passenger load to be carried by fewer vehicles, a net capital and operating savings.

Effective Operation of LRT

The LRT plan is based on the use of trains of large (88-ft) vehicles, loading from the street. Each two-car train has 16 door streams. Erecting fare barriers at on-street stations would be expensive and in many locations unacceptable. Farebox fare collection would be so slow that each trip would take several minutes longer. More cars would be required to maintain system capacity, and operators would be required on trailing cars for the sole purpose of collecting fares. Not surprisingly, SSFC has been adopted on the new LRT systems in Edmonton, Calgary, and San Diego, as well as on all LRT systems in Europe.

Avoidance of Expense of Farebox Replacement

When Tri-Met's Zone 3 fare reaches $1.00 in June 1982, the ability of fareboxes to accept dollar bills will become a major concern. Not only do Tri-Met's existing farebox vaults have a capacity of about 60 dollar bills, but the bills have a tendency to jam the farebox. Torn bills are sometimes presented, resulting in lost revenue and increased money-room costs. SSFC, by reducing the percentage of fares paid into the farebox to less than one-third of their current volume, will enable the existing fareboxes to continue in service and the drivers to deal with the bill problem by requiring

bills to be presented unfolded, if necessary, without significant delay to service. Recent experience by other agencies who have replaced their fareboxes with electronic fareboxes capable of accommodating dollar bills has shown that the capital cost that Tri-Met is incurring in switching to self-service are no greater than the costs other properties are incurring by replacing their fareboxes and vaults.

Increased Fare Equity

As fares increase, Tri-Met, like most agencies operating service over a large geographical area, is finding it desirable to make the fare cost more closely reflect the length of trip. This can only be achieved by use of a zonal fare system. In 1978, Tri-Met switched from a flat fare to a two-fare zone structure. However, under increasing fiscal pressure this is not proving sufficient. Although the fare for the long-distance trips on the system is still less than it was 10 years ago, the fare for short trips is so high as to discourage ridership. This position can be rectified only by adding one or more additional fare zones. But the current fare collection system cannot control more than two zone fares. The alternatives are either a hat-check system, which would delay service and be entirely impractical with articulated buses and LRT, or SSFC.

With SSFC, additional fare zones can be instituted without operational delay and in a fair and enforceable way. Moreover, by selectively increasing fares to what the market will bear, transit revenue can be increased with little loss of ridership.

Fare-Evasion Control

The potential for fare evasion is widely quoted as a reason for not adopting SSFC. However, Tri-Met now experiences passengers who forge passes, refuse to pay, short-change the farebox, and override the zones. Drivers can do little to control these abuses. While opportunities for certain types of fare evasion are increased under SSFC, other types of fare evasion, particularly forged passes, short-changing, and zone overriding, can be effectively controlled by fare inspectors. After a year of SSFC operation, Edmonton reports a fare evasion level of around 1 percent. On Tri-Met, not only is SSFC expected to reduce revenue loss from fare evasion, but some additional revenue will be generated from the premium fares charged to passengers traveling without proof of payment. Moreover, the system is partly self-stabilizing, since the greater the revenue loss from fare evasion, the greater the potential revenue from premium fares.

Improved System Security

The presence of radio-equipped fare inspectors traveling at random on the system will provide a measure of visible and real support to drivers and enhance passengers' perception of transit system security.

More Convenience for Passengers

The new fare structure will open up new and more convenient ways to pay fares. The new multiride ticket, for up to 10 rides, will permit passengers to travel without needing the exact fare for each trip. Moreover, pass holders, who will make up more than 50 percent of Tri-Met's passengers, will no longer have to dig for their pass each time they board a transit vehicle. Except when requested by fare inspectors, pass holders will carry their passes just as automobile drivers now carry their driver's licenses.

Reduced Cash-Handling Costs

The extensive adoption of prepayment of fares (targeted at 85 percent) under SSFC is expected to reduce money-room and cash-transfer costs and related security requirements.

