SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT

METRO RAIL PROJECT

SYSTEMS INTERFACE REQUIREMENTS

WITH FARE COLLECTION SYSTEM

WBS 09

Final Report

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T A B L E O F C O N T E N T S

I N D E X O F E X H I B I T S

SUMMARY

Booz, Allen & Hamilton Inc. was requested by the Southern California Rapid Transit District (SCRTD) to undertake a study of requirements for the Metro Rail fare collection system to interface with station and other Metro Rail operations. The objective of the study was to develop a fare collection system for Metro Rail, defining in as much detail as possible the major elements of the fare collection system--fare media, equipment, personnel, and procedures--to enable final design to proceed.

The fare collection system as developed in this report reflects the policy recommendations presented by the SCRTD's Transit Systems Development and Planning Departments to the Board of Directors in December 1984. These recommendations, based in part on the interim findings of this study, call for simplification of the Metro Rail fare collection system through revisions to the requirements and objectives originally approved by the Board of Directors in 1983. The changes recommended include:

- Elimination of bus-to-rail transfers (except with passes)
- Elimination of round-trip rail tickets (for single journeys).

In addition to defining the major elements of the Metro Rail fare collection system, this report defines the interfaces with the proposed Long Beach-Los Angeles Light Rail Line and SCRTD's extensive bus system. Patron interactions with the fare collection systems are described for different types of trips and patrons. The report also discusses the equipment, personnel, and procedures required for operational support of the fare collection system in five areas: media and revenue processing; central control; maintenance; security; and public information. Finally, the system is evaluated in terms of several key criteria reflecting the objectives adopted for the Metro Rail fare collection system.

1.0 INTRODUCTION

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Booz, Allen & Hamilton Inc. was requested by the Southern California Rapid Transit District (SCRTD) to undertake a study of requirements for the Metro Rail fare collection system to interface with station and other Metro Rail operations. The objective of the study was to develop a fare collection system for Metro Rail, defining in as much detail as possible the major elements of the fare collection system--fare media, equipment, personnel, and procedures--to enable final design to proceed.

Because Metro Rail is one component of the SCRTD's planned transit network of heavy rail, light rail, and bus systems, the development of the Metro Rail fare collection system could not proceed in isolation from fare collection requirements on the proposed Long Beach-Los Angeles Light Rail Line and the SCRTD's extensive bus system. Therefore, study efforts focused not only on developing a system that is logical and effective in itself, but also on developing a system that ensures appropriate interfaces among the three transit systems.

In this introductory chapter, each of the three transit modes is briefly described to provide a background for subsequent discussion of fare collection system development. Following this description, the chapter discusses the scope of the study effort and organization of the report.

1.1 DESCRIPTION OF RAIL AND BUS SYSTEMS

By the 1990s, plans call for the SCRTD to be operating a multi-modal transit system consisting of heavy rail, light rail, and bus operations. This section first describes the proposed rail systems--Metro Rail and the Long Beach-Los Angeles Light Rail line--and then discusses the SCRTD's bus system.

1.1.1 Metro Rail

The initial Metro Rail line will be a conventional two-track, steel wheel, steel rail system. It will consist of approximately 18 miles of underground trainway and will serve the central business district, Wilshire Boulevard, and the Hollywood and North Hollywood areas. Eighteen stations are presently planned, with the distance between stations ranging from 0.4 miles in the downtown area to 2.5 miles through the Santa Monica Mountains.

Stations will be subway construction with either one or two fare collection locations and with multiple entry/exit points to street level. Additional exits will be provided for use in emergencies. Escalators, stairs, and elevators will provide vertical circulation between street, fare collection, and platform levels, with elevator access limited to one route per station. The Metro Rail fare collection system will be an automatic entry-and exit-barrier system. Plans call for equipping stations for both attended and unattended operation.

Some stations will have adjacent parking facilities, pick-up/drop-off areas, and/or bus pull-in areas to accommodate patrons arriving by automobile or by bus. It is estimated that more than half of all Metro Rail patrons will arrive at stations by bus.

By the year 2000, it is estimated that Metro Rail will be carrying 364,000 passengers per day. The travel patterns of Metro Rail patrons are not expected to be concentrated toward the downtown business district, nor are they expected to be heavily peaked by direction of travel or time of day.

Operating characteristics for the year 2000 are as follows:

- Operating hours of 20 hours per day (5:30 am to 1:30 am)
- Maximum train length of 6 cars
- Minimum headways of 3 1/2 minutes between trains
- Maximum headways of 15 minutes between trains
- Peak hour travel time of 36 1/2 minutes between North Hollywood and Union Station--an average speed of 30 mph.

The service provided in the preliminary operating plan requires a fleet of 130 vehicles, including spares.

Extensions to the initial 18-mile segment are under consideration, with proposals for lines to Santa Monica and Norwalk.

1.1.2 Light Rail

The preferred alternative for the planned Long Beach-Los Angeles Light Rail line is a two-track system beginning as a subway track at the 7th/Flower Metro Rail Station. The alignment will follow the Southern Pacific Transportation Company right-of-way to Long Beach. The route will be approximately 22 miles long, consisting largely of at-grade trainway with small portions of aerial and subway construction. Twenty-three stations are presently planned, with station spacing ranging between 0.5 and 1.5 miles.

Some stations will have adjacent parking facilities and/or bus transfer facilities. Aerial stations will have elevator and/or escalator access. The fare collection system will be a barrier-free, self-service system.

By the year 2000, the light rail transit (LRT) line is expected to carry almost 55,000 passengers per day, with approximately half arriving by bus.

Operating characteristics for the year 2000 are as follows:

- Operating hours of 20 hours per day (5:30 am to 1:30 am)
- Maximum train length of three cars
- Headways of 12 to 15 minutes during the mid-day period; 15 to 20 minutes at night and on holidays and weekends; and 6 minutes at peak hours
- Maximum operating speeds of 55 mph in the mid-corridor and 25 mph on street-running segments.

The vehicles will be six-axle, articulated cars with capacity for 64 seated passengers and 110 standees.

The 22-mile light rail line is one segment of a proposed regional transit system that is ultimately planned to include 150 miles of rail transit. Light rail facilities are under consideration for the San Fernando Valley, along the Century Freeway, and extending along the coastline. In addition, a northern extension of the Long Beach line to Pasadena has been proposed. These extensions, if implemented, will result in Metro Rail-Light Rail interface stations in addition to the 7th/Flower Station.

1.1.3 Bus System

The SCRTD bus system includes approximately 250 lines and currently serves an estimated 1.6 million riders per day. In addition to local bus service, the SCRTD provides express service which utilizes the freeway system in Los Angeles and neighboring counties.

In 1980, the SCRTD adopted the Sector Improvement Plan, a program for bus service improvements. This plan, currently being implemented, will by the year 2000 result in such improvements as:

- Creation of a simpler grid system
- Establishment of continuous bus lines on major streets
- Addition of bus service on north-south crosstown streets previously unserved.

Daily bus boardings (assuming the 18-mile Metro Rail line) in the year 2000 are estimated to be 2,065,000.

The SCRTD also has transfer agreements with 14 municipal carriers within the County of Los Angeles, such as Santa Monica Bus Lines and Long Beach Transit. Many of these systems have lines that will intersect with the proposed Metro Rail and Long Beach-Los Angeles Light Rail lines.

1.2 STUDY SCOPE

The scope of the effort to develop a Metro Rail fare collection system changed somewhat over time, as interim findings clearly pointed to the need to reassess certain study assumptions.

Initially, the study focused on identifying previously adopted fare collection policies and operational criteria, and then on developing a system that fulfilled those policies to the greatest possible extent. That system was referred to as the "baseline" system, since it represented the starting point for subsequent refinements to the fare collection system. Following development of the baseline system, several alternatives to equipment or fare elements were identified, and their advantages and disadvantages relative to the baseline were assessed.

The adopted fare collection policies included requirements that transfers among all modes be accommodated and that maximum flexibility in fare policy be allowed. This meant that the fundamental task in the initial study effort was to integrate the three distinct types of fare

collection methods specified for the Metro Rail, LRT, and bus transit modes, and to accomplish this integration in a manner that would enable a potentially complex fare structure to be accommodated.

The baseline fare collection system developed in this manner thus overlaid on three distinct fare collection system technologies, a wide range of fare elements and types of fare media, with a concomitant variety of patron and operations procedures. The complexities imposed by these requirements were excessive. Although the system promoted intermodal integration, it did not promote patron convenience, ease of administration, or cost-effectiveness.

Based on the interim findings and recommendations of this study, several fare collection policies previously adopted by the Board of Directors were revisited. An evaluation of alternative policies was conducted and is documented in the January 1985 Special Study of Fare Policy Alternatives, Final Report. This evaluation and related discussions led to a recommendation by the SCRTD's TSD and Planning Departments of the following policies:

- Elimination of bus-to-rail transfers (except with passes)
- Elimination of round-trip rail tickets (for single journeys).

These recommendations and other fare policy features were presented to the SCRTD Board of Directors for approval on December 13, 1984. The study effort then proceeded with the development of the revised baseline system to reflect these recommended fare policy modifications. It is this revised baseline system that is the subject of this report.

1.3 ORGANIZATION OF THE REPORT

Following the introductory chapter, the study background is discussed in Chapter 2, which describes the fare policies that guided system development and the fare structure that evolved from them. Chapter 3 presents a description of the baseline system's major elements--fare media, station fare collection equipment, and station fare collection personnel--and Chapter 4 addresses the procedures patrons will follow in using that system.

Chapter 5 describes the supporting equipment, personnel, and procedures required for system operation. The report concludes with a summary and evaluation of the system, presented in Chapter 6.

2.0 DEVELOPMENT OF THE BASELINE SYSTEM

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The development of the baseline system began with the need to define the elements of Metro Rail's automatic entry- and exit-barrier system, and to provide appropriate interfaces with the separate fare collection systems specified for LRT and bus operations:

- LRT fare collection will be a barrier-free, self-service system, with fare inspectors verifying fares.

- Bus fare collection will be accomplished on board buses using electronic fareboxes and driver verification of fares.

The development effort was guided by a number of general fare collection policy requirements and objectives that had been adopted prior to the start of this study. As work progressed on system development, the operational complexities associated with several of these requirements and objectives became better understood, and the fare policy was refined to promote system efficiency and effectiveness. This chapter identifies the initial objectives and requirements that guided system development, discusses the refinements that were made as a result of interim findings, and presents the integrated bus/rail fare policy that evolved from those refinements. The revised fare policy was presented to the SCRTD Board of Directors last December, a copy of which is shown in Appendix A.

2.1 SYSTEM REQUIREMENTS AND OBJECTIVES

Initial efforts to develop a fare collection system involved review of existing reports as well as discussions with SCRTD staff to identify criteria relating to definition of system elements.* This review resulted in the

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* Reports that were reviewed primarily include: SCRTD Metro Rail Project Preliminary Engineering, Fare Collection Operational Criteria (WBS 16 CAE 11), prepared by Booz, Allen & Hamilton, June 1983; Environmental Impact Report for Long Beach-Los Angeles Light Rail Project, prepared by LACTC, May 1984; Fare Collection System (Transit Coach Operations) Concept Development, prepared by Booz, Allen & Hamilton for SCRTD, July 1983.

identification of 19 general policy statements concerning fare collection on the SCRTD's planned heavy rail/light rail/bus network. These statements were then categorized as system requirements or as system objectives. The resulting requirements and objectives, described below, were adopted by the Board of Directors in 1983.

2.1.1 System Requirements

System requirements are constraints that must be satisfied by the fare collection system. Ten such requirements were identified:

(1) Fare Verification

The system will be designed to permit verification of fare payment by drivers for bus operations, by entry and exit gates for Metro Rail, and by inspectors for LRT.

(2) Revenue Security

The system will not expose revenue or high-value media to unauthorized personnel or the public.

(3) Technology

Equipment will be of proven design. Priority will be given to selecting equipment proven to be reliable and technically sound in revenue service. In the event such equipment does not exist, consideration may be given to equipment for which available test data indicate the units will meet standards for reliability and maintainability.

(4) Media Handling

All fare collection systems will accept valid media for existing fare elements including regular and discount fare single-trip tickets and monthly passes, and including transfers.

(5) Intermodal Transfers

The fare collection system will accommodate intermodal transfers, charging only one base fare per trip.

(6) Fare Levels

The system will be designed to accommodate multi-dollar fares on all modes.

(7) Operational Compatibility

The fare collection system will be compatible with current SCRTD operations and will not require bus operators to collect through-fares.

(8) Unattended Stations

The fare collection system will be capable of operating without station personnel and must accommodate agents assigned to selected stations at selected hours. The requirements for Metro Rail and LRT integration, however, may require that the 7th/Flower Metro Rail Station be attended.

(9) Emergency Exit

The system will not impede emergency egress requirements, as defined in the Fire/Life Safety Criteria for the Metro Rail Project.

(10) Handicapped Accessibility

The system will accommodate patrons who are handicapped.

2.1.2 System Objectives

In addition to the specific requirements listed above, a number of broad fare collection objectives were identified, representing desired outcomes of the system. Nine such objectives were identified:

(1) Cost-Effectiveness

Cost-effectiveness is a policy that has been established for all aspects of the Metro Rail and Long Beach-Los Angeles Light Rail Projects, as well as for bus operations and capital improvements. Cost-effectiveness must be based on the benefits of a system in light of its life-cycle costs, including capital and annual operating and maintenance costs.

(2) Fare Enforcement

The system must ensure that each patron pays the correct fare and that the loss of revenue through fare underpayment, non-payment, use of invalid or altered fare media, and misuse of transfers is minimized.

(3) Fare Flexibility

The fare collection system must accommodate the existing fare structure as well as new fare elements, including distance-related or time-related fares, time-of-day fare differentials, single-trip and round-trip tickets, multi-trip or stored-value tickets, and usage restrictions on discount fares.

(4) Patron Convenience

Next to the transit service itself, the fare collection system is the most important element of public interface. To create a positive experience for the patron, the fare collection system must emphasize convenience. Convenience issues include the number of steps and amount of time required to use the system, the ease of understanding the system, the likely difficulties a passenger may encounter, and the procedures established for resolving passenger difficulties.

(5) System Integration and Compatibility

Integration of fares should not complicate bus and rail operations and administration. Procedures for processing transfers between the bus and rail systems must not be burdensome to the bus driver as this may affect bus system performance or result in collection of an incorrect fare.

(6) System Dependability, Reliability, and Maintainability

The fare collection equipment must be designed to function reliably in the transit operating environment, particularly in light of the high projected ridership volumes. The equipment should withstand the effects of high-volume usage and resist the effects of vandalism in order to minimize the delays and costs associated with equipment failure. These requirements include all elements needed to ensure high reliability and minimal maintenance and repair. To provide the necessary security of revenue, the equipment should also resist tampering by the public or by unauthorized personnel.

(7) Accommodation of System Expansion

The 18-mile Metro Rail line is expected to be the initial segment of a larger heavy rail system. In addition, the Long Beach-Los Angeles Line is only one segment of a planned regional LRT system. Unnecessary future expenditure should be avoided by considering, in equipment design, the future additions of new stations and lines. These additions could add to the complexity of the fare structure and thus to the equipment.

(8) Adequacy of Data Collection

Lack of an adequate data base can hamper effective service planning. Design of the integrated fare collection system provides an opportunity for efficiently recording and transmitting pertinent revenue and ridership information. The revenue data collected by cash-handling equipment will aid in auditing equipment for control of revenue.

(9) Ease of System Administration

The administrative requirements of the fare collection system should not be burdensome to SCRTD operations. Administrative requirements include all record-keeping functions such as the collection and processing of fare offender data, imposition of fines, and logistic requirements (e.g., media encoding and distribution).

2.2 APPLICATION OF REQUIREMENTS AND OBJECTIVES

In applying the above-listed requirements and objectives, all objectives by definition had to be assumed to be of lesser importance than any system requirements. Therefore, in developing the baseline system, the primary criterion initially was that the system must satisfy all identified requirements, and the attainment of objectives was a secondary goal.

In practice, this meant that the requirements to accommodate intermodal elements and a wide range of fare elements and media types had the greatest impact on system development. The imposition of these requirements resulted in an inherently complex system, for the need to accommodate all intermodal transfers in essence required a maximum degree of integration among the differing fare collection equipment of the Metro Rail, LRT, and bus systems. The complexities arising from the need for extensive integration were increased by the great variety of fare media each system was required to accept--graduated fares; discount fare and full fare single- and round-trip

tickets; bus and rail passes; transfers from bus to bus, and between bus and rail; and interface mechanisms for patrons moving between Metro Rail with its magnetically encoded fare media and LRT with its printed (paper) tickets. The result was a system that maximized intermodal integration and the objective of maximum fare flexibility, but did so at the expense of such system objectives as patron convenience, ease of administration, and cost-effectiveness.

A comparative assessment was then made of a variety of alternatives to elements of the initially defined system. These alternatives, which are discussed in Appendix B, included changes to elements of the fare structure as well as to fare collection equipment, media, or procedures. Inasmuch as the alternatives constituted changes to the definition of system elements, and not to the fundamental requirements imposed on the system, they were not found to alleviate the high costs and complexities arising from certain of those requirements. In fact, in most instances these alternatives led to additional costs with no discernible benefits, and as a result were excluded from the baseline system.

Given the complexities associated with the baseline as initially defined, the SCRTD requested an evaluation be conducted of the effects of changes to the fare collection policy requirements and objectives. That evaluation, documented in the January 1985 Special Study of Fare Policy Alternatives, and subsequent discussions led to recommendations by staff that the objectives of cost-effectiveness, patron convenience, and ease of administration be considered of greatest importance. The result was to simplify that baseline system by:

- Eliminating bus-to-rail transfers (except with passes)
- Eliminating round-trip tickets (for single journeys).

The refined fare policy, discussed below, became the basis for developing the baseline fare collection system described in this report.

2.3 INTEGRATED BUS/RAIL POLICY

Given the interim findings of this study and the recommendations of the special study of policy alternatives, the SCRTD's Planning and TSD Departments jointly prepared a refined statement of fare policy to enable system development to proceed. Because Metro Rail will be one of three modes in the SCRTD's planned transit network, the statement presents an integrated policy for bus, heavy

rail, and light rail. This section summarizes the key points of the policy with regard to fare elements, fare categories, and methods of payment. (Details on the integrated bus/rail policy are contained in Appendix A.)

2.3.1 Fare Elements

The fare policy specifies a distance-related fare structure, under which a base fare is charged for a minimum transit trip and incremental charges are added as a patron crosses fare zones. The policy also establishes a maximum fare level and transfer charges. These fare elements are summarized in Exhibit 2-1 and are described in the following paragraphs.

Base Fare and Zone Increment Charges

The base fare refers to the fare charged for a minimum trip, defined as any local or limited local bus trip or any trip within one fare zone on rail or one distance step on express bus.

To this base fare are added zone surcharges, incurred as a patron crosses fare zones on rail or express bus. Zone fares are typically imposed on either fixed zones with non-moving zone boundaries, or floating zones with zone boundaries that differ for each trip origin (e.g., a zone is defined to include a given number of stations). The fixed-zone concept has been adopted by the SCRTD because it is easier to administer and understand on a transit network that encompasses Metro Rail's barrier fare collection system and LRT's no-barrier system.

For design purposes, it has been assumed that there will be five fixed zones on the 18-mile Metro Rail line (see Exhibit 2-2), and six fixed zones on the 22-mile LRT line. The number of zones will increase as the rail system is expanded in the future.

A maximum rail fare has been specified under the fare policy. This maximum fare, including the base fare and zone surcharges but excluding any transfer charges and express bus distance-steps, stipulates that the maximum fare will be equivalent to a four-zone trip. That is, no trip on Metro Rail, or on LRT, or on a combination of Metro Rail and LRT, will exceed the base fare plus zone increment charges of a four-zone trip (exclusive of any transfer and express bus charges).

EXHIBIT 2-1
Fare Elements Under the Integrated Bus/Rail Fare Policy

Fare Element	Description
Base Fare	Initial fare for boarding on bus or rail; allows travel on local bus or travel within one rail zone.
Bus-to-Bus Transfer	Charge for transfer to a second bus within specified time interval and subject to route and directional restrictions. (Only one use per transfer permitted.)
Rail-to-Bus Transfer	Charge for transfer from rail to bus within specified time interval.
Zone Increment	Charge for crossing zone boundary on rail or for distance step on express bus.
Maximum Fare	Base fare plus specified number of zone increments (excluding transfer and express bus distance charges).

EXHIBIT 2-2
Metro Rail Fare Zones

Fare Zone	Station
M1	Union Station
	Civic Center
	5th/Hill
	7th/Flower
	Alvarado
M2	Vermont
	Normandie
	Western
	Crenshaw
M3	La Brea
	Fairfax
M4	Santa Monica
	Sunset
M5	Universal City
	North Hollywood

Transfer Charges

Transfer provisions under the integrated bus/rail fare policy include bus-to-bus and rail-to-bus transfers.*

All bus-to-bus transfers will be permitted with payment of a nominal transfer charge and applicable distance-based surcharge, if any. Bus-to-bus transfer media will expire after a prescribed time period and will be subject to limitations on allowable directions of travel.

All transfers from Metro Rail and LRT to bus will similarly be permitted with payment of a transfer fee and applicable distance-based surcharges, if any. Rail-to-bus transfers can easily be accommodated by the ticket vending machines of both the Metro Rail and LRT systems (see Chapter 3). When the desire to transfer to a bus is indicated, the pertinent transfer information is printed on the rail ticket.

Transferring from bus to rail, however, will require payment of the full rail base fare, rather than a transfer charge. The provision of bus-to-Metro Rail transfers was found to complicate station equipment requirements and patron procedures, as well as necessitate the central pre-encoding of such transfers for each day and time period (a.m. and p.m.) and their distribution on a daily basis to bus drivers of each division. Because of the complexities and high costs associated with these requirements, bus-to-rail transfers were eliminated under the integrated fare policy.**

Peak/Off-Peak Fare Differentials

Although no surcharge for travel during peak hours is currently included in the fare policy, the policy stipulates that nothing should preclude the implementation of this alternative in the future.

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* The Metro Rail and LRT lines are considered to comprise a unified rail system, and trips requiring patrons to switch between the two lines are defined as a single continuous trip. Movements between Metro Rail and LRT are therefore not technically considered transfers and are not subject to transfer charges.

** Although bus-to-LRT transfers could be provided without requiring encoded media, the recommendation for their elimination was based on the desire to coordinate Metro Rail and LRT fare policy.

2.3.2 Fare Categories

Three fare categories are established by the integrated bus-rail fare policy, as follows:

- Regular--Full fare.
- Discount--Senior and disabled citizens eligible for discount cash base fare and discount passes.
- Free--Children under 5 years; SCRTD employees and dependents; SCRTD retired employees; SCRTD Board members; and uniformed law enforcement employees.

The discounts available to the elderly and handicapped apply only to base fare charges; no discounts are provided for zone increment or transfer charges. Eligible patrons must have a valid discount fare permit--a printed photo permit--to enable them to obtain their discount fare benefits.

Free fares available to designated riders in some cases will require proper identification (e.g., District employees, blind, police).

2.3.3 Methods of Payment

The integrated bus/rail fare policy stipulates that the fare collection system will continue to accommodate cash fares and monthly passes. These fare types are currently in use and are most compatible with the three modal fare collection systems, using proven technology.

Cash

On Metro Rail, all regular fares and distance-based surcharges will be paid by means of electronically encoded media purchased at the point of entry. Discount Metro Rail tickets will be sold only at SCRTD service centers and selected sales outlets.

All LRT fares (including discount fares) will be paid by means of printed tickets purchased at the point of entry. LRT ticket vendors will sell both regular and discount tickets because LRT fare inspectors will verify that a patron is eligible for a discount fare.

Metro Rail and LRT fares will be integrated, with each ticket vendor (or service center/sales outlet) accepting payment for all rail destinations.

On buses, cash in the exact amount of the fare will be accepted for fare payment on all bus service.

Transfers to bus will be provided as pre-printed paper media on all buses. Metro Rail and LRT tickets will also be accepted as transfers on buses when an appropriate indication is displayed on the ticket. All transfers must be surrendered when used.

Passes

Monthly bus-only and bus/rail passes will be sold at designated sales outlets. The bus-only pass will be a printed pass valid for local and limited local bus service. The pre-encoded bus/rail pass will be good for travel within a specified number of Metro Rail zones, as well as for travel on local and limited local buses. For travel on express bus or light rail, monthly stamps will be sold, valid for travel through a specified number of distance zones or for travel between specified light rail zones. In addition, an encoded monthly regional pass will be offered, valid for travel anywhere on the SCRTD system.

3.0 DESCRIPTION OF THE BASELINE SYSTEM

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Each major element of the Metro Rail baseline fare collection system--its fare media, station fare collection equipment, and station fare collection personnel--was defined to satisfy the operational criteria and the requirements specified in Chapter 2. For ease of presentation, this chapter describes each of these elements separately, although it should be noted that the relationship among them is an interactive one, with the needs of one influencing certain capabilities or requirements of another.

Two other facets of the presentation should also be noted. First, this chapter focuses on identifying and describing the system's elements. These descriptions set the stage for Chapter 4, where the elements are tied together through a detailed explanation of the procedures for their use. Second, while the focus of the chapter--and indeed of the report--is on the Metro Rail system, that system must enable patrons to interface easily with the SCRTD's bus and LRT systems. The following sections therefore address requirements on these other modes in sufficient detail to enable the interfaces to be understood.

3.1 FARE MEDIA

As noted in Chapter 2, the integrated bus/rail fare policy specified that the baseline system would accommodate cash fares as well as bus-only and bus/rail passes. The fare media defined to meet these specifications and other requirements are summarized in Exhibit 3-1 and are described below. Additional detail on the information encoded and/or printed on media is provided in Appendix C.

3.1.1 Rail Tickets

On Metro Rail, magnetically encoded single-trip tickets will be available for one-zone or zone-to-zone travel (including tickets to LRT zones). Regular fare patrons will purchase their Metro Rail tickets at station ticket vending machines (TVMs). Discount fare tickets may only be purchased at SCRTD service centers or sales outlets, and a valid photo permit must be presented at the time of purchase. Discount fare tickets will be

EXHIBIT 3-1
Fare Media Under the
Baseline System

Metro Rail Tickets	Encoded regular or discount single-trip tickets from Metro Rail origin zone to Metro Rail or LRT destination zones, with or without transfer to bus. (Discount tickets will be color coded and sold only at sales outlets.)
LRT Tickets	Printed regular or discount single-trip tickets from LRT origin zone to LRT or Metro Rail destination zones, with or without transfer to bus.
Metro Rail Exit Cards	Encoded by 7th/Flower station agent and exchanged for printed LRT ticket with Metro Rail destination zone.
Bus-to-Bus Transfer	Printed transfer for boarding second bus.
Local Bus Pass	Printed regular or discount monthly pass valid for travel on local and limited local bus.
Bus/Rail Pass	Encoded regular or discount monthly pass valid for travel on given number of Metro Rail zones, and/or on local and limited local bus. (Discount fare pass will be color coded.)
Light Rail Stamp	Printed regular or discount monthly stamp valid for travel on given number of LRT zones. Zone pairs to be traveled between must be written or stamped at time of purchase. Stamp must be shown with a valid bus or bus/rail pass.
Express Bus Stamp	Printed regular or discount monthly pass valid for travel on given number of express bus distance steps. Stamp must be shown with a valid bus or bus/rail pass.

EXHIBIT 3-1
Fare Media Under the
Baseline System

Regional Pass	Encoded regular or discount monthly pass valid for travel anywhere on RTD system. (Discount fare pass will be color coded.)
Discount Fare Permit	Printed photo permit used to allow eligible fare patrons to purchase discount Metro Rail tickets, bus and bus/rail passes and bus and rail stamps at sales outlets; also used as valid I.D. on bus for discount cash drop, and on LRT when presenting discount LRT ticket to inspector.
Emergency Media	Printed emergency rail-to-bus and MRT-to-LRT transfers, and encoded emergency exit cards, for use when equipment failures cause a patron to lose valid fare media on the ticket.

pre-encoded to facilitate distribution, and will be color-coded.*

Regular fare Metro Rail tickets will be encoded by the TVM with fare category and zone information. (Destination zone buttons on station TVMs will enable patrons to select desired zones of travel, as explained subsequently in Section 3.2.) The TVM will also print the same information on the face of the ticket (See Exhibit 3-2). For example, 1X or 2X** will be printed to indicate regular or discount fare; M3-M1/M5 to indicate a trip originating within Metro Rail zone 3 and valid for two zones of travel on Metro Rail (to zone 1 or zone 5). Because a maximum fare equivalent to four zones of travel has been specified, Metro Rail tickets for four or more zones will be encoded and printed with either MXX (indicating the ticket is valid to <u>all</u> Metro Rail destinations) or LXX (indicating the ticket is valid for <u>all</u> LRT destinations).

Discount Metro Rail tickets will be centrally pre-encoded and pre-printed. The codes for fare category and transfer to bus will be the same as for regular fare tickets and will be printed on the ticket as well as encoded on the magnetic strip. On discount tickets only the number of zones of travel and the rail system destination will be printed, rather than the origin and destination zones. This is necessary in order to minimize the number of types of tickets that need to be pre-printed and stocked at the sales outlets.

The Metro Rail entry fare gates will magnetically encode date and time of entry and origin station name on the ticket. On Metro Rail tickets to LRT destination zones (or with transfers to bus, as is described subsequently), the fare gates will also print this information on the face of the ticket (see Exhibit 3-2). This information will be printed to enable LRT fare inspectors to verify that a Metro Rail ticket is valid for travel on LRT.

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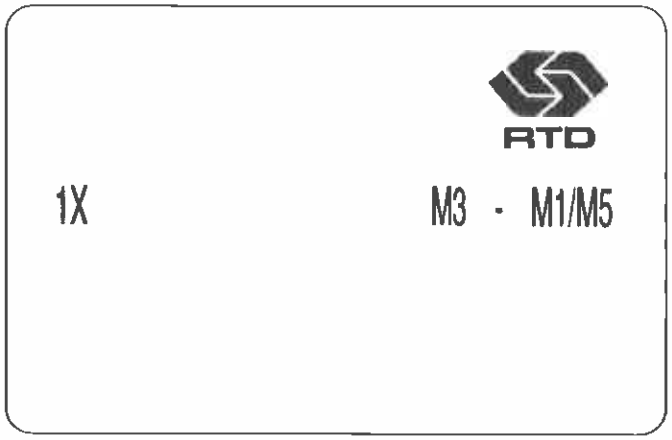
* To enable discount tickets to be vended by TVMs, discount fare photo IDs would need to be pre-encoded and readable by TVMs or fare gates as a means of enforcing eligibility requirements. This alternative was rejected from the baseline system as discussed in Appendix B.

** The "X" indicates a rail ticket without transfer to bus. As is noted below in Section 3.1.2, the "X" is replaced by a "T" on tickets with transfer to bus.

EXHIBIT 3-2
Sample Ticket Media

Metro Rail Tickets

Regular Fare to MRT Destination



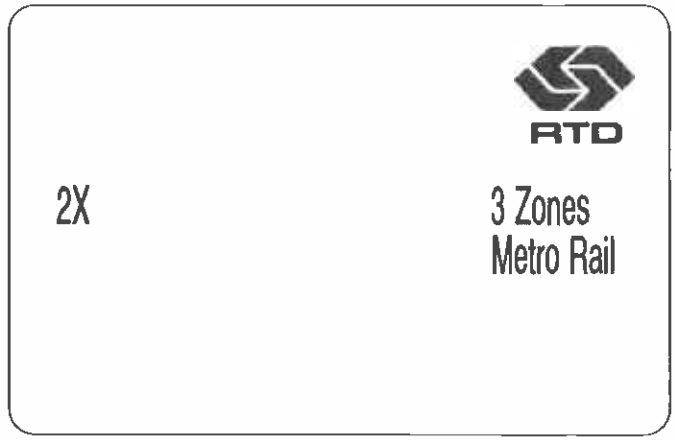
As issued by TVM and returned by entry fare gate.

Key: 1X = Regular fare with no transfer to bus

M3 = Origin zone

M1/M5 = Valid destination zones

Discount Fare to MRT Destination



As issued at sales outlet/service center and returned by fare gate. Discount fare tickets color coded.

Key: 2X = Discount fare with no transfer to bus

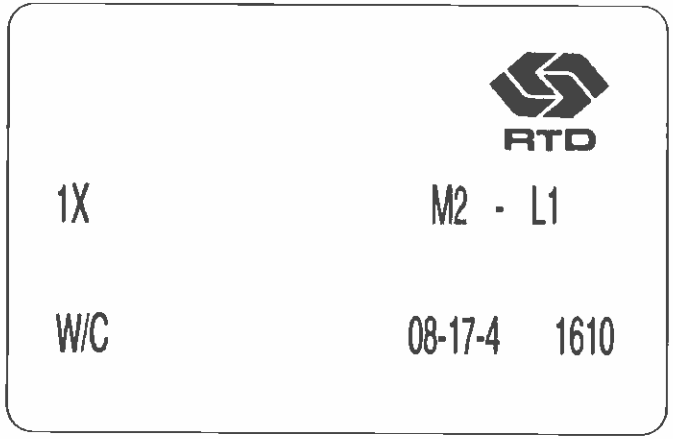
3 zones = Number of valid zones of travel

Metro Rail = Rail system on which trip ends

EXHIBIT 3-2
Sample Ticket Media

Metro Rail Tickets

Regular Fare To LRT Destination



Top line printed by TVM; bottom line information printed by entry fare gate.

Key: 1X = Regular fare with no transfer to bus

M2 = Origin zone (Metro Rail)

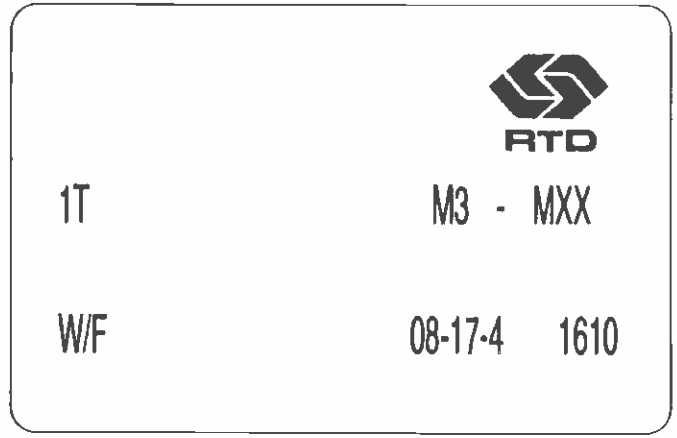
L1 = Destination zone (LRT)

W/C = Origin station (Wilshire/ Crenshaw)

08-17-4 = Date of use

1610 = Time of entry

Regular Fare to
MRT Destination With Transfer to Bus



Top line printed by TVM; bottom line transfer information printed by entry fare gate.