Reduced Driver Tasks

SSFC will provide clearer definition of the driver's role with regard to fare collection and will reduce and define the tasks and responsibilities. The driver will no longer be required to try to extract a fare from a reluctant passenger nor to argue over cash or transfers. Fare disputes are the most common source of passenger/driver friction today and are one of the main sources of stress and driver absenteeism.

Improved Passenger Comfort

Passenger comfort will also be improved because multidoor loading will provide better passenger distribution on the vehicle. Passengers may enter and leave through any door, thereby being exposed to less bunching and jostling on the vehicle. Overall, the passenger's perception of transit service is likely to be enhanced.

Economic Analysis

An economic analysis was developed to estimate the cost and benefits of those aspects of SSFC for which such estimates can be made (1). Estimates were developed for three different years--1983, 1985, and 1990--and for a transit fleet expected to grow as follows:

Type of Vehicle	No. of Vehicles		
	1983	1985	1990
Standard bus	500	700	800
Articulated bus	87	125	250
LRT	0	26	68

Operating cost and capital cost projections for SSFC were developed separately.

Operating Cost and Revenue Comparisons

The cost of operating SSFC can be determined with considerable accuracy since implementation is well advanced and all major expenditures are budgeted. By far the largest operating cost is fare inspection, for which 50 fare inspectors are budgeted. Other costs include transit police support, administration, marketing, and equipment maintenance. Operating costs are not expected to increase in proportion to system ridership, since as passengers get used to self-service, less inspection effort per passenger is anticipated.

The major dollar benefit attributable to SSFC lies in the reduction in number of vehicles required to provide an equivalent level of service capacity compared with that for operation without SSFC. These benefits will occur primarily on the most heavily used lines and particularly during peak periods. Improvement in system efficiency during peak periods is particularly significant since the transit fleet is sized to provide the necessary peak capacity. Any vehicle savings occurring in the peak period are therefore potential savings in the total fleet size.

Operating cost savings on the LRT system are

Table 1. Net systemwide operating cost savings from SSFC.

Item	1982 Constant Dollars (000s)		
	1983	1985	1990
Costs			
Fare inspection	-1696	-1846	-1846
Administration	-470	-470	-470
Other	-75	-100	-150
Subtotal	-2241	-2416	-2466
Savings			
Bus operation	1000	1405	1789
LRT operation	-	910	2080
Absenteeism	375	400	500
Reduced fare evasion	180	240	290
Zone-fare revenue increase	1800	2400	2900
Premium fares	1000	1100	1200
Net operating-cost savings	2114	4039	6293

Table 2. Net saving in systemwide capital needs from SSFC.

Item	1982 Constant Dollars (000s)		
	1981-1982	1983-1985	1986-1990
Costs			
On-board equipment (validators, etc.)	-2950	-900	-1700
Rear-door modifications	-250	-	-
Vending machines	-	-1030	-800
Subtotal	-3200	-1930	-2500
Reduced capital needs			
Bus fleet reduction	3000	1400	1500
LRT fleet reduction	-	4000	2000
Farebox replacement	2450	460	450
Subtotal	5450	5860	3950
Net reduction in capital needs	2250	3930	1450

particularly dramatic and are expected to exceed the savings in bus operations by the year 1990. The reason for this lies with the nature of LRT operations. Specifically, operation of LRT with the traditional system of fare collection would require a driver on the trailing car of a two-car train solely to collect fares, would increase dwell times at stations, would require two additional train sets to maintain equivalent service capacity, and would require additional maintenance personnel. Along with most transit agencies, Tri-Met experiences considerable lost time and expense due to driver absenteeism. Tri-Met expects SSFC to be one factor in reducing driver job stress and hence absenteeism.

In addition, SSFC is expected to generate some additional revenue. One source of anticipated additional revenue is the reduction of fare evasion due to fare inspectors. In addition, increasing the number of fare zones enables Tri-Met to increase fare revenue without increasing the base fare. Thus, for any given base fare, a fare structure including multiple zones collected by self-service will have a higher level of revenue.

Passengers found riding the transit system without a ticket will be charged a surcharge fare of $20 by fare inspectors. Tri-Met expects to generate significant new revenue from this source, even after allowing for administrative expenses and uncollectable surcharge fares.

The net operating cost savings attributable to SSFC are summarized in Table 1.

Capital Cost Comparisons

The capital costs of introducing SSFC are accurately determinable since procurement of most of the capital equipment is in progress. Equipment requirements include the on-board equipment, such as validators and ticket printers, the retrofitting of rear doors of buses to permit passengers to enter vehicles through either door, and the purchase of a small number of vending machines to sell tickets at key focal points on the transit system.

Just as SSFC will reduce the transit system operating costs by enabling fewer buses to provide the same amount of service capacity, so too will SSFC reduce Tri-Met's fleet requirement, both buses and, later, LRT vehicles. In addition, the adoption of SSFC will enable Tri-Met to avoid replacing its existing fareboxes with new fareboxes able to accept dollar bills and count the large number of coins now required to make up a transit fare.

The balance of capital costs and savings attributable to SSFC is shown in Table 2.

IMPLEMENTATION PLAN

Policy Guidelines

One problem that surfaced early was how to develop a design rationale for aspects of the project for which there was little relevant information, for instance, what the initial level of fare inspection should be or how one should change the system of fare collection on an operating 600-bus system without severe service disruption. To resolve problems of this type, a series of policy guidelines evolved and is used to provide direction when decisions are required.

Among the key policy guidelines are the following:

1. Minimize legal risk through the use of existing powers and a generally low-profile enforcement program;
2. Minimize financial risk through phased implementation to avoid the possibility of substantial fare evasion;
3. Use proved equipment and, where applicable, proved techniques;
4. Be cost-effective; SSFC is not to be a "glorious experiment";
5. Minimize changes required in riders' habits and maintain as much consistency as possible with other U.S. transit systems;
6. Develop the program to provide clear public benefits from the day of start-up; SSFC must be presented as more than a convenience to the transit agency; and
7. Introduce the full program in stages to minimize risk and provide the opportunity for fine tuning and modifications as the program moves forward.

Development of Implementation Plan

The initial implementation plan called for SSFC to be introduced in several phases consistent with the policy of minimizing risk. The first phase would introduce the new ticket and fare structure and the proof-of-payment concept, but fares would continue to be monitored by drivers. With driver monitoring, passengers would, of course, continue to board only through the front door. Legal risk is minimized because the system could still revert to the traditional system of fare collection overnight in the event of a challenge, and financial risk is minimized because during this phase there is no change in the opportunities for fare evasion. Once this system had become established, successive phases would provide a gradual transition away from driver monitoring to full SSFC, starting with the heaviest lines, where the benefits are greatest. This type

of phased implementation is often found in Europe, particularly at this time in France. It also can provide a guarantee to the agencies' directors that SSFC will be phased in only as fast as it can be shown to work. Both driver-monitored and full self-service would have the following features:

1. Passengers would be required by ordinance to possess a valid ticket or pass when traveling on district vehicles;
2. Passengers traveling without a pass would complete their fare transaction immediately on boarding, either by paying a cash fare and obtaining a ticket or by validating a multiride ticket purchased before boarding the bus;
3. The farebox would be retained for fare payment since it exists and is fairly efficient, but the percentage of passengers using the farebox would be reduced in order to avoid issuing excessive numbers of tickets; this would be achieved by discounting the new multiride tickets;
4. Fare collection would be enforced by fare inspectors who would check tickets on a random basis; passengers traveling without a valid ticket or pass would pay a surcharge fare.

As project implementation proceeded, an interesting evolution occurred. Phased implementation had the disadvantages of small initial benefits and of giving the impression that the fare system was in a constant state of change. Moreover, as SSFC became better understood and as favorable reports came in from Canada and San Diego, Tri-Met's directors became increasingly comfortable with the concept of SSFC and questioned whether the additional steps inherent in the phased approach were necessary. After extended debate, it was concluded that the increased simplicity of a single one-time switch to systemwide full self-service and the faster realization of operating benefits more than outweighed the benefits of the more cautious multiphase approach. Accordingly, the original plan was revised to provide for full systemwide conversion to self-service without interim phases. This change had no impact on the on-board equipment required for either driver-monitored or full self-service but did require an additional outlay in fare inspection.