Key: 1T = Regular fare with transfer to bus

MXX = Valid for all Metro Rail destination zones

W/F = Origin station (Wilshire/ Fairfax)

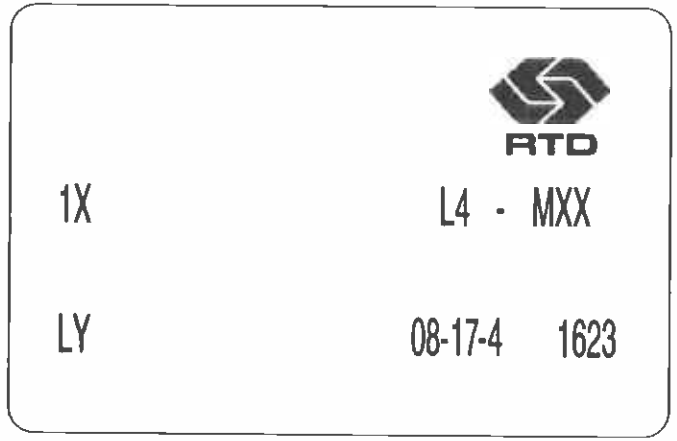
08-17-4 = Date of use

1610 = Time of entry

EXHIBIT 3-2
Sample Ticket Media

Light Rail Tickets

Regular Fare to MRT Destination

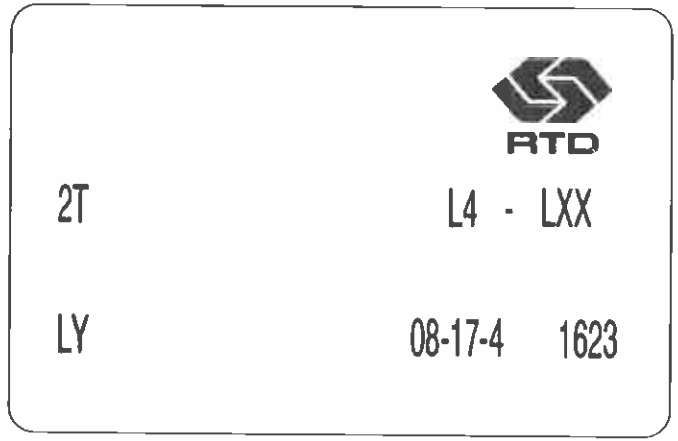


Single-trip ticket from Light Rail TVM (printed).

Key: 1X = Regular fare with no transfer to bus

MXX = Valid for all light rail and Metro Rail destination zones

Reduced Fare to LRT Destination



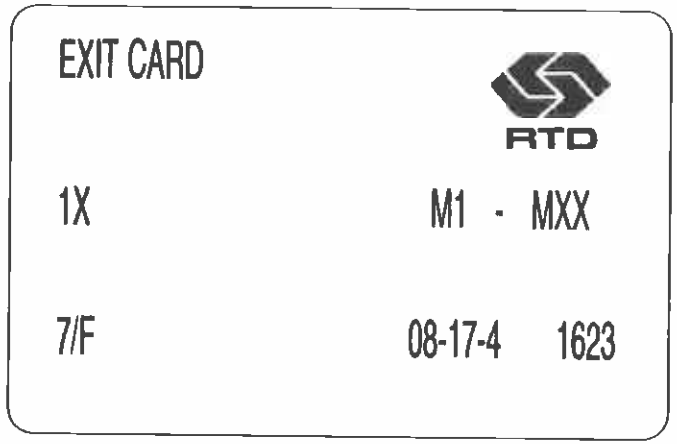
Single-trip ticket from Light Rail TVM (printed).

Key: 2T = Discount fare with transfer to bus

LXX = Valid for all light rail destination zones

EXHIBIT 3-2
Sample Ticket Media

Metro Rail Exit Card



Exit card issued by 7th/Flower station agent in exchange for the sample regular fare LRT ticket shown previously. Top line printed pre-printed; second line printed by station agent encoder; bottom line printed by entry gate.

Key: 1X = Regular fare with no transfer to bus

M1 = Origin zone

MXX = Valid for all Metro Rail destination zones

7/F = Origin station (7th/Flower)

08-17-4 = Date of use

1623 = Time of entry

Because Metro Rail tickets will not be dated and timed until they are inserted in a fare gate to enter the system, patrons may purchase them at any time for later use.

On the LRT system, printed paper tickets for single trips will be purchased at station TVMs by both regular and discount fare patrons. Similar to the Metro Rail system, the LRT TVMs will print tickets with fare category and zone information, and will also print date, time and origin station on the ticket. Because LRT tickets will be dated and timed by the station TVMs at the time of purchase, they cannot be purchased in advance for later use. Exhibit 3-2 provides sample illustrations of LRT tickets.

Given the differences in fare media between Metro Rail and LRT, LRT patrons continuing on to Metro Rail destinations must exchange their printed paper LRT tickets for encoded media if they are to be able to exit through Metro Rail's automatic barrier system. Consequently, a special full-time station agent will be assigned under the baseline system to the 7th/Flower station. LRT patrons with tickets to Metro Rail destinations will present their paper tickets to the station attendant, who will use a ticket encoder to provide magnetically encoded MRT exit cards in exchange for the printed tickets. Exhibit 3-2 illustrates such an exit card.

3.1.2 Transfers

Under the baseline fare collection system, bus-to-bus and rail-to-bus transfers will be accommodated. Bus-to-bus transfers will remain the same as they now are, being pre-printed paper media valid for a local bus trip or base fare credit on express bus, and having time and directional limitations.

Rail-to-bus transfers will be the same basic media as regular rail tickets, but will be printed/encoded to indicate that a transfer has been purchased. Metro Rail and LRT patrons wishing to transfer to bus will select a "transfer" button when purchasing tickets at station TVMs (or, in the case of Metro Rail discount fare patrons, will request a ticket with transfer at SCRTD service centers/ sales outlets). Rail tickets with transfers will be printed with a "T" on the face of the ticket (rather than the "X" printed on regular rail tickets); Metro Rail tickets will also be magnetically encoded with the transfer information.

Rail tickets will be printed with date and time and origin station, as noted previously, by the station TVM in the case of LRT tickets and by the entry fare gates in the case of Metro Rail tickets with transfers to bus (see Exhibit 3-2). The printed "T" code plus the date and time will enable bus drivers to verify valid transfer tickets. The transfer to bus must be made within a fixed interval (e.g., 2 hours) of the time printed on the face of the ticket, and must be surrendered at the time of transfer.

3.1.3 Monthly Passes

Because the new rail system will initially serve only a small percentage of existing SCRTD riders, it will be unnecessary to issue every pass user with an encoded bus/rail pass. Therefore, a printed monthly pass good only for local and limited local bus service will continue to be offered.

A pre-encoded monthly bus/rail pass will be sold for travel on Metro Rail. Each pass will be valid for travel on a specified number of Metro Rail zones, with the patron choosing the appropriate number of zones rather than being required to identify specific zones of travel. That is, a patron will choose, for example, a three-zone pass, enabling him to travel between any three zones on Metro Rail, rather than being constrained to choose between specific zone pairs, e.g., M1-M3 pass, or M2-M4. This monthly bus/rail pass will also be valid for local and limited local bus service.

For travel on express bus or light rail, monthly stamps will be sold. When purchased in conjunction with a local bus-only pass, the stamps will be affixed directly to the pass; when purchased in conjunction with a bus/rail pass, they will be affixed to a separate supplement card, since they cannot be placed on the magnetically encoded media. The supplement card and stamp must be shown in conjunction with a bus/rail pass as a means of controlling abuse of passes.

The express bus stamp will be good for travel through a specified number of distance steps. The light rail stamp will be valid for travel within a specified number of zones on the LRT system, with the zones to be traveled written on the stamp at the time of purchase. Unlike Metro Rail passholders, purchasers of LRT stamps must choose their specific zones of travel, to enable LRT fare inspectors to verify that the stamp is valid for the trip being made.

The various combinations of passes and stamps will enable patrons to choose the trip types they require, including local bus/LRT, local bus/Metro Rail, local bus/Metro Rail/LRT, etc. Given that the integrated bus/rail policy specifies a maximum fare equivalent to four zones of travel, any patron wishing to purchase a monthly pass and intending to travel regularly four or more zones on the system will purchase a monthly regional pass. This pre-encoded pass will be valid for travel anywhere on the SCRTD transit system.

Exhibit 3-3 illustrates the various monthly passes and stamps that will be available under the baseline system.

3.1.4 Emergency Media

In addition to the regular fare described in the preceding section, certain emergency media must be available for use in non-routine situations. Two types of emergency media will be provided under the baseline system:

- Emergency transfers--These pre-printed media will be carried by station agents and line supervisors (rail) in the event that TVMs, add fare machines, or fare gates fail to return valid transfer media. The media will be designated as valid for travel on bus or LRT by the agent.

- Metro Rail emergency exit cards--These magnetically pre-encoded cards will permit patrons to exit once at any fare barrier. They will be carried by station agents for use when Metro Rail equipment fails to return valid fare media.

3.2 STATION FARE COLLECTION EQUIPMENT

This section describes in detail the fare collection equipment required at Metro Rail stations under the baseline system. Fare collection equipment on the bus and LRT systems are then briefly addressed to make clear interfaces with Metro Rail.

3.2.1 Metro Rail

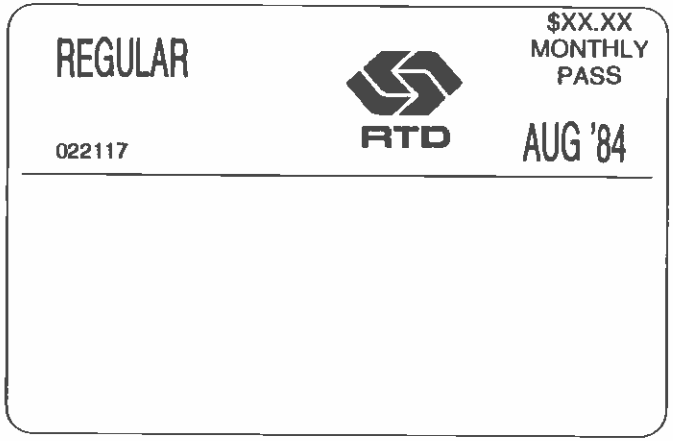
Each Metro Rail station will include the following fare collection equipment:

- Ticket vending machines

- Bill changer machines

EXHIBIT 3-3
Sample Monthly Passes

Local Bus-Only Pass



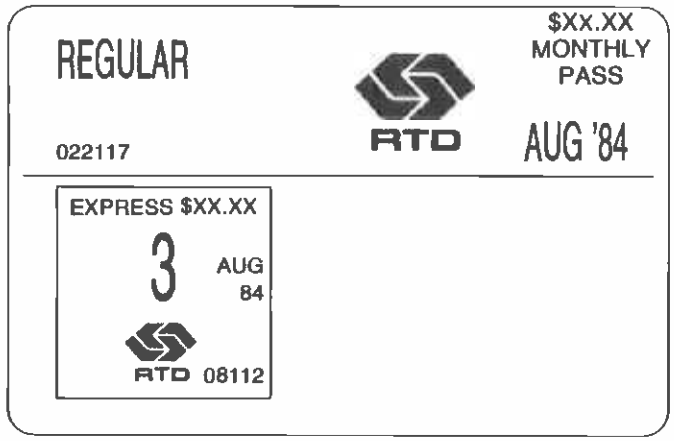
Monthly pass good on all local and limited local bus service (printed).

Bus/Rail Pass

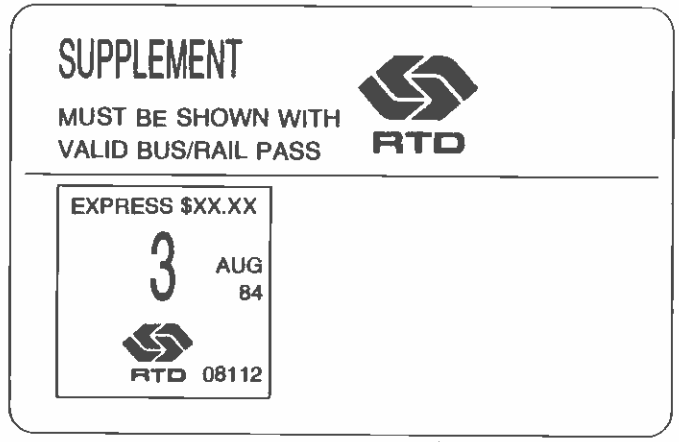
Monthly pass good on all local and limited local bus service and on specified number of Metro Rail zones (encoded).

EXHIBIT 3-3
Sample Monthly Passes

Passes With Express Bus and Light Rail Stamps



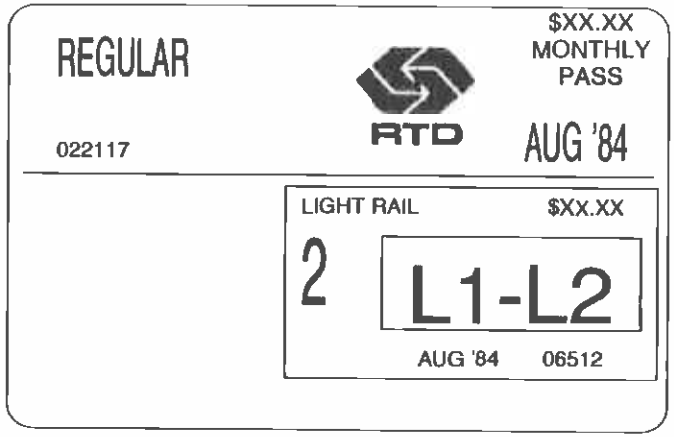
Monthly pass same as above with stamp for express bus service (printed).



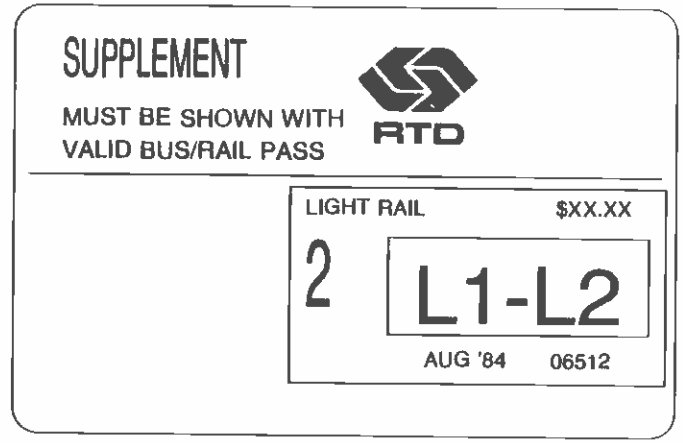
Supplement card (no value) with stamp for express bus service. Must be shown with bus/rail pass.

EXHIBIT 3-3
Sample Monthly Passes

Passes With Express Bus and Light Rail Stamps



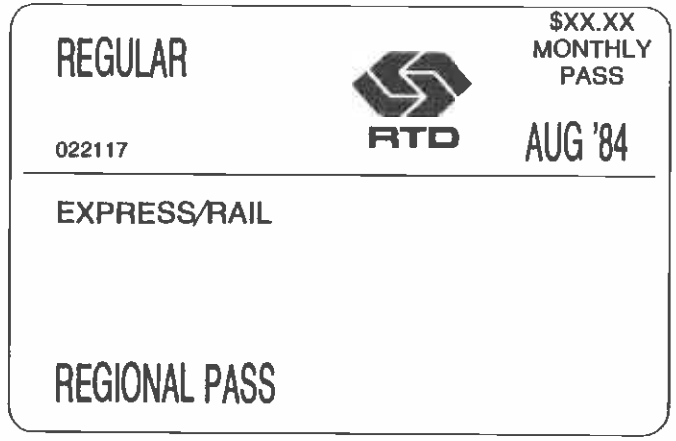
Monthly pass same as above with stamp for for light rail service (printed). Zones are written on stamp at time of purchase.



Supplement card with stamp for light rail service (printed). Zones are written on stamp at time of purchase.

EXHIBIT 3-3
Sample Monthly Passes

Regional Pass



Monthly regional pass good on all SCRTD services (encoded).

- Entry/exit barriers:
  - Automatic fare gates
  - Handicapped gate
  - Emergency exit gate
- Add fare machines
- Passenger assistance centers
  - Passenger assistance intercom
  - Ticket reader
- Station Fare Collection Control Unit.

This equipment is illustrated in the conceptual diagram provided as Exhibit 3-4, and is described in the following paragraphs.

The free area of Metro Rail stations will incorporate ticket vending machines and bill changer machines. Bill changer machines will be provided so that patrons may readily obtain the coins required to purchase Metro Rail tickets from, or upgrade Metro Rail fare media in, the station ticket vending machine (TVM). Each bill changer machine (BCM) will accept U.S. $1 or $5 bills, dispensing in return one or five U.S. Susan B. Anthony dollar coins for use in the TVM.