Organization

With the partial approval of project funding in September 1980, the project moved into the implementation phase. Because SSFC affects every facet of a transit agency, an organizational structure was required to ensure internal coordination. To achieve this, an interdepartmental committee was established with representatives from each department charged with overseeing all aspects of the work and making recommendations where appropriate on technical details of the project. Subcommittees were assigned to perform the detailed work and prepare technical recommendations. There were nine subcommittees covering the following areas:

1. Fare structure (zones, pricing structure, ticket design);
2. Ticket and schedule outlets (ticket and pass sales, retail outlet policy, vending machines);
3. On-board equipment (procurement of validators and printers, rear-door modifications);
4. Legal aspects (legal review, drafting ordinances);
5. Fare inspection (procedures and selection, training, deployment of fare inspectors);
6. Records, billing, and collection (processing and collection of surcharge fares);
7. Operations (on-street deployment of SSFC);
8. Public information (program and materials for public information and marketing); and
9. Evaluation study (assist independent contractor with evaluation of SSFC).

This organizational structure provides the two most important requirements for a project of this type--assignment of responsibility for performance of all tasks to specific individuals and coordination between departments by direct involvement.

PROJECT DESCRIPTION

This section provides an overview of the key features of the fare collection system that will go into effect on September 5, 1982, together with some of the considerations that led to their adoption.

Proof of Payment

Under SSFC all transit passengers will be required to possess a valid ticket or pass. Under Oregon law, mass transit districts may adopt ordinances having the force of law that cover any matter directly relating to the use of transit district facilities. By using these powers, Tri-Met may require that all passengers possess proof of payment when riding the transit system and may carry out fare inspections and assess surcharge fares to passengers traveling without proof of payment.

Fare-Payment Options

Under SSFC, Tri-Met passengers have three fare-payment options:

1. Cash fare: passengers will pay the fare into the farebox as they do now and receive a single ticket from a machine situated by the farebox and known as the dispenser. The dispenser is activated by the driver and is described more fully below. The single-ride ticket thus issued is similar to today's transfer. Transfers will no longer be necessary. About 15 percent of passengers are expected to continue to use the farebox.
2. Multiride tickets: this new method of fare payment requires passengers to purchase a card ticket valid for up to 10 rides. This ticket can only be purchased off the vehicle. To encourage use of the multiride ticket, a discount of about 10 percent will be offered compared with the cash fare. Passengers using the multiride ticket must validate the ticket at the beginning of each trip, using a validator that will be installed on all buses. Approximately 30 percent of all passengers are expected to choose multiride tickets.
3. Passes: passes will continue to be used in the same manner as they are now. Pass use will continue to be encouraged by providing an attractive discount to pass users. Pass use is expected to increase from approximately 50 percent to about 55 percent of Tri-Met's ridership.

Each of these three alternative methods of fare payment is targeted on a particular segment of the ridership market. In addition, the payment options are designed to minimize farebox use, since the use of the front door and farebox are factors that limit transit operating speed. Another feature of these payment options is that no passenger will be required to change his or her fare-paying habits at the start of self-service, although many are expected to do so in response to the discounts offered by the new fare structure.

Fare Structure

One issue requiring resolution early in the project

was the type of fare structure for which the SSFC program should be designed. Elimination of the constraints associated with multiple fare zones under the traditional system of fare collection automatically raises the question of what zone system is most desirable in the absence of existing constraints. Whether to change the zone system, and if so to what, is influenced by a number of considerations, including the following:

1. Numerous requests by the public at previous fare hearings to increase the number of fare zones rather than the base fare,
2. The desirability of developing a closer relationship between trip length and fare, and
3. The need to adopt the simplest possible zone system.

The fact that the equipment to be installed on the buses would impose a certain measure of constraint on future changes to the zone system gave an added urgency to resolve this issue.

It was found that two possible zone configurations would meet Tri-Met's needs. One was a set of five concentric zones, and the other was a pattern of 25 roughly equal cellular zones covering the entire region. Both types of zone system are widely used on other self-service operations. However, on the Tri-Met system where the majority of ridership is radial, the concentric-zone pattern was sufficient to meet Tri-Met's revenue needs without introducing the complexity of the cellular-zone system. Moreover, the concentric-zone pattern provided an additional incentive for passengers to make increased use of Tri-Met's new crosstown service for crosstown trips, instead of traveling via downtown.

Equipment

The major capital expense of initiating SSFC is the requirement to install equipment on every bus to provide passengers with accurate and readily verified proof of payment. The equipment selected is actually a system made up of three types of units.

To enable multiride ticket users to validate their tickets, every bus will be equipped with a validator attached to the stanchion behind the driver's seat. When a passenger inserts a ticket into the validator, the unit will check that the ticket has the correct dimensions and that it is not used up, and it will then stamp the date, time, and zone on the ticket. At the same moment a small piece of the ticket, corresponding to one ride, will be clipped from the ticket. Validators are a widely used device and are found on almost all European surface transit equipment. Tri-Met's articulated buses will have three validators, one at each door.

To provide a ticket to passengers wishing to pay their fare into the farebox, a ticket dispenser will be installed on all buses adjacent to the farebox. This unit contains most of the same components of the validator and in addition a paper ticket-dispensing unit. When a passenger pays a fare into the farebox, the driver provides a ticket by pressing one of six buttons on the control panel. The dispenser then prints a ticket showing the date, time, zone, and fare paid.

No equipment is, of course, required for pass holders.

The driver is provided with a unit known as a controller to control the operation of the validator and dispenser. The controller contains the electronic logic elements for the validator and dispenser, including a calendar and clock. The controller also enables the driver to code in the zone in which the bus is traveling so that all tickets correctly indicate the zone in which the passenger boarded. In addition, the controller alerts the driver to any equipment malfunction or vandalism and maintains a count of tickets issued or validated.

Tri-Met has awarded a contract to supply this equipment to a joint venture of CAMP of Paris, France, and Vultron of Waterford, Michigan, who are in the process of supplying and installing 874 controllers, 1198 validators, and 904 dispensers.

A second equipment program is the modification or retrofitting of the rear doors of all buses to enable passengers to board through both front and rear doors.

Ticket and Pass Sales

Prepayment of fares through the use of multiride tickets and passes is a vital element of the SSFC program. Over a number of years, Tri-Met has developed a distribution system for tickets and passes by using retail outlets. Under SSFC, this existing system will be streamlined and expanded. In addition, Tri-Met expects to introduce a limited number of vending machines at key focal points of the transit system. These vending machines would initially sell only multiride tickets. The possibility of multiride ticket-vending machines that accept only credit cards is being investigated for this purpose. If successful, these machines would significantly reduce the cost and problems of servicing, since no cash would be handled.

Fare Inspection

Fare inspection is a vital and integral part of self-service. It is also the most controversial element. In establishing a plan for fare inspection, Tri-Met was guided by a number of policy considerations. The Tri-Met fare inspection program is intended to be as reasonable and unprovocative as possible, using transit employees in transit uniforms rather than police uniforms. Simple rules and modest penalties are designed to avoid antagonizing inadvertant offenders. Although easy on inadvertant offenders, the enforcement program must have credible disincentives for anyone who would challenge or ignore the fare ordinances. Enforcement should require no more powers than are now thought necessary. Should experience demonstrate a need for additional enforcement powers, they can be more readily justified in the light of experience. The enforcement program should also incorporate sufficient flexibility to be able to adjust enforcement practices in the light of experience.

Tri-Met's initial fare inspection program is targeted at a 6 percent inspection level systemwide. Inspectors will normally work in teams of two and will be deployed according to a carefully developed schedule, working on one or more quadrants of the system on specific days. The inspection schedule will be developed in order to provide an equal but apparently random level of inspection throughout the system. Passengers found traveling without proof of payment may be charged a surcharge fare by a fare inspector. The fare inspector will record all instances of passengers traveling without proof of payment and may collect the surcharge fare on the spot, issue a written notice to pay the surcharge fare, or in exceptional circumstances give a written warning. In every case the fare inspectors will attempt to get identification from the passenger.