TVMs will vend regular fare single-trip magnetically encoded tickets and will incorporate selection buttons to enable patrons to choose among various ticket options. The selection buttons on Metro Rail TVMs, as illustrated in Exhibit 3-5, will include:

- Rail system destination--One button to select LRT destinations; the TVM defaults to Metro Rail destinations if no selection is made.
- Travel zones--One button each for one, two, three, and four or more zones of travel.
- Transfer to bus--Pressed when a patron desires to transfer to bus after the rail trip.
- Peak/off-peak (optional)--If peak/off-peak fare differentials are implemented, TVMs will be programmed to automatically vend tickets at fares appropriate for the time of day during which the ticket is being purchased. A peak/off-peak button will be provided to permit patrons to override the fare levels automatically used by the TVM and to purchase tickets for use during another time period. Hence, during

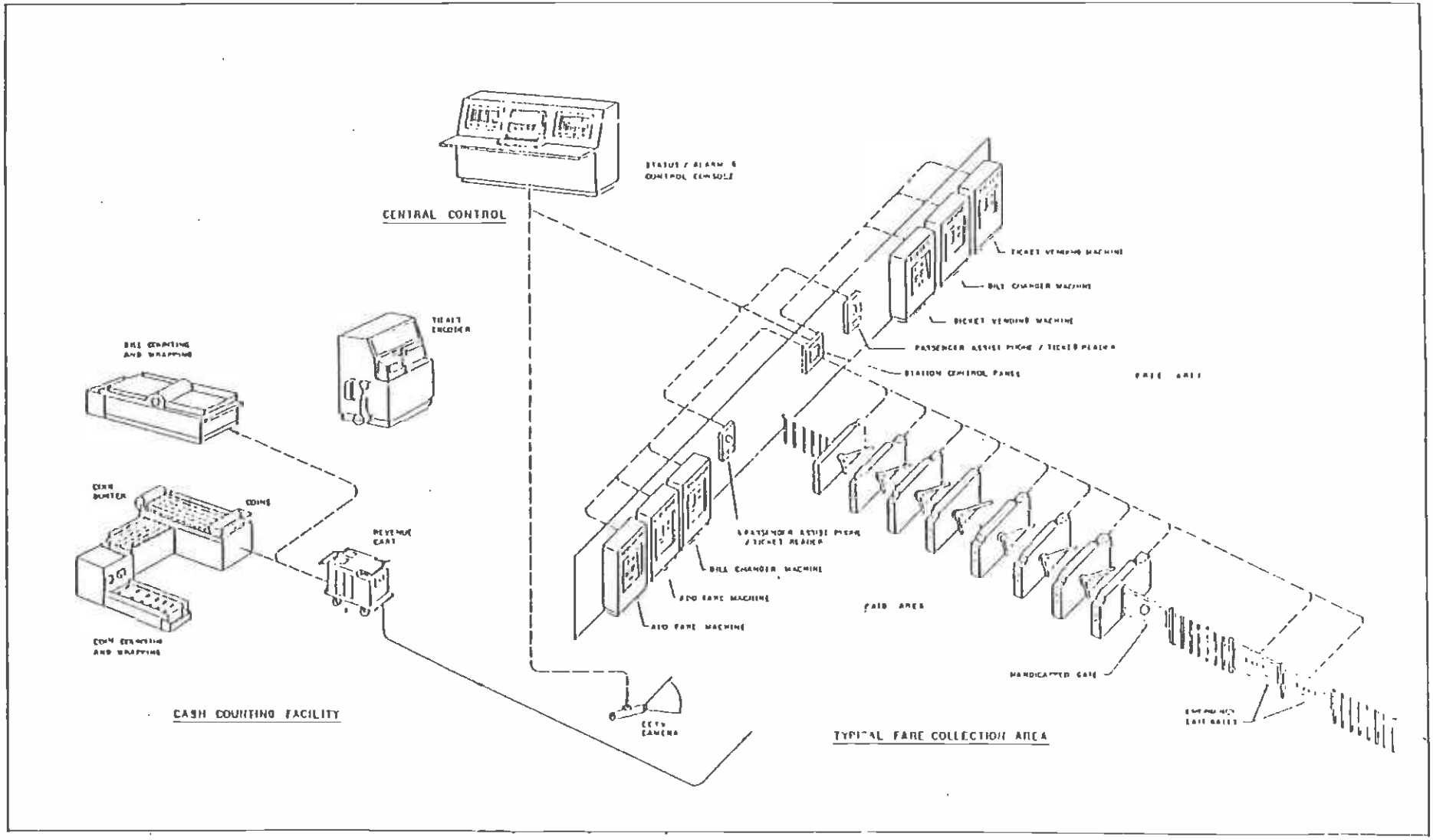
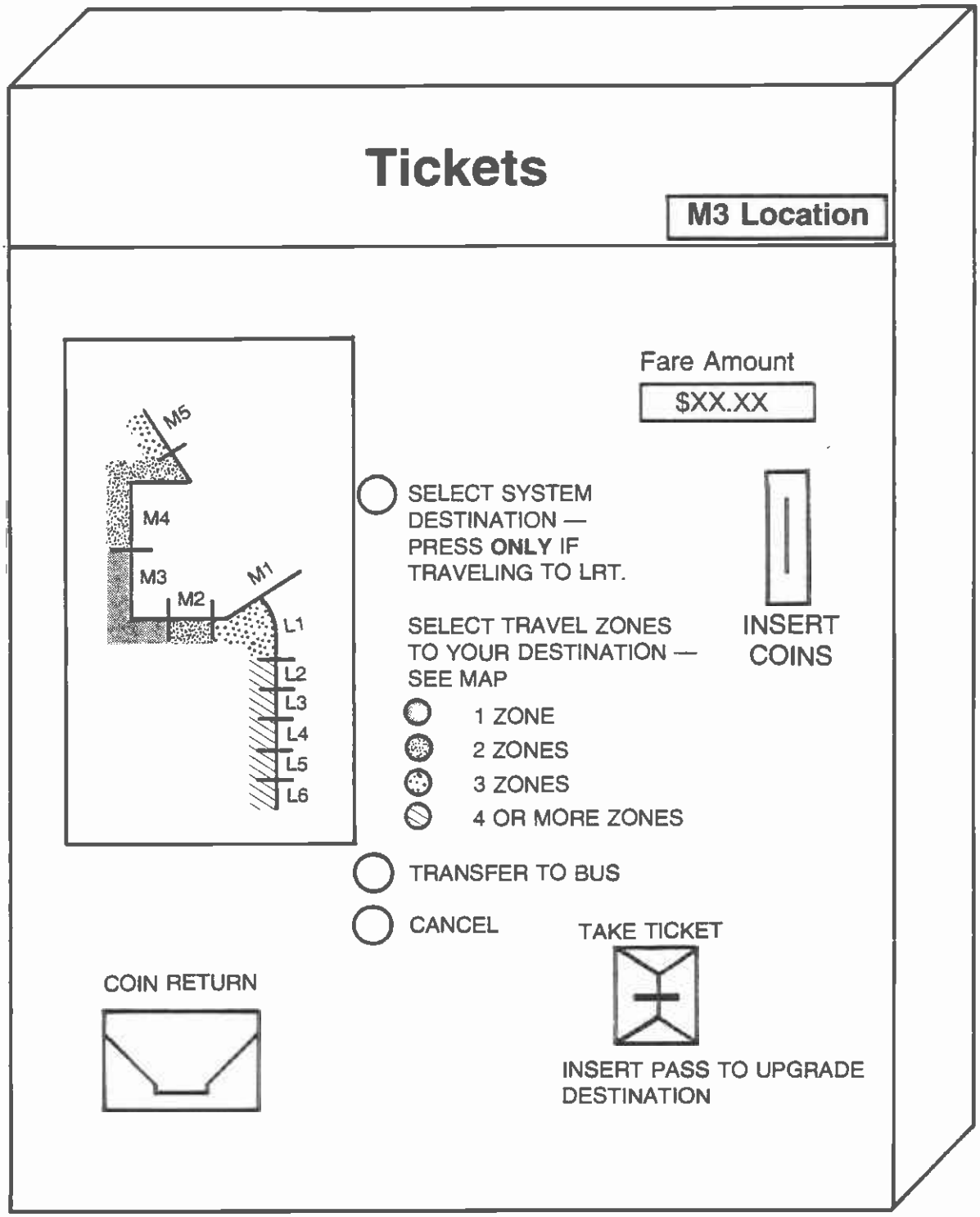


EXHIBIT 3-4
Metro Rail Fare Collection Equipment

EXHIBIT 3-5

Metro Rail Ticket Vending Machine



peak periods, a patron may purchase an off-peak ticket by depressing the peak/off-peak button, and may similarly purchase a peak ticket during off-peak hours.

- Cancel--Pressed when patron desires to cancel any transaction before a ticket is issued or change dispensed.

Patrons will use the TVM by choosing among the various ticket options and depositing fare payment equal to the amount displayed. If insufficient payment has been made for the selected ticket, the remaining fare required will be displayed by the TVM, and the amount will decrease to zero as the balance of the fare is paid. If overpayment is made, the TVM will dispense change.

TVMs can also upgrade the value of magnetically encoded bus/rail passes for a single trip to a further destination, although patrons may also use add fare machines (see below) to pay the additional fare required for travel on Metro Rail beyond valid pass zones. In either case, upon payment of the additional fare, the number of zones for the single trip will be encoded on the pass and will be erased when the patron uses the pass to exit the system.

The data encoded and/or printed by Metro Rail TVMs (or centrally pre-encoded on media sold at remote sales outlets) will include not only such information on media and trip type (such as regular fare and number of zones), but also entry and exit codes and controls on media use, such as passback controls. (Appendix C summarizes the information encoded/printed on Metro Rail media under the baseline system.)

Fare barriers will separate the free area of Metro Rail stations from the paid area. The barriers will consist of automatic fare gates, a handicapped gate, and an emergency exit gate.

- Fare gates--Fare gates will control passage to and from the paid area of a station by reading magnetically encoded fare media to ensure they are valid, and will also accumulate ridership data for transmittal to the Rail Control Center and subsequent tabluations by the central computer (e.g., number of patrons by fare element, number of station-to-station movements by time of day). Fare gates may be bidirectional, used for either entry or exit, or may be unidirectional gates dedicated to a single directional flow. Entry fare gates will read media for a valid entry code, and in turn will encode origin

station, date and time, and other information on the media. Entry gates will also print the origin station name and the date and time on Metro Rail tickets with transfers to bus and to LRT zones so that such tickets and transfers may visually be checked by bus drivers or LRT fare inspectors. Exit fare gates will read the media to determine if proper fare payment has been made for exit at the station, rejecting the media if insufficient fares are encoded. Exit gates will capture expired fare media but will return media required for subsequent use, such as passes, tickets with transfers to bus, and tickets to LRT destinations. Returned media will be encoded (but not printed) with usage data, such as date and time of exit, and with operations/control data, such as exit codes. Also, as noted above, exit gates will erase any single-trip upgrade information on passes.

- Handicapped gate--Handicapped gates will be provided in fare barriers for semi-ambulatory and non-ambulatory patrons who are unable to negotiate regular fare gates. The handicapped gate will be located in line with the regular fare gates at each Metro Rail station mezzanine having elevator access. It will normally be closed to passage in either direction, but will release automatically when a valid ticket or pass is inserted into the console. (Only media encoded for use by handicapped patrons or SCRTD employees will be accepted by the gate.) The gate will close automatically once the patron has cleared the aisle. The gate will also be equipped with a manually-activated crash bar that can be used to release the gate during emergency use.

- Emergency exit gates--Emergency exit gates will be included in the fare barrier to permit patrons to exit rapidly during emergencies. The gates will be released by a manually-activated crash bar on the paid-area side of the gate.

The paid areas of Metro Rail station mezzanines will contain add fare machines (AFMs) and, since these will accept only valid U.S. coins, will also contain bill changer machines. The AFMs will enable patrons holding fare media of insufficient value to pay the additional fare required to exit at that particular Metro Rail station. AFMs will read the fare media and display the additional fare required for exit. The amount displayed will decrease to zero as payment is made; if the patron overpays the fare amount, change will be dispensed. Once

payment is complete, the AFM will magnetically re-encode the fare media and return it to the patron.

To enable patrons needing assistance to contact the Rail Control Center (RCC), passenger assistance centers will be located in each station, in the free area near the fare gate array and in the paid area near add fare machines, as well as near remote TVMs. These assistance centers will include:

- A "hands-free" intercom to enable passengers needing assistance to directly communicate with CCTV operators when no station agent is available.

- A ticket reader to enable station agents or CCTV operators to read the magnetically encoded information on Metro Rail media as an aid to identifying passenger problems with the media.

A station fare collection control unit at each Metro Rail station will incorporate a computer that will enable station agents and other Metro Rail personnel to put each piece of fare collection equipment into or out of service, and will also provide troubleshooting information on equipment (i.e., diagnostics on equipment problems). The computer will permit, via the cable transmission system (CTS), remote transmission of equipment status changes and statistical data to the RCC, as well as remote control of equipment from the RCC. Fault and intrusion alarms will be sent in real time to the RCC.

All TVMs, AFMs, BCMs, and fare gates will have self-diagnostic capabilities, will automatically shut down when disabled, and will transmit changes in status via the CTS to the RCC in real time. They will also respond to commands received by remote control from either the station fare collection control panel or the RCC. Commands include take out of service, put in service, reverse direction (fare gates), single release (fare gates), and free wheel (fare gates in case of emergency). In addition, the equipment will display messages indicating any malfunction to patrons. For example, TVMs experiencing a loss of secondary functions such as change-making will display an appropriate message. Display messages include exact change only (TVMs, AFMs), add fare (fate gates), call for aid (all), and out of service (all).

The various pieces of fare collection equipment described above will be located in each Metro Rail station. In addition, at the 7th/Flower station, a station ticket encoder will be located at the special station agent booth. This encoder will enable the agent to prepare magnetically encoded MRT exit cards which are equal

in value to and will be exchanged for printed tickets held by LRT patrons continuing on to Metro Rail destinations. The encoder will imprint codes on the magnetic strip of blank stock and will also print the appropriate information on the face of the card.

3.2.2 Equipment on Other Modes

Buses will continue to use on-board fare collection equipment, with fares monitored by the bus driver as a patron boards the bus.

On the LRT system, each station will incorporate TVMs, BCMs, and passenger assistance intercoms. The LRT TVMs will vend single-trip regular and discount fare printed paper tickets. The LRT TVMs will be as similar as possible to Metro Rail TVMs and will incorporate the same selection buttons to enable patrons to choose among various trip options (rail line on which trip ends--MRT or LRT, zones of travel, and transfer to bus). The LRT TVMs will in addition include a discount fare button for use by patrons in valid fare categories (senior citizens and handicapped). The LRT TVMs will default to regular fare if the discount fare button is not selected.* Bill changer machines and passenger assistance intercoms at LRT stations will have the same functions as those described previously for Metro Rail.

3.3 STATION PERSONNEL REQUIREMENTS

Under the Metro Rail baseline fare collection system, several types of personnel are required to facilitate or monitor the direct interface between patrons and the system. Such personnel include:

- Station agents
- Line supervisors
- CCTV operators
- Transit police
- Fare collection personnel on other modes.

In addition to providing routine patron assistance with use of the Metro Rail system and fare collection

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* Because the LRT fare collection will be a proof-of-payment system, LRT TVMs will vend discount fare tickets. To provide the same capability for Metro Rail TVMs, a system would be required whereby the TVM could determine that the patron is eligible for the discount fare. Such a system was examined under the assessment of alternatives described in Appendix B.

equipment, these personnel will be responsible for specific functions at stations. The responsibilities are described in the following subsections. The personnel needed to provide additional administrative, maintenance and operations support to the Metro Rail fare collection system are discussed in Chapter 5 of this report.

3.3.1 Metro Rail Station Agents

Station agents will be selectively assigned to Metro Rail stations. Among the varied responsibilities of station agents, the following are related to the fare collection system:

- Patron assistance
  - Assisting patrons in using collection equipment
  - Providing information on SCRTD fare structure
  - Providing information on system route and schedules
  - Reading encoded media using the ticket reader in one of the patron assistance centers
- Correcting equipment failures
  - Unjamming equipment
  - Putting equipment into or taking it out of service via the station fare collection equipment control panel
  - Reporting hard failures of fare collection equipment to the RCC communications controller and completing equipment incident reports
  - Providing emergency media to patrons when equipment jams or fails to return a valid ticket or pass; or releasing the fare gate to enable the patron to exit
  - Providing and completing claim forms to patrons who have lost coins or valid fare media in the fare collection equipment
  - Releasing all exit fare gates for emergency egress.

In addition, a special station agent will be stationed during all operating hours at a station agent booth at the 7th/Flower station. This agent will be responsible for encoding Metro Rail exit cards for LRT patrons with printed tickets traveling to Metro Rail destinations and for carrying out patron assistance duties when otherwise unoccupied.

3.3.2 Metro Rail Line Supervisors

Metro Rail line supervisors will carry emergency media (transfers and exit cards). These supervisors may be dispatched by the RCC Rail Operations Supervisor to provide emergency media to patrons at unattended stations who, through equipment jams or other non-routine situations, have lost valid fare media. Line supervisors will also be able to perform finger tip repairs of soft failures (e.g., unjamming equipment).

3.3.3 CCTV Operators

Within the RCC, CCTV operators will have responsibility for responding to all patron assistance requests at unattended Metro Rail stations, as well as for visually monitoring equipment and station activity via CCTVs. Although CCTV operators are not physically located at stations, they are responsible for direct communications with patrons and, as such, are included in this section. Additional RCC personnel are discussed in Chapter 5. CCTV operators functions will include the following:

- Answering calls made from rail station passenger assistance intercoms
- Reading encoded information on tickets inserted in ticket readers
- Taking information for mailing of patron claims forms when necessary
- Placing fare collection equipment into or out of service by remote control or transmitting some other command
- Interfacing with the RCC communications controller in cases of equipment failure reported by patrons
- Monitoring CCTVs to observe station equipment and station activity
- Notifying transit police dispatcher of security problems.

3.3.4 Transit Police

Transit police will be responsible for patrolling the entire SCRTD system and will have full police powers. Their responsibilities related to the Metro Rail fare collection system will include:

- Apprehending fare evaders (fare compliance team)
  - Issuing citations to gate jumpers and persons with invalid media
  - Arresting habitual fare evaders for whom warrants have been issued
- Apprehending vandals (foot patrol)--arresting persons found vandalizing fare collection equipment.

3.3.5 Fare Collection Personnel on Other Modes

Bus drivers and LRT fare inspectors will interface directly with Metro Rail patrons continuing trips on these other modes.

Bus drivers will be responsible for capturing rail tickets with transfers (and for collecting any required distance-step fares on express bus); for verifying the validity of all transfer tickets and monthly passes, and collecting additional fares as required; and for providing bus-to-bus transfers to patrons desiring such.

On the LRT system, roving fare inspectors will be responsible for:

- Inspecting patrons' proof-of-payment on-board LRT vehicles
- Capturing invalid fare media
- Issuing citations to fare evaders
- Notifying transit police when habitual fare evaders for whom warrants have been issued are encountered.

4.0 USE OF THE BASELINE METRO RAIL SYSTEM

4.0 USE OF THE BASELINE METRO RAIL SYSTEM

This chapter describes in detail the procedures whereby patrons will use the Metro Rail baseline fare collection system. It is organized within two major sections. First, procedures under normal operating conditions are described, and then procedures during equipment failures are addressed.

4.1 PROCEDURES UNDER NORMAL OPERATING CONDITIONS

The discussion on patron procedures under the Metro Rail baseline system is organized by trip type, as follows:

- Metro Rail only
- Metro Rail to bus
- Bus to Metro Rail
- Metro Rail to LRT
- LRT to Metro Rail.

In each case, the discussion focuses first on procedures for cash fare patrons, and then describes the procedures to be followed by passholders. Appendix D contains detailed step-by-step procedures for these types of trips, and also for trips not involving the Metro Rail System (e.g., bus only, LRT only). It should also be noted that references to information encoded and printed on media are made in order to describe the need for different patron procedures. For a comprehensive discussion of encoded/printed information, see Appendix C.

4.1.1 Metro Rail Only

Cash Fare Patrons

Patrons traveling a single trip on Metro Rail will purchase a ticket for the desired number of zones to be traveled.* To prevent fare abuse, Metro Rail station ticket vending machines (TVMs) will be programmed to vend tickets only at regular (full fare) rates. To purchase

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* Patrons will also select at time of purchase whether they wish to transfer to bus or to continue their trip to an LRT station, as described subsequently in Sections 4.1.2 and 4.1.4.

discount fare Metro Rail tickets, therefore, eligible patrons must go to an SCRTD service center or sales outlet where they will be required to present valid identification.

Regular fare patrons will use selection buttons on station TVMs to obtain the desired ticket. Since each TVM will automatically register the proper origin zone, patrons need only select the appropriate destination for their trips. The face of the TVM, as was shown in Exhibit 3-5, will incorporate a system destination button to enable patrons to choose either a Metro Rail or LRT destination,* and will also include four buttons for the following zone options:

- One zone
- Two zones
- Three zones
- Four or more zones.

A simplified system map, color-keyed to these buttons, will assist patrons in making the appropriate ticket selection. On a Metro Rail-only trip, a regular fare patron will simply need to select on the TVM the correct zone button for the desired trip, since the TVM will automatically register a Metro Rail destination unless the LRT system destination button is pressed. The patron will then pay the fare amount displayed by the TVM to receive the selected ticket.

Discount fare patrons making Metro Rail-only trips will similarly specify the number of zones to be traveled (and the rail system) when purchasing a ticket from the agent at the service center of sales outlet.

The number of zones and rail system will be encoded on a magnetic strip on the back of the ticket, and will also be printed on the face of the ticket. Because no date or time will be encoded when a ticket is issued, patrons may pre-purchase tickets for subsequent use.

When a patron making a Metro Rail-only trip enters the Metro Rail System, the entry fare gate will read the

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* Such a button is required because, as noted in Chapter 3, Metro Rail fare gates must print information on the face of tickets to LRT destinations, but will not print on the face of tickets to Metro Rail destinations. Tickets must therefore be encoded by the TVM with either a Metro Rail or an LRT destination code.

magnetic strip and will encode on the ticket (but not print) origin station information and the date and time of entry. After reading and encoding the ticket, the entry gate will return the ticket to the patron. The patron will then board a Metro Rail train, alight at the desired Metro Rail destination station, and insert the ticket in the fare gate to exit the system.

If the patron's Metro Rail trip has been beyond the zones for which the ticket is valid, the patron must pay the additional zone charges at an add fare machine before the fare gate will permit him or her to exit the system. Upon insertion of the ticket, the add fare machine will automatically calculate, and display for the patron, the additional fare the patron has incurred. After payment has been made, the AFM will re-encode the ticket to permit the patron to exit at that destination station.

The exit fare gates will capture all tickets for Metro Rail-only trips.

Passholders

Patrons making Metro Rail-only trips may use one of two types of monthly pass: the magnetically encoded bus/rail pass, or the magnetically encoded regional pass. Both regular and discount fare patrons must purchase their pass at an SCRTD service center or sales outlet. Discount fare passes will be color-coded.

When purchasing a bus/rail pass, patrons will specify the number of zones on Metro Rail that they wish to travel, choosing among one-, two-, or three-zone passes. (Patrons who wish to travel four or more zones will purchase a regional pass rather than a bus/rail pass, as noted below.) Bus/rail passes will be multi-zone passes; that is, they will be pre-encoded/pre-printed with the number of zones for which they are valid, rather than being limited to specific zone pairs (e.g., zone 1 to zone 3). This multi-zone concept provides greater convenience to the patron, and is easily accommodated by Metro Rail equipment.

A patron who has purchased a bus/rail pass will use it on Metro Rail in the same way a single-trip Metro Rail ticket is used. That is, the patron will insert the bus/rail pass into the fare gate to enter the system; retrieve the pass; board a Metro Rail train; alight at the desired destination station; upgrade the value of the pass at an add fare machine for a single trip beyond the zones for which the pass is valid; and insert the pass into the fare

gate to exit the system.* Exit fare gates will return passes to patrons for subsequent use during their month of validity.

Patrons wishing to regularly travel four or more zones on Metro Rail will purchase a regional pass. This four-zone criterion is based on the fare structure specified under the integrated bus/rail zone policy, which imposes a maximum fare equivalent to four zones of travel, and the pricing of passes will be set accordingly.

For Metro Rail-only trips, patrons will use regional passes in the same way as bus/rail passes, with the exception that the value of regional passes will never need to be upgraded since the passes are valid for systemwide use.

4.1.2 Metro Rail to Bus

Cash Fare Patrons

Cash fare patrons wishing to transfer to bus at the conclusion of their Metro Rail trips will purchase a transfer at the time they purchase their Metro Rail ticket. Regular fare patrons will select the "transfer to bus" button when they purchase their tickets from Metro Rail station TVMs. Discount fare patrons will request a ticket with transfer to bus when they purchase the ticket at an SCRTD service center/sales outlet. Tickets with transfers will be encoded as such, and a "T" will be printed on the ticket face, at the time the ticket is issued.

When a patron inserts into a Metro Rail entry gate a Metro Rail ticket with transfer, the fare gate will print on the face of the ticket, as well as encode on the magnetic strip, the station, date, and time at which the patron entered the system. This information as well as the "T" code noted above, must be imprinted on the face of tickets to enable bus drivers to recognize valid transfer media.

After retrieving the ticket from the entry fare gate, the patron will board a Metro Rail train to the desired destination station, and will insert the ticket in the fare gate to exit the system (first paying any additional zone increment charges at an add fare machine, if necessary.) Exit fare gates will return all Metro Rail tickets with transfers to patrons. The patron will surrender the ticket upon transferring to bus.

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* As noted in Chapter 3, patrons may upgrade their pass for a single trip at the TVM, but will find it more convenient to do so at the add fare machine after the trip is completed.

Metro Rail tickets with transfers have limitations on the time during which they remain valid for use on bus (e.g., 2 hours after the time printed on the face of the ticket). In addition, patrons will not be able to transfer at the origin station printed on the ticket. A patron may use a Metro Rail ticket with transfer on all local and limited local bus service without paying any additional fare. On express bus, a ticket with transfer will cover the base fare cost of the trip; patrons must pay the incremental fares for distance steps.

Passholders

Patrons regularly making combined Metro Rail/bus trips may purchase either a bus/rail pass, a bus/rail pass with express bus stamp, or a regional pass.

The magnetically encoded bus/rail pass will be valid not only for travel on a specified number of Metro Rail zones, as described in Section 4.1.1, but will also be valid for all travel on local or limited local buses during its month of validity. Holders of such passes will use the pass to enter/exit the Metro Rail System and will use the pass as a flash pass to transfer to local/limited local buses at the conclusion of the Metro Rail trip. The pass will also be valid for the base fare on express bus; bus/rail passholders transferring to express bus at the conclusion of the Metro Rail trip will show the pass to the bus driver and then pay the incremental fare for the express bus distance steps they desire to travel.

Patrons regularly combining Metro Rail and express bus trips may purchase a bus/rail pass plus an express bus stamp. The patron will select the number of express bus distance steps desired on the express bus stamp, as well as the number of Metro Rail zones desired on the bus/rail pass. The express bus stamp will be affixed to a supplemental card, since it cannot be affixed directly to the encoded bus/rail pass. When boarding an express bus, the patron must show the bus/rail pass, as well as the supplemental card with express bus stamp, to the bus driver.

Again, if a patron regularly travels four or more zones, he or she will purchase a regional pass rather than a bus/rail pass or bus/rail pass with express bus stamp. This pass will be valid for systemwide use.

4.1.3 Bus to Metro Rail

Cash Fare Patrons

Patrons originating their transit trips on bus and continuing on to Metro Rail will be required to pay the full fare on both modes. No bus-to-rail transfers are

provided under the baseline system because, as noted in previous chapters, bus-to-Metro Rail transfers would need to be magnetically encoded media, and the complexities inherent in the provision, distribution and use of such media impose significant administrative burdens and high costs and lessen patron convenience.

Passholders

As on Metro Rail-to-bus trips, patrons may use either a bus/rail pass, a bus/rail pass with express bus stamp, or a regional pass. See Section 4.1.2 for details.

4.1.4 Metro Rail to LRT

Cash Fare Patrons

Since the Metro Rail and LRT fare structures will be integrated, patrons originating their trips on Metro Rail and continuing on to an LRT destination will not pay any transfer charge, but will only pay the base fare plus applicable zone surcharges.

Regular fare patrons will purchase their Metro Rail tickets to LRT destinations at Metro Rail station TVMs. As previously illustrated in Exhibit 3-5, the station TVMs will incorporate a system destination button to enable patrons to choose LRT destinations (the TVM will default to Metro Rail destinations if this button is not selected), as well as zone option buttons. Regular fare patrons wishing to switch from Metro Rail to LRT will, at the TVM, select the "TO LRT" button, and will then choose the correct zone option button (1 zone, 2 zones, 3 zones, 4 or more zones), referring to the system map on the station TVM for assistance in selecting the correct zones of travel. (The patron will also press the "transfer to bus" button if he/she wishes to continue the transit trip on bus after exiting the LRT system.)

Discount fare patrons, who must purchase their Metro Rail tickets at SCRTD service centers or sales outlets, will specify the rail system destination (LRT) and the total number of zones they will be traveling on rail. The sales person at the service center/sales outlet will supply the appropriate pre-encoded ticket, which will be color coded.

At the time of issue, Metro Rail tickets to LRT destinations will be encoded with the number of zones and LRT destination information, and this information will also be printed on the face of the ticket.

When a patron inserts a Metro Rail ticket to an LRT destination into an entry fare gate, the fare gate will encode and print on the ticket the station, time, and date of entry. This information, coupled with the LRT zone designation printed on the ticket at the time of purchase will enable LRT fare inspectors to verify whether a patron holds valid media for the LRT trip being made.

The patron, after retrieving the ticket from the entry fare gate, will board a Metro Rail train to the 7th/Flower station. At that station, the patron will pass through the exit gate, which will return the ticket to the patron. He/she will then proceed to the LRT platform area and board an LRT train to the desired destination station. On board the LRT train, the patron will show the ticket, if requested, to an LRT fare inspector.

Passholders

Patrons regularly traveling from Metro Rail to an LRT destination station may use either a bus/rail pass with light rail stamp or a regional pass. If the patron is traveling less than four zones, a bus/rail pass with light rail stamp will be purchased. The number of Metro Rail zones will be specified on the magnetically encoded bus/rail pass; the specific LRT zones pairs (e.g., L1-L2) in which the patron will be traveling will be selected, and will be written on the stamp at the time of purchase. (The zone pairs must be specified on LRT to enable LRT fare inspectors to determine if valid trips are being made.) The light rail stamp will be affixed to a separate supplemental card, since it cannot be affixed directly to the magnetically encoded pass. On LRT, the patron must display both the pass and the light rail stamp to an LRT fare inspector, if requested. In the event that a patron wishes to travel beyond the zones specified on the light rail stamp, a separate ticket must be purchased for that trip.

If the patron regularly travels four or more zones, a regional pass should be obtained. This magnetically encoded pass will be used to enter and exit Metro Rail fare gate arrays, and will be shown as a flash pass on LRT. It will be valid for systemwide use.

4.1.5 LRT to Metro Rail

Cash Fare Patrons

Given the difference in fare media between Metro Rail and LRT, an interface mechanism is needed to enable patrons originating on LRT to enter and exit Metro Rail's automatic barrier system. The 7th/Flower station is the point of intersection between the two rail lines, and

under the baseline system will be configured much like other Metro Rail stations, in that the free area of the station will be separated from the paid area by a fare gate array. However, the station will also incorporate a dedicated corridor connecting the LRT platform area with the free area, and a station agent booth will be located within this corridor. The station's free area will include both Metro Rail and LRT station TVMs.

As noted previously LRT station TVMs will be like Metro Rail TVMs, incorporating a system destination button to enable patrons to select Metro Rail or LRT destinations (this will be a "TO Metro Rail" button; the TVM will default to LRT if no selection is made), as well as zone options and a system map color-coded to the travel zone buttons (1 zone, 2 zones, 3 zones, 4 or more zones.) The TVM will also incorporate a "transfer to bus" button, and a discount fare button. The latter will enable discount fare as well as regular fare patrons to purchase tickets at station TVMs.*

At station TVMs, patrons wishing to travel to a Metro Rail station will select the Metro Rail destination button, the appropriate zones of travel, and other options as appropriate (discount or regular fare, with or without transfer to bus). After payment of the fare amount displayed by the TVM, the patron will receive a printed ticket. Patrons will then board an LRT train, showing tickets to fare inspectors, if requested to do so, and will alight at the 7th/Flower station. There they will proceed to the station agent's booth, where they will exchange their printed tickets for a magnetically encoded Metro Rail exit card (valid only for the completion of that trip). The 7th/Flower station agent will have a ticket encoder and media stock to provide such exit cards. After obtaining their magnetically encoded media, patrons follow the same procedures as other Metro Rail patrons, using the exit card to enter the 7th/Flower fare gate array and to exit at the desired Metro Rail destination, and using add fare machines as necessary.

Passholders

Patrons regularly beginning transit trips on LRT and travelling to a Metro Rail destination may purchase either

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* This is possible because LRT is a proof-of-purchase system, with LRT fare inspectors verifying the validity of fare media. On LRT, discount fare passengers will show their tickets (encoded with a "2" to indicate fare category--see Chapter 2) and their photo discount fare I.D. cards, if requested.

a bus/rail pass with a light rail stamp or a regional pass. See Section 4.1.4 for details.

4.2 PROCEDURES DURING EQUIPMENT FAILURES

This section describes the procedures to be followed under the Metro Rail baseline fare collection system during equipment failures and other abnormal functions. The following situations are addressed:

- Fare media, bill, or coin jams
- Fare media rejection
- Ticket not printed
- Ticket lost by patron
- Hardware failure.

It should be noted that, in general, these procedures incorporate a philosophy on patron claims that requires acceptance of a patron's statement of loss in all cases that cannot be immediately verified, unless the patron is a known and repeated fare abuser. Moreover, Metro Rail station agents and CCTV operators will follow steps required to expedite the processing of patrons so that patrons experiencing a loss due to equipment malfunctions are not unnecessarily detained. If appropriate, a patron claim form will be completed in the event that money is claimed to be owed by SCRTD to the patron. One copy of the claim form will be received by the Claims Department and one copy by the patron. All settlements to patrons will be handled by mail.

When media are damaged or lost due to equipment malfunction and are required to complete the patron's journey, emergency media may be provided by the on-site station agent or a line supervisor dispatched by the Rail Control Center. Two kinds of emergency media will be available: (1) pre-encoded emergency exit cards which will allow a single exit at any Metro Rail station and which will be captured by the exit fare gate; and (2) emergency paper transfers which will permit a transfer to bus or travel on light rail. The emergency transfers will be accepted as valid media when the date, time, and destination (bus or an LRT destination zone) are printed and signed by a station agent/line supervisor on the face of the transfer.

4.2.1 Fare Media, Bill, or Coin Jams

In the event that fare media, bills, or coins jam in equipment at Metro Rail stations, patrons will notify he station agent, if one is available, or will notify the CCTV operator via the passenger assistance intercom. (In most instances, the communications controller will also receive an alarm indicating the equipment malfunction).

If a station agent is available, he or she will follow the procedures outlined below:

(1) Open the equipment and attempt to locate and retrieve the lost media or money.

(2) Test the equipment and, if the unit functions properly, restore the unit to service. If the unit does not function properly, or if it has failed several times, the agent will take the unit out of service, complete an equipment incident report, leave a copy of the report in the unit (for reference by the field technician), and communicate the failure to the communications controller.

(3) If the media or currency is retrieved and undamaged, the agent will instruct the patron to use another unit of equipment, unless the media has been intentionally altered, in which case the agent will ask the patron to wait until the proper personnel can be available and then request (out of the patron's hearing) that transit police be dispatched.

(4) If the media is located but not retrieved, or if the media is retrieved in damaged form, the agent will retain any damaged media and have the patron sign the media; allow the patron to enter through the service gate, provide emergency media for exit and completion of the trip, and/or simply allow the patron to exit through the service gate; provide the patron with a voucher for replacement media if the media was a monthly pass or other multi-ride media to be turned in at any service center.

(5) If the currency is located but not retrieved, the agent will follow the procedures listed below:

(a) If the loss is equal to or greater than the value of completing the journey, the agent will allow the patron to enter through the service gate, provide emergency media for exit and completion of the trip, and/or simply allow the patron to exit through the service gate; the agent will also complete a patron claim form to be signed by both the agent and patron if the loss exceeded the value of the trip.