Initially, some 30 full-time fare inspectors will be used, supported by an additional 30 extra fare inspectors. These extra fare inspectors may work either as fare inspectors or bus drivers, as re-

quired, thereby building some flexibility into the fare inspection process.

Surcharge fares that are not paid at the time of inspection may be paid by mail or in person to Tri-Met within seven days. Persons who ignore a notice to pay a surcharge fare will incur a late charge after a certain time period. Persons who continue to ignore the surcharge fare will eventually have their account turned over to a collection agency. All record keeping, billing, and collection of surcharge fares will be handled by an outside contractor. Passengers who persistently travel without proof of payment will also be liable to increased civil penalties up to $500.

Tri-Met will institute an internal appeals procedure in order to provide recourse for persons who feel they have been charged a surcharge fare unfairly.

Public Information Program

An effective public information program is a vital component of the SSFC project. With approximately 140 000 trips on Tri-Met a day, a major communications effort is called for. Elements of the public information program include the preparation of decals and signage for use on Tri-Met vehicles and facilities, the preparation of exhibition buses to tour the region, and the development of brochures, advertising, and on-street customer assistance personnel. Closely related to the public information program is the training of all Tri-Met employees to have a basic understanding of the self-service system, as well as the detailed training of drivers, fare inspectors, and maintenance personnel. Perhaps the biggest challenge for the public information program is this: Although the full SSFC project consists of a complex of interrelated elements, the individual passenger is concerned only with an individual fare. Knowing and paying that fare must be made as simple as possible.

Schedule

Implementation of SSFC began in September 1980 on the award of project funding and will be complete at the start-up of self-service on September 5, 1982. The main task controlling the schedule has been the procurement time for the on-board equipment, which will have required 18 months from contract date to start-up.

Evaluation Program

A small but highly significant element of the SSFC program is an evaluation study sponsored by UMTA through the Transportation Systems Center to determine how well SSFC has worked and how other transit properties may benefit from Tri-Met's experience. This study will address seven areas of interest: fare compliance, operating impact, equipment performance, fare-payment characteristics, enforcement, and passenger attitudes and awareness. For each of these work elements comparisons will be made before and after start-up of SSFC and wherever possible numerical analysis will be performed.

The major aim of the evaluation study will be to help other transit properties decide whether it makes sense for them to follow a similar program and, for any who do make that decision, to provide data and perhaps recommendations on how to do so with the greatest benefit.

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Atlanta Transit Pricing Study: Moderating Impact of Fare Increases on Poor

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Alternative methods for moderating the impact of fare increases on low-income groups in Atlanta are described and evaluated. The study, sponsored by the Transportation Systems Center under the Service and Methods Demonstration Program, considers five alternatives to a flat fare increase: direct user subsidies, quality-based fares, reduced fares on designated routes, peak/off-peak fare differentials, and distance-based fares. We evaluate these fare strategies according to a set of standardized criteria that considers the target efficiency, coverage of the target group, administrative cost, total cost, and degree of relief offered by each option. The study finds that a direct user subsidy provides the highest degree of relief to low-income patrons with the lowest revenue loss. This is because user subsidies are more efficient in reaching the target population and offer a higher level of coverage of the poor than do other alternatives. The results of the analysis also suggest that fare strategies that increase pricing efficiency by relating fares to cost, such as peak/off-peak fare differentials and distance-based fares, may not aid low-income riders. The analysis indicates that the equity implications of such pricing strategies must be assessed on a city-by-city basis. The desirability of direct user subsidies as a means of offering fare assistance appears to be more universal, however, primarily because it is distributed directly to the poor. With many transit properties facing court challenges to flat fare increases, these results may be of interest to operators throughout the United States.

This case study describes and evaluates alternative methods for moderating the impact of fare increases on low-income groups in Atlanta. Although the study primarily concerns the Metropolitan Atlanta Rapid Transit Authority (MARTA), which recently raised its fare from $0.25 to $0.50, the results of the study