(b) If the loss fell short of the value of the trip and the problem occurred at the TVM, the agent will request that the patron purchase a replacement ticket from another TVM and will complete a patron claim form for the lost currency.

(c) If the loss fell short of the value of the trip and the problem occurred at the add fare machine, the agent will allow the patron to exit through the service gate.

(6) If the media or currency is not located, the agent will use discretion in determining whether such a loss occurred:

(a) If the station control panel indicates no malfunction (and it is the first failure of the day) and the problem occurred at the patron's entry station, the agent will request that the patron purchase a replacement ticket and will complete a patron claim form.

(b) If the patron's claim is deemed justified based on equipment status indicators or prior failures, or in the case of any problem occurring at the patron's destination station, the agent will follow step 4 or step 5, as appropriate.

(c) If the patron is known to repeatedly claim losses, the agent will ask the patron for identification and will request the patron to wait until assistance can be provided, and then request that a transit police officer be dispatched. The patron may choose to retract his claim and purchase another ticket.

At Metro Rail stations, when no agent is available, the CCTV operator will assist the patron in an analagous manner. The status of equipment will be checked remotely and the equipment will be taken out of service if it is malfunctioning. At the earliest opportunity, a field technician will be dispatched by the communications controller, who will also be responsible for completing an equipment incident report.

Based on the operator's judgment concerning the validity of the patron's claim, appropriate steps will be followed. If the problem occurred at the entry station and there is no failure indication (and it is the first failure of the day), the operator will request that the

patron purchase a replacement and complete a patron claim form. For failures validated by indicators or prior malfunctions or for any problems at the destination station, fare gates will be opened remotely by CCTV operators to enable the patron to enter or exit the system (for patrons entering the system, fare gates will be opened subsequently at the patron's destination station); and patron claim information will be taken and a copy of the claim form will be mailed to the patron. If necessary, a station agent or line supervisor will be dispatched to supply the patron with emergency media. The patron may choose to purchase a replacement ticket rather than wait for the agent to arrive, in which case a patron claim form will be completed. In the case of jams for high-value media such as monthly passes, the patron will be instructed to wait until an agent can be dispatched to retrieve the media or provide a replacement voucher. In the event that the patron is known to repeatedly claim losses, the CCTV operator will ask the patron to identify him/herself and request that transit police be dispatched.

4.2.2 Fare Media Rejection

If a pass or ticket is rejected by a Metro Rail fare gate, the patron will notify a station agent, if one is available, or will use the passenger assistance intercom to contact the CCTV operator. If the media appears valid based on printed information, the patron will be instructed to insert the media into the station ticket reader at the passenger assistance center. If the fare medium appears to be correctly encoded and undamaged, the patron will be instructed to try to use the media in another fare gate. If this fails, the station agent will release the fare gate and supply emergency media, as needed. The agent will also test the gate and put it into or out of service, reporting the failure as necessary. If no agent is available, the CCTV operator will open the fare gate, and will dispatch personnel with emergency media if needed. The patron may choose to purchase a replacement ticket, in which case a claim form will be completed. A field technician will be dispatched by the communications controller to repair the fare gate at the earliest opportunity. Whenever equipment must be taken out of service, an equipment incident report will be completed by the station agent or the communications controller for reference by field technicians. In the event that the media has been altered, the patron will be asked to present identification and to wait until transit police can be dispatched.

4.2.3 Ticket Received Without Printed Information

If station TVMs or entry gates fail to print information, the patron will contact the station agent, if available, or the CCTV operator. The patron may be instructed to insert the ticket or transfer in the ticket reader to ensure that it is properly encoded. If the correct information is encoded, that status of the equipment will be diagnosed. If the equipment cannot be repaired immediately, it will be taken out of service, an equipment incident report will be completed, and a field technician will be dispatched to make repairs. The on-site station agent or a line supervisor dispatched to the station will supply emergency media and retain the problem media. The patron may choose not to wait until dispatched personnel arrive, in which case he may elect to purchase a replacement ticket or continue his journey and pay the full fare required to complete his journey. In such a case, a patron claim form will be completed by the CCTV operator.

Ticket Loss By Patron

If a patron has lost a ticket after entering the Metro Rail system, he or she will notify a station agent, if available, or the Rail Control Center. The agent or CCTV operator will release the fare gate to allow the patron to exit the system. If the ticket included a transfer to bus or to an LRT destination, the patron will be told that the full fare or a new ticket must be purchased. In cases of hardship, agents or CCTV operators may, at their discretion, provide an emergency transfer. If the patron is recognized as one who repeatedly claims ticket losses, he or she will be asked to show identification and the agent or operator will request that a transit police officer be dispatched.

4.2.4 Hardware Failure

Hardware failures may be detected by the communications controller who will monitor the status of equipment, by station agents or line supervisors, or by patrons. Generally, the equipment will take itself out of service and transmit diagnostic information directly to the Rail Control Center via the station control panel. The communications controller will enter into the computer an equipment incident report and dispatch field technicians. If a station agent or line supervisor detects a hardware failure, he or she will complete an equipment incident report and leave a copy of the report in the equipment unit. The agent will also communicate the incident to the communications controller by using the patron assistance intercom and asking the CCTV operator to transfer the call to the communications controller.

Once the field technician is dispatched, maintenance will be carried out through on-site repair or component change-out. The technician will receive additional troubleshooting information from the equipment incident report.

5.0 OPERATIONAL SUPPORT REQUIREMENTS

5.0 OPERATIONAL SUPPORT REQUIREMENTS

Previous chapters have described the equipment, personnel, and procedures required for patron use of the Metro Rail baseline fare collection system. This chapter discusses the equipment, personnel, and procedures needed to support the operation of the Metro Rail system. In identifying these general support requirements, it is assumed that Metro Rail is fully operational, and start-up requirements are therefore not addressed.

Support for the Metro Rail baseline fare collection system is required in five functional areas:

- Media and Revenue Processing--Requirements for media encoding and distribution; retrieving, processing, and replenishing media stock; and retrieving, processing, and replenishing cash.
- Central Control--Requirements for ensuring the smooth operation of the fare collection system; maintaining system software; and reporting, transmitting, and processing data.
- Maintenance--Requirements for ensuring the reliability and maintainability of fare collection equipment, including both preventive maintenance and troubleshooting.
- Security--Requirements for effective enforcement of fares; protection of SCRTD personnel and property required by the fare collection system; and internal security relating to media and cash handling.
- Public Information--Requirements for effectively communicating to the public how to use the fare collection system; for the public sale of fare media; and for handling customer complaints and refunding fares.

The following sections identify the requirements of the Metro Rail baseline fare collection system in each of these five areas.

5.1 MEDIA AND REVENUE PROCESSING*

Media and revenue processing requirements include the facilities, equipment, personnel, and procedures needed to support the distribution, storage, retrieval, and handling of fare media and revenues.

5.1.1 Facilities and Equipment

The following facilities and equipment are required for processing:

- Revenue processing facility
- Ticket encoding and storage facility
- Media supply
- Ticket encoders
- Revenue carts
- Armored trucks.

The SCRTD revenue processing facility at Division 2 currently processes bus revenues during a single work shift. It is expected that a second shift operating at the same facility will handle revenues from Metro Rail.

A ticket encoding and storage facility will be provided for media processing, and its functions will be integrated with SCRTD's current printed bus pass operations. All fare media will be stocked at and distributed from this facility, and a ticket encoder will be located within the facility for the pre-encoding of magnetic media. Although the precise location of this facility is currently the subject of discussion at SCRTD, the encoding operation will be integrated with the existing stockroom operation.

Revenue carts will transport revenue and media around Metro Rail stations and to SCRTD armored trucks. The armored trucks will transport revenue carts between the processing facilities and rail stations, service centers, and sales outlets. As is currently the case, a private armored truck service will be used to transport revenue from the central revenue processing facility to the bank.

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* Equipment and personnel requirements are based on SCRTD Metro Rail Project Preliminary Engineering, Revenue Processing Study (WBS 16 CAE 11), prepared by Booz, Allen & Hamilton, August 1983; revenue servicing procedures are based in part on Coin Recirculation Study (draft), prepared by H. A. Anderson Associates, April 1984.

5.1.2 Personnel

The personnel required for media and revenue processing include:

- Revenue collectors
- Security guards
- Revenue clerks and supervisors
- Media clerks and supervisors.

The revenue collectors will be responsible for distributing revenue and fare media to, and retrieving them from, Metro Rail station fare collection equipment and SCRTD service centers and sales outlets (media only). Revenue collectors will be accompanied by security guards during revenue and media pick-up/delivery trips.

At the revenue processing facility, revenue clerks will process the cash collected from Metro Rail. Their activities will be overseen by revenue supervisors. The facility will be manned by a security guard.

Media clerks will sort and package fare media, and pre-encode magnetic media, for distribution to service centers and sales outlets. Media supervisors will oversee the efforts of the media clerks. A security guard will be stationed at the ticket encoding and storage facility.

5.1.3 Procedures

Revenue servicing is assumed to be a closed system with coin recirculation. Recirculation allows the Susan B. Anthony dollars to be automatically returned from TVMs and AFMs to BCMs. Under a closed system, revenue and media stock are kept in secured containers during handling. A revenue crew, composed of two revenue collectors and two security guards, will be sent to each Metro Rail station during off-peak periods or during non-revenue service hours. One security guard will serve as the driver of the armored truck and will remain with the truck while the other guard will accompany the revenue collectors to service the station. The crew will be responsible for the following functions:

- Removing full secured bill stackers from bill changer machines and replacing them with empty stackers

- Emptying cash boxes from TVMs and add fare machines into the revenue cart money vault, and returning emptied boxes to equipment units

- Checking levels of change storage units and replenishing the supply if necessary

- Replenishing empty or near-empty ticket magazines of Metro Rail TVMs with blank ticket stock

- Removing ticket magazines with captured tickets from Metro Rail fare gates and emptying them in trash bags.

All cash box contents and full bill stackers will be secured within a money vault on a revenue cart. The cart will be pushed through the handicapped gate for access between the free and paid areas of Metro Rail stations. The revenue cart will be removed from Metro Rail stations by elevator or escalator and placed in the armored truck. Revenue crews will also collect revenues from SCRTD service centers. After servicing of Metro Rail stations and service centers is completed, the armored trucks will return to the central revenue processing facility, delivering the revenues to processing clerks.

The revenue collectors will also be responsible for distributing fare media to remote locations, as follows:

- Service centers and sales outlets--Magnetically pre-encoded Metro Rail discount fare tickets and magnetically pre-encoded passes (regular and discount fare).

- Rail Control Center*--Pre-printed emergency transfers; Metro Rail emergency exit cards; blank stock for Metro Rail exit tickets.

In all cases, unused, expired media will be retrieved by revenue collectors at the same time that new media are distributed. The frequency of media delivery to remote locations will in most cases be not more than once or twice a month.

The crew dispatcher at the RCC will distribute emergency transfers and emergency exit cards to regular Metro Rail station agents and line supervisors; the special station agent at 7th/Flower will be given blank Metro Rail exit card stock. At the end of each shift, unused stock will be returned to the staff security room at stations for subsequent use or for pick-up by revenue collectors.

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* The rail operations supervisor, located in the RCC facility, will oversee station agents and line supervisors. These personnel will be assigned by the crew dispatcher.

Servicing of service centers and sales outlets will involve the same procedures as are currently followed. At the service centers and sales outlets, unused stock will be stored in a safe along with collected revenues. Revenue crews will collect revenues from service centers; at sales outlets, revenues will be remitted to accounting on a regular basis in the form of a check, at which time a report of sales will also be submitted.

5.2 CENTRAL CONTROL

Central Control requirements include all equipment and personnel needed to support the functions of the fare collection system, including monitoring the status of the equipment; responding to abnormal conditions; maintaining the fare collection software; and reporting and retrieving data.

5.2.1 Facilities and Equipment

The Rail Control Center (RCC) will be the center of responsibility for monitoring the status of all fare collection equipment; for responding to equipment and patron problems; and for maintaining software and data transmission.

Within the RCC, consoles at communications controller and CCTV operator workstations will be equipped to enable operators to:

- Visually monitor fare collection equipment on CCTV screens (CCTV operators)
- Communicate with patrons (CCTV operators) and SCRTD personnel (communications controller)
- Remotely control fare collection equipment (CCTV operators and communications controller)
- Monitor the status of the equipment (communications controller)
- Dispatch field technicians (communications controller).

With regard to communications, CCTV operators housed in the CCTV room will communicate with Metro Rail patrons needing assistance via passenger assistance intercoms located at all rail stations. SCRTD personnel will communicate with the communications controller as follows: police will use radio transmitters; maintenance personnel will have phone jacks; and station agents and line supervisors will use the passenger assistance intercom (and the

call will be transferred by the CCTV operator) or the phone in the security staff room.

For emergency communications, emergency telephones will be located in stations, parking areas, and other SCRTD subsystem facilities to allow direct access to the RCC.

5.2.2 Personnel

Within the Rail Control Center, three categories of personnel will be required to support the fare collection system: CCTV operators, communications controller, and an RCC supervisor.

The CCTV operators will be responsible for monitoring CCTVs, providing patron assistance, and transmitting remote commands to fare collection equipment.

The communications controller will monitor the status of fare collection equipment and, if necessary, dispatch maintenance personnel.

The RCC supervisor will oversee the functions and personnel of the Rail Control Center. He will be responsible for interface with other units supporting the fare collection system, such as transit police and maintenance.

5.2.3 Procedures

The procedures followed by the RCC, in addition to routine observation of equipment status, largely relate to requirements during equipment failure, patron problems, and emergencies. These procedures have already been described in Chapter 4.

5.3 MAINTENANCE*

Maintenance requirements include equipment, personnel, and procedures needed to support both preventive maintenance and troubleshooting of fare collection equipment.

5.3.1 Facilities and Equipment

An equipment maintenance shop, located in the downtown Central Maintenance Facility, will be provided for the repair, overhaul, and testing of all fare collection

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* Maintenance procedures are based on "Fare Collection System Maintenance Philosophy" (draft), prepared by SCRTD, April 1984.

equipment and new components. The shop will contain work benches, tools, materials, and supervisory offices.

Test equipment will be available to supplement diagnostics for troubleshooting and for adjustment and alignment procedures. An inventory of spare components for on-site component change-outs and for major repairs at the maintenance facility will also be maintained.

5.3.2 Personnel

The maintenance requirements of the fare collection system will be primarily the responsibility of field technicians, who will be dispatched by the communications controller to carry out on-site repair of equipment and component change-outs. Within the equipment maintenance shop, shop technicians will be responsible for testing and overhauling components, testing new components, etc. The efforts of all maintenance technicians will be directed by maintenance supervisors who will schedule and assign shop repairs as well as preventive maintenance by field technicians.

5.3.3 Procedures

The maintenance policies and procedures to be followed will make maximum use of the centralized failure alarm reporting system. Equipment failures, both soft and hard, will be reported to the RCC via the station control panel. In the case of soft failures, station agents (if available) will be responsible for correcting the problem. If an agent is not available or if a hard failure occurs, the RCC communications controller will dispatch a field technician at the earliest opportunity.

Based on the equipment incident report completed at the time the failure is first reported, the field technician will bring the appropriate repair equipment to the station. If the repair requires access to revenue secure areas in TVMs, AFMs, or BCMs, the communications controller will also arrange for a security guard to be present at the station and, if necessary, to accompany the field technician on his return to the shop. At the station, the technician will receive additional troubleshooting information from portable diagnostic equipment. The technician will perform a component change-out and bring the component back to the shop for repair.

Preventive maintenance will be performed according to the policies established for parts replacement and light maintenance (cleaning and inspection), and will be handled by field technicians during off-peak times according to a predetermined maintenance schedule.

5.4 SECURITY*

The fare collection system's requirements for support in the area of security include fare enforcement requirements, protection of fare collection equipment from vandalism, and the provision of internal security for revenue and media and processing personnel.

5.4.1 Facilities and Equipment

A Police Command Center will be the focal point for system security, and will be co-located with the Rail Control Center facility to allow maximum interaction between the two units. The equipment contained in the Command Center will include the following:

- A two-position transit police dispatcher console will be provided for police dispatch operations.
- A crime information printer will be used to obtain crime data accessed from central state police data banks as well as from SCRTD records.

In addition, a glass-enclosed watch commander's office will be located within the Police Command Center.

5.4.2 Personnel

A watch commander will be the ranking officer on duty at the Police Command Center, and will be responsible for all transit police activities during his shift.

Police dispatchers at the dispatcher console will be responsible for deploying police in response to calls or requests from the RCC or from the Bus Dispatch Center.

Transit police will be responsible for policing the entire SCRTD system. Police assigned to the fare compliance team will be responsible for issuing citations to fare evaders and for apprehending habitual fare evaders. Police assigned to foot patrol will rove the system and respond to calls for police presence received from the police dispatcher.

Security guards will be assigned to security duty at revenue and media handling facilities and sent on revenue collection rounds, as well as be present when field

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* Security requirements based on SCRTD Metro Rail Project, Security Policies Recommendations Study, prepared for the Security Subcommittee by Booz, Allen & Hamilton, December 1983.

technicians require access to revenue secure areas of equipment.

5.4.3 Procedures

The policies and procedures to be followed in support of fare collection system security relate to three areas:

- Fare collection equipment vandalism
- Fare evasion
- Revenue processing internal security.

Equipment Vandalism

The Police Command Center will be notified by the RCC communications controller of any violation of fare collection equipment. CCTV operators will also relay pertinent information to the watch commander. If necessary, police will be dispatched to the scene. Dispatched police will also be responsible for ensuring that the alarm system is reset and in proper working order.

Fare Evasion

Plainclothes transit police will be assigned to the Metro Rail fare compliance team and be responsible for issuing citations to fare evaders. A record of fare evaders will be maintained by the transit police so that habitual evaders may be prosecuted or have appropriate action taken against them as permitted by law. A list of these persons will be distributed to all fare compliance personnel.

In the case of remote detection of fare evasion, a member of the transit police will be dispatched to try to apprehend the evader. SCRTD may also consider having operators address gate jumpers via the public address system when evasion is detected on CCTVs.

Internal Revenue Security

The policies concerning internal security for the revenue processing function will be essentially the same as those currently followed, as amended by the findings of the Security Policies Recommendations Study. Major policies include the following:

- Fare collection and counting equipment will be designed to permit regular crosschecks of tickets dispensed against revenue counted and deposited.

- SCRTD will conduct background checks on police officers, security guards, and any employee with access to revenue and media.

- Keys to revenue equipment or processing areas will be electronic card keys and will be kept in a locked safe operable only by police and revenue department joint action.

Additional detail on policies and procedures is provided in the Security Policies Recommendations Study.

5.5 PUBLIC INFORMATION

This section identifies the equipment, personnel, and procedures needed to present information to patrons on the use of Metro Rail fare collection equipment and on fare collection policies and procedures. To the extent that passenger assistance by RCC personnel and station agents has already been addressed, these functions will not be described here.

5.5.1 Facilities and Equipment

This section discusses public information centers and materials required under the baseline system.

Information Centers

The central SCRTD information office will have a telephone center where operators will receive calls from the public.

Ten SCRTD service centers, located throughout the metropolitan area, will serve as information centers and media sales outlets. Each center will have the full complement of SCRTD information materials, including system maps and schedule and fare information. Instructions for using fare collection equipment will be provided in a multi-lingual brochure.

Sales outlets (approximately 240 located throughout the metropolitan area) are basically restricted to the sale of media and therefore may only provide information on the types of tickets and passes available, and on their prices.

Each Metro Rail station will have a station information center where information materials will be displayed, including schedules, fare information, and fare collection equipment instructions.

A public address system will also be required on board vehicles to allow operators to make announcements. In support of the fare collection system, operators will make an announcement when pulling into the 7th/Flower station advising patrons on the requirements for transferring between Metro Rail and LRT.

Information Materials

At SCRTD service centers and at each rail station ticket vending area there will be a large system map made of tamper-resistant material. The map will indicate all Metro Rail and LRT stations and fare zones, as well as major feeder bus routes. These maps will be clearly visible from the ticket vending machines to assist patrons in determining their destination station. A schematic of the rail line may also be provided on the face of TVMs. Smaller system maps will be located in rail vehicles. All maps will be designed to assist the visually impaired by the use of such elements as upper and lower case letters, raised letters, and light print on dark background.

At service centers and at displays within rail stations, printed information pamphlets will be available to provide instructions on how to use fare collection equipment, and to provide information on the fare structure and the transit system in general. The pamphlets will provide translations in at least Spanish and perhaps several additional languages.

Adjacent to the passenger assistance intercoms in all rail stations, wall-mounted printed instructions will indicate the step-by-step sequence for using fare collection equipment. The instructions will be given in English and Spanish, and graphic symbols will be used to clarify the instructions. The lettering will also be designed to facilitate use by the visually impaired. It may be advisable to have at least one passenger assistance intercom in each station fitted with a TTY device for use by deaf patrons.

The lettering on ticket vending machines, add fare machines, bill changer machines, and passenger assistance intercoms will be in English and Spanish, and will be designed to assist the visually impaired. The face plates of all machines will be standardized to facilitate their use by the visually impaired. The electronic message displays at all equipment (including fare gates) will be in English only.

Signage in stations will be provided to indicate the location of platforms, fare gates, escalators, elevators, emergency exits, emergency telephones, and fare collection equipment. Tactile strips will be provided along platforms and in station areas to assist blind patrons.

Signs indicating that patrons must have valid fare media to enter and exit the Metro Rail paid area will also be provided. At the 7th/Flower station, special signage will be installed to help patrons transferring between Metro Rail and LRT. Signs will be in English and Spanish and will be designed to assist the visually impaired. All signage will include, to the extent possible, graphics to assist non-English and non-Spanish speaking persons.

5.5.2 Personnel

Telephone operators and supervisors, and information and sales agents, will be required to support the information requirements of the Metro Rail baseline system.

The telephone operators will be responsible for handling all in-coming calls and providing system information.

The telephone supervisors will be responsible for day-to-day supervision of the telephone center. The supervisor will be responsible for interfacing with other units of SCRTD having responsibility for responding to passenger complaints and for scheduling, fare, and promotional decisions.

Information and sales agents will staff SCRTD service centers and will be responsible for providing system information and for selling media not available at ticket vending machines.

The personnel described above will be supported by station agents and RCC staff who provide patron assistance, and by employees of sales outlets who sell fare media for SCRTD on a commission basis.

5.5.3 Procedures

Telephone operators will respond to all information calls, or will fill out and forward reports to appropriate Operations Department personnel for follow-up. Telephone reports will identify the nature of the call, the patron's name and telephone number, and the date and time the call was received.

All information personnel will be responsible for explaining and following SCRTD's guidelines for settling claims in the case of lost or stolen media. Claim forms will be available directly from SCRTD information and sales personnel, station agents, or may be sent by mail by CCTV operators. Claim settlements will be handled by the SCRTD Accounting Department located in the Main Office. The policy will be clearly explained on all printed pamphlets containing fare information.

Applications for discount fare identification (I.D.) cards will be available at the SCRTD Main Office. Senior Citizen fare I.D. cards may be obtained at service centers, while handicapped I.D. cards will be processed only at the Main Office.

6.0 SUMMARY AND EVALUATION

6.0 SUMMARY AND EVALUATION

The preceding chapters have described the currently recommended Metro Rail baseline fare collection system and its requirements for interface with other Metro Rail operations and with the bus and planned light rail fare collection systems. The primary focus of this report has been to provide a detailed description of the physical elements of the Metro Rail fare collection system--fare media, station equipment, and fare collection system personnel--and of the way in which Metro Rail patrons will interact with the fare collection system. Also addressed, though in less detail, are the requirements for operational support of the fare collection system.

This final chapter presents an evaluation of the convenience to Metro Rail patrons of the fare collection system and then gives a more general summary of the system requirements on Metro Rail operations.

6.1 EVALUATION OF SYSTEM PATRON CONVENIENCE

Within the requirements specified for the baseline system, it is important to determine that the system as developed has specified procedures that are convenient to the greatest number of patrons. The distribution of patrons by media and trip types and fare categories is given in Appendix E.

The baseline system maximizes convenience for rail passholders. These patrons, typically regular and frequent riders, represent about 58 percent of all riders* and will generally be able to bypass TVMs and sales outlets. Patrons with prepurchased Metro Rail tickets making their return trip or traveling at a later date, about 10 percent of all patrons, may also bypass TVMs and sales outlets. Therefore, patron convenience is greatest for 68 percent, more than two-thirds, of all riders.

Of only slightly less convenience are the transactions of patrons purchasing tickets at TVMs when these

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* Includes patrons who may ride free without media such as children under 5 years.

tickets allow them to typically complete their trip with no additional fare or media transaction required. This includes regular fare patrons who are riding Metro Rail only (about 5 percent), or who are continuing from Metro Rail to bus (about 10 percent) or to LRT (less than 1 percent). Hence, another 15 percent of patrons encounter a relatively convenient trip.

The types of patrons who are most inconvenienced by the baseline are: discount fare Metro Rail patrons without pre-paid tickets (about 1 percent), regular fare bus-to-Metro Rail patrons without prepurchased tickets (about 15 percent); and patrons with printed tickets traveling from LRT to Metro Rail (0.3 percent). The first group must purchase tickets at off-site sales outlets, the second group must pay a cash fare upon boarding the bus and purchase a Metro Rail ticket from a TVM, and the third group must obtain encoded exchange tickets from the 7th/ Flower station attendant. These patrons together account for 17 percent of boardings.

In summary, the baseline system ensures that fully 83 percent of patrons are handled in the most convenient way possible, given the requirements of the system.

6.2 SUMMARY OF SYSTEMS REQUIREMENTS

The assessment of patron interactions given above demonstrates that the procedures developed for the baseline system are logical and effective within the requirements of the system. This section gives a more general assessment of the impacts on other operations/ systems required to support and/or interface with the fare collection system. These requirements are evaluated in terms of the following criteria based on the baseline system objectives:

- System integration
- Operational compatibility
- System administration.

These criteria are themselves correlated with the remaining policies (i.e., dependability, system expansion, and cost-effectiveness) adopted for the fare collection system, and therefore are indicative of the extent to which the baseline fulfills all system objectives.

One of the key aspects of the fare collection system is the degree of integration achieved within the overall multi-modal transit system. The baseline system maximizes integration from Metro Rail to bus and light rail lines. In terms of movements from LRT to Metro Rail, the interface procedures allow for the greatest integration given the different fare collection technologies adopted for

each system. Finally, the baseline system achieves partial integration from bus to rail in that rail passholders (i.e., patrons with bus/rail passes or bus-only passes with light rail stamps) may transfer in an uninterrupted fashion. For cash patrons no fare integration from bus to rail is provided because of the high costs imposed by such a system. However, as noted previously, of a limited share of riders (15 percent) are inconvenienced by this policy.

One of the major benefits of the baseline system is its compatibility with bus and rail operations. Despite the addition of two new, totally distinct rail lines to the existing SCRTD bus system, relatively minor burdens will be placed on bus operaters. While operators will be required to accept rail tickets with transfers to bus as well as combined rail/bus passes, enforcement of transfer restrictions and validation of passes will be facilitated by clear display of relevant information. Although rail operations such as media/revenue processing and control center and maintenance functions will need to be expanded because of the sophistication of the fare collection system, requirements are mitigated through simplification of the fare structure and media as well as through provision of trained station personnel and rationalization of procedures in the event of fare collection system failures.

The administrative requirements of any system are a function of its size and complexity but also of its interfaces with other systems. Because the fare collection system interfaces with the revenue processing, central control, maintenance, media sales and public information functions, a high level of coordination with other SCRTD operations will be necessary. However, the logistics involved in achieving this coordination are simplified through clearly defined responsibilities, procedures, and communications and reporting requirements.

In summary, the baseline Metro Rail fare collection system maximizes attainment of objectives adopted for the system without imposing undue burdens on any operational or administrative functions. Where extraordinary complexities resulted from policies initially imposed on the system, these requirements were relaxed in order to ensure that the system would be cost-effective, easy to administer, and compatible with bus and rail operations. The Metro Rail baseline fare collection system as developed therefore provides for effective and logical interfaces with other (planned and existing) SCRTD systems and with other Metro Rail operations, and at the same time, handles the large majority of patrons in the most convenient way possible.

APPENDIX A

BUS/RAIL INTEGRATION FARE POLICY
PRESENTATION TO SCRTD BOARD OF DIRECTORS

F. FARE POLICY AND EQUIPMENT

Introduction

During Preliminary Engineering, the Board of Directors adopted a barrier fare collection concept for the Metro Rail system. With this concept, each station would have fare gates capable of reading magnetically-encoded data on tickets and passes, thereby controlling patron entry and exit.

Development of the baseline fare collection system defined in Preliminary Engineering was guided by several objectives. Key among these were cost effectiveness, fare policy flexibility, system integration and compatibility, patron convenience and system reliability.

To meet the flexibility and integration objectives, the system was developed to accommodate a graduated (zone) fare structure on the rail system and to permit transferring between bus and rail by both cash fare and pass-holding patrons.

As work has progressed on system development, the operational complexities associated with the baseline definition have become better understood. Trade-offs among the system objectives have been evaluated, and the fare policy has been refined.

In order to permit design of the fare collection system to proceed on schedule, it is necessary that the fare policy be established. Therefore, the proposed fare policy is being presented to obtain Board consensus.

Description of Proposed Fare Policy

Because Metro Rail will be one of three modes of the SCRTD transit network, the TSD and Planning Departments have jointly prepared a proposed integrated fare policy for bus, heavy rail and light rail. Although system integration is one objective, the different types of fare collection systems on each mode makes this difficult to achieve. In addition to the barrier system of Metro Rail, the Los Angeles County Transportation Commission (LACTC) has adopted a European style, barrier-free concept for the light rail lines it is planning. This concept utilizes printed paper tickets and inspection of these tickets by fare inspectors to ensure that each patron has paid the valid fare.

The bus system operated by SCRTD utilizes on-board fare collection monitored by the driver upon entry. Because suitable technology is still years away, RTD buses cannot be outfitted with magnetic data reading equipment to fully integrate with Metro Rail.

The proposed integrated fare policy is presented in Exhibit 1, with associated fare elements, media and equipment itemized in Exhibit 2. Key points in this fare policy are discussed below:

- Fares will be composed of base fare and distance-based surcharges

  On all local and limited local bus service, only the base fare will be charged, as it is today. On express bus, heavy rail and light rail, a distance-based surcharge will be added to the base fare. A maximum cash fare level will be set.

  Analysis has shown that if only the base fare were charged on heavy rail, and the proposed distance-based surcharges were not, ridership would increase by 2%; however, annual revenue would decrease by 35%, with little offsetting savings in operating and maintenance costs.

- The heavy rail and light rail lines will be divided into fixed zones

  Distance-based fares are typically described by either a fixed zone with non-moving zone boundaries or a floating zone with zone boundaries differing for each trip origin. The fixed zone is the easier concept to understand and administer on a barrier/no-barrier rail system with a monthly pass.

  For design purposes, the number of zones will be limited to five on the 18-mile heavy rail line and six on the 23-mile light rail line. The number of zones will expand proportionally as the rail system grows. The maximum fare will be equivalent to a 4-zone trip.

- The fare system will continue to accommodate cash fares and monthly passes

  These fare types are currently in use and are most compatible with the three modal fare collection systems, using proven technology. Metro Rail design will not preclude the future potential of adopting a magnetically-encoded stored-value fare card, when technology makes this a proven, viable option for the bus system as well.

- Bus-only and Bus/Rail passes will be sold

  Because the new rail system will initially serve only a small percentage of existing SCRTD bus riders, it is impractical to issue every pass user an encoded bus/rail pass. Therefore, a printed pass good only for local and limited local bus service will still be offered.

  For travel on heavy rail, a pre-encoded bus/rail pass will be sold. Each pass will be good for travel in a specified number of zones. It will also be good for travel on local and limited local buses.

  For travel on express bus or light rail, monthly stamps will be sold, which must be shown with either a bus or bus/rail pass. The express bus stamp will be good for travel through a specified number of distance zones. The light rail stamp will be valid for travel between

a specified number of zones, with the zones to be traveled written on the stamp at time of purchase. Specifying the light rail zones to be traveled enables the fare inspector to verify that the pass/stamp is valid for the trip being made.

- Heavy rail and light rail fares will be integrated, with each ticket vendor accepting payment for all rail destinations

  For light rail-to-heavy rail trips, a cash patron will purchase a printed paper ticket for use on light rail, exchange it for an encoded ticket at 7th/Flower Street Station, and complete the trip on Metro Rail.

  For heavy rail-to-light rail trips, a patron will purchase an encoded ticket that is printed with the information necessary for use on light rail.

- Rail-to-bus transfers will be issued, but transferring from bus to rail will require payment of the full rail fare

  Bus-to-heavy-rail transfers would need to be centrally pre-encoded for each day and time period (a.m. and p.m.) and then distributed on a daily basis to bus drivers of each division. Analysis of the cost-effectiveness of this fare element has indicated that, while 23% of the heavy rail patrons might otherwise take advantage of the bus-to-rail transfer, without it actual ridership would drop by only 3%, and annual revenue would increase by 20%. Capital and operating and maintenance (O&M) costs would also be reduced, by 7% and 13%, respectively.

  Although bus-to-light rail transfers can be provided without requiring encoded media, the proposal not to provide them is based on the desire to coordinate heavy rail and light rail fare policy.

  Rail-to-bus transfers are easily accommodated by both heavy rail and light rail ticket vendors. When the desire to transfer to a bus is indicated, the pertinent transfer information is printed on the rail ticket.

- Discount cash-fare rail tickets will be sold by light rail ticket vendors for light rail trips and at sales outlets for heavy rail trips

  Heavy rail ticket vendors will sell only regular fare tickets. If they were to sell discount tickets as well, the photo IDs now used to verify discount-fare eligibility would need to be encoded and be readable by the ticket vendors or fare gates to ensure that only eligible patrons purchase and use them.

  Currently, only 13% of all discount fare trips are cash fares. The remainder are pass boardings.

Light rail ticket vendors will sell both regular and discount tickets because fare inspectors will verify that a patron is eligible for a discount fare. Furthermore, because light rail tickets will be validated for immediate use only, it is not practical to sell them off-site.

EXHIBIT 1

PROPOSED INTEGRATED FARE POLICY

1. Basic Policies

   (a) All local and limited local bus service will be accessible with payment of a flat fare;

   (b) All Special Service Bus service will be subject to individual pricing applicable to each service, as appropriate;

   (c) All other modes will be accessible with payment of a flat fare and additional surcharges determined as a function of distance travelled;

   (d) Although no off-peak discounts are included presently, this policy does not preclude this alternative in the future.

   (e) Fares for all fare classes other than Regular may be discounted by amounts which may vary by fare class (e.g. senior citizens, handicapped);

   (f) Distance-based surcharges may vary by mode and will not be discounted on the basis of fare class; and

   (g) Free fares available to designated riders may be subject to restrictions and require proper identification (e.g. District employees, blind, police).

2. Transfer Policies

   (a) Intramodal Transfers - Cash

   - All Bus-to-Bus transfers will be permitted with payment of a transfer surcharge and applicable distance-based surcharge, if any. Bus-to-Bus transfer media will expire after a prescribed time period, and will be subject to limitations on allowable directions of travel.

   - All Light Rail-to-Light Rail and Heavy Rail-to Heavy Rail transfers will be permitted with payment of only the applicable distance-based surcharges.

(b) Intramodal Transfers - Pass

- All intramodal transfers are permitted without payment of additional fees except applicable distance increments exceeding those provided for with the pass.

(c) Intermodal Transfers - Cash

- All transfers from Heavy Rail and Light Rail to bus will be permitted with payment of a transfer fee and applicable distance-based surcharges, if any.

- All transfers between Heavy Rail and Light Rail will be permitted with payment of applicable distance-based surcharges, if any.

- Transfers from bus to Heavy and Light Rail will require payment of the rail base fare and applicable distance-based surcharges, if any.

(d) Intermodal Transfers - Pass

- Bus/Rail pass transfers will be permitted at no additional cost between all modes except for the payment of distance increments exceeding those provided for with the pass.

- With a local bus pass, transfers to rail will not be permitted.

3. Method of Payment Policies

CASH

(a) All regular Heavy Rail fares and distance-based surcharges will be paid by means of magnetically encoded media purchased at point of entry.

(b) Cash in exact amount will be accepted for fare payment on all bus services;

(c) Discount Heavy Rail fares will be puchased only at RTD service centers.

(d) All Light Rail fares, including discount fares and distance-based-surcharges, will be paid by means of printed tickets purchased at point of entry;

(e) Transfers will be provided as preprinted paper media on all buses. Light Rail and Heavy Rail tickets will also be accepted as transfers when appropriate indication is displayed on the ticket. Transfers must be surrendered when used.

PASS

(f) Monthly local bus and bus/rail passes will be presold at designated outlets. Passes will be sold at a cost equal to a fixed multiple of the applicable base fare for each fare class, as appropriate, plus distance-based surcharges, if any.

(g) For riders using passes showing insufficient fare:

- when boarding a bus, a cash drop will be required;
- when exiting the paid area of a Heavy Rail station, additional fare must be purchased; and
- on Light Rail, no pass upgrade is available. User must purchase appropriate fare before entering the vehicle.

EXHIBIT 2

1. Fare Elements

Base fare -	Initial fare for boarding on bus or rail; allows travel on local bus or travel within one rail zone.
Bus-to-Bus Transfer -	Charge for transfer to a second bus within specified time interval and subject to route and directional restrictions. (Only one use per transfer permitted.)
Rail-to-Bus Transfer -	Charge for transfer from rail to bus within specified time interval.
Zone Increment -	Charge for crossing zone boundary on rail or for distance step on express bus.
Maximum Fare -	Base fare plus specified number of zone increments (excluding transfer charge).

2. Fare Categories

Regular -	Full fare.
Discount -	Senior and disabled citizens eligible for discount cash base fare and discount passes. (Fare reduction not applied to zone increment or transfer charges.)
Free -	Children under 5 years; RTD employees and dependents; RTD retired employees; RTD board members; and uniformed law enforcement employees.

3. Fare Media - (See conceptural illustrations attached to this exhibit.)

MRT Tickets -	Encoded regular or discount single-trip tickets from Metro Rail origin zone to Metro Rail or LRT destination zone, with or without transfer to bus. (Discount tickets will be color coded and sold only at sales outlets.)
LRT Tickets -	Printed regular or discount single-trip tickets from LRT origin zone to LRT or Metro Rail destination zone, with or without transfer to bus.
MRT Exit Cards -	Encoded by 7th/Flower station agent and exchanged for printed LRT ticket with Metro Rail destination zone.

Bus-to-Bus-Transfer - Printed transfer for boarding second bus.

Local Bus Pass - Printed regular or discount monthly pass valid for travel on local and limited local bus.

Bus/Rail Pass - Encoded regular or discount monthly pass valid for travel on given number of Metro Rail zones, and/or on local and limited local bus. (Discount-fare pass will be color coded.)

Light Rail Stamp - Printed regular or discount monthly stamp valid for travel on given number of LRT zones. Zone pairs to be traveled between must be written or stamped at time of purchase. Stamp must be shown with a valid bus or bus/rail pass.

Express Bus Stamp - Printed regular or discount monthly stamp valid for travel on given number of express bus distance steps. Stamp must be shown with a valid bus or bus/rail pass.

Regional Pass - Encoded regular or discount monthly pass valid for travel anywhere on RTD system. (Reduced-fare pass will be color coded.)

Discount Fare Permit - Printed photo permit used to allow eligible fare patrons to purchase discount Metro Rail tickets, bus and bus/rail passes and bus and rail stamps at sales outlets; also used as valid i.d. on bus for discount cash drop, and on LRT when presenting discount LRT ticket to inspector.

4. Media Sales

Metro Rail Ticket Vendors - Sell regular single-trip tickets.

Light Rail Ticket Vendors - Sell regular and discount single-trip tickets for date and time of purchase.

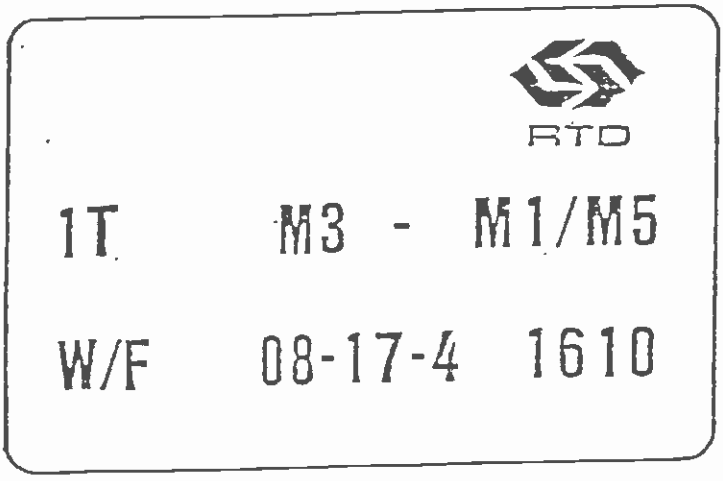
RTD Service Centers and Sales Outlets - Sell regular and discount monthly bus and bus/rail passes, and express bus and light rail stamps.

Sell discount Metro Rail tickets.

7th/Flower Station Agent - Exchanges encoded regular and discount tickets for printed regular and discount tickets for Light Rail-to-Metro Rail trips.

EXHIBIT 2

EXAMPLES OF TICKET MEDIA

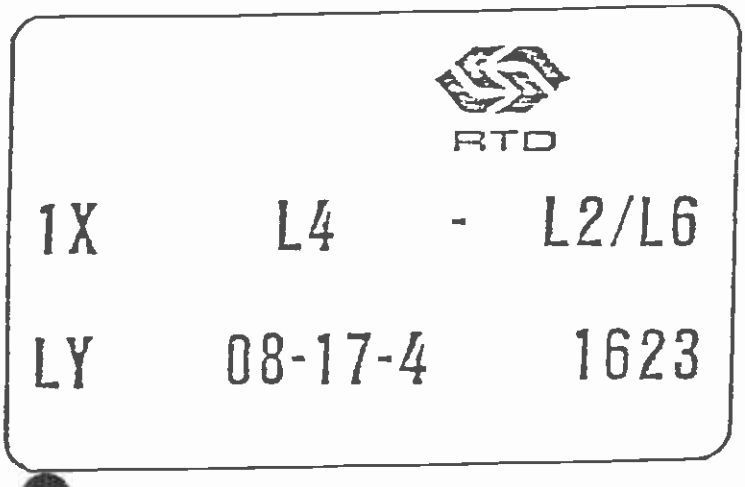


Single trip ticket from Metro Rail ticket vending machine (TVM) (encoded)

Top line printed by TVM

Bottom line transfer information printed by fare gate

Key:
1T: regular fare w/transfer to bus
M3: origin zone
M1/M5: two valid destination zones
W/F: station where trip began
08-17-4: date of use
1610: time of trip start

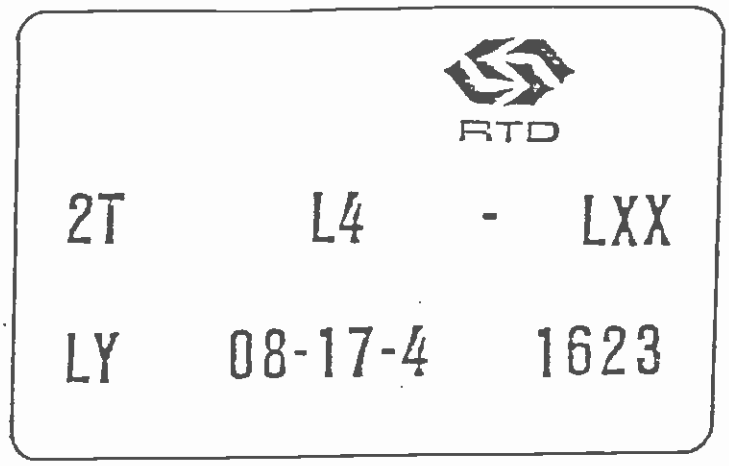


Single trip ticket from Light Rail TVM (printed)

Both lines printed by TVM

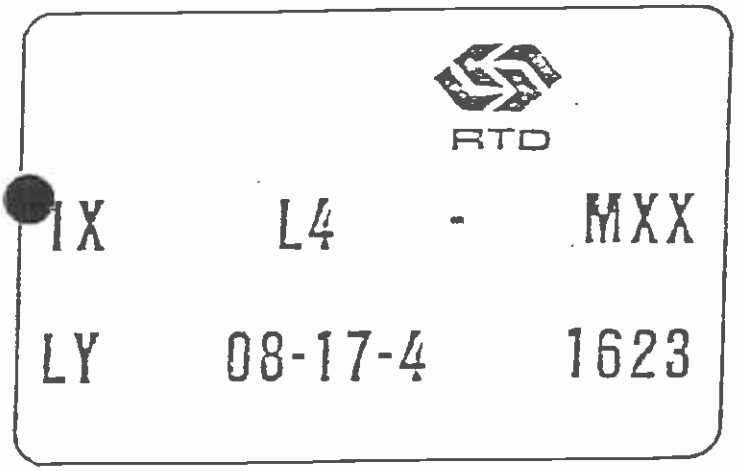
EXHIBIT 2

EXAMPLES OF TICKET MEDIA



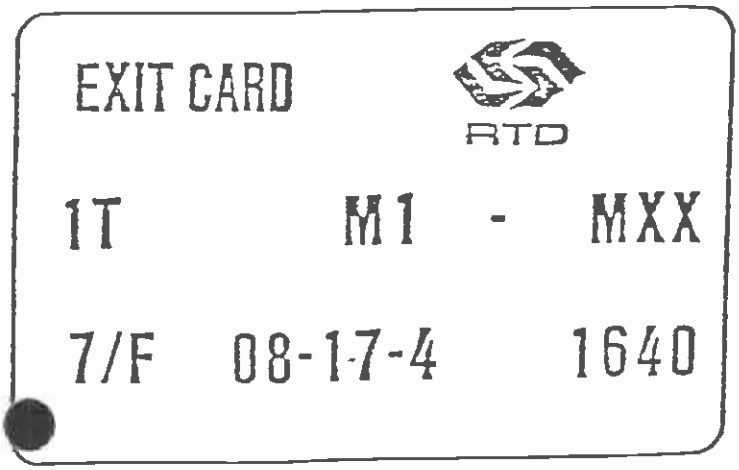
Single-trip ticket from Light Rail TVM (printed)
Key:

2T: discount fare w/transfer to bus
LXX: good to all light rail destinations



Single trip ticket from Light Rail TVM (printed)
Key:

1X: regular fare w/no transfer
MXX: good to all light rail and Metro Rail stations.

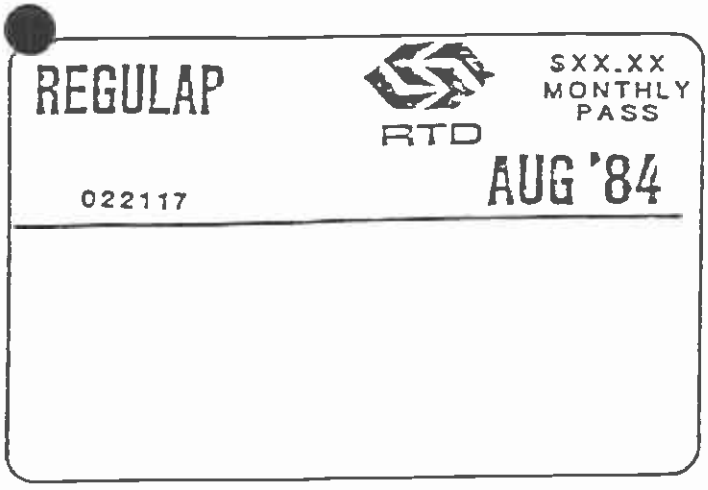


Exit-card issued by 7th/Flower station agent (encoded)
Key:

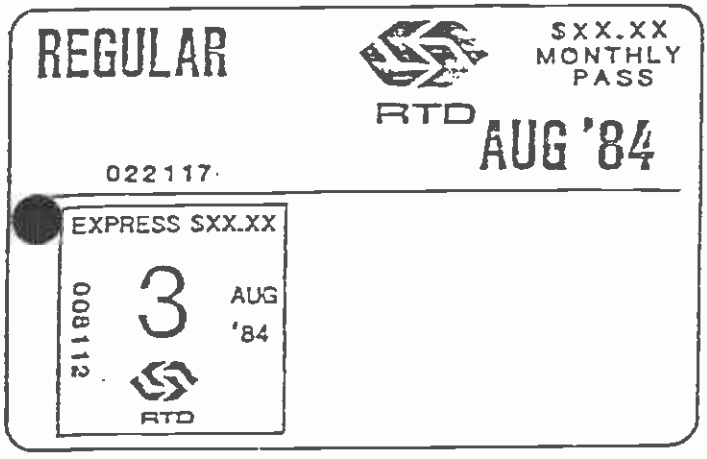
MXX: good to all Metro Rail stations

EXHIBIT 2

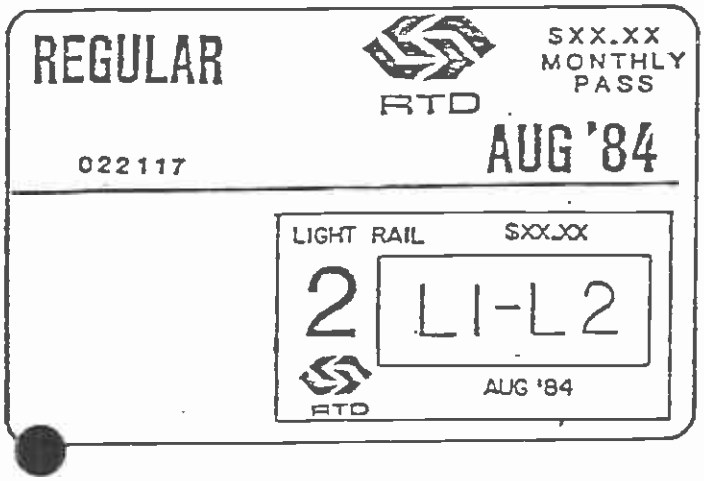
EXAMPLES OF PASS AND STAMP MEDIA



Monthly Pass good on all local and limited local bus service. (printed)



Monthly Pass same as above with stamp for express bus service. (printed)

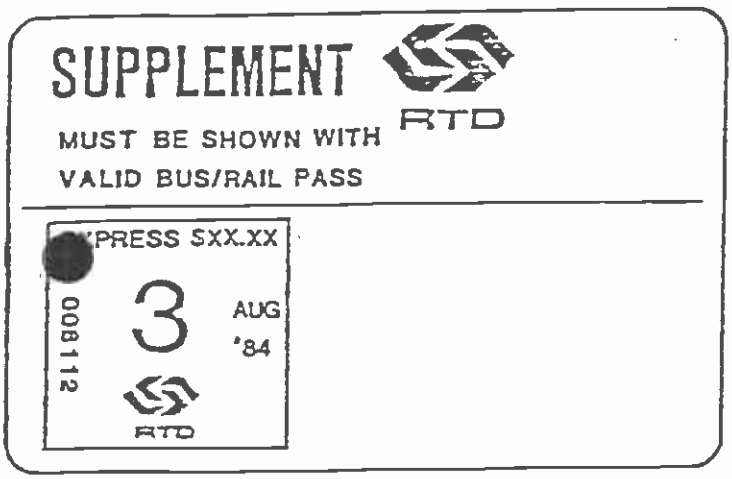


Monthly Pass same as above with stamp for light rail service. Zones are written on stamp at time of purchase. (printed)

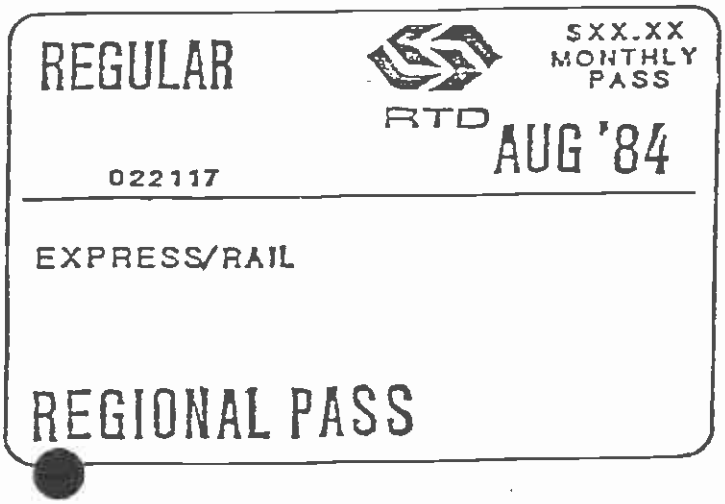
EXHIBIT 2

EXAMPLES OF PASS AND STAMP MEDIA

Monthly Bus/Rail Pass good on Metro Rail and all local and limited local bus service. (encoded)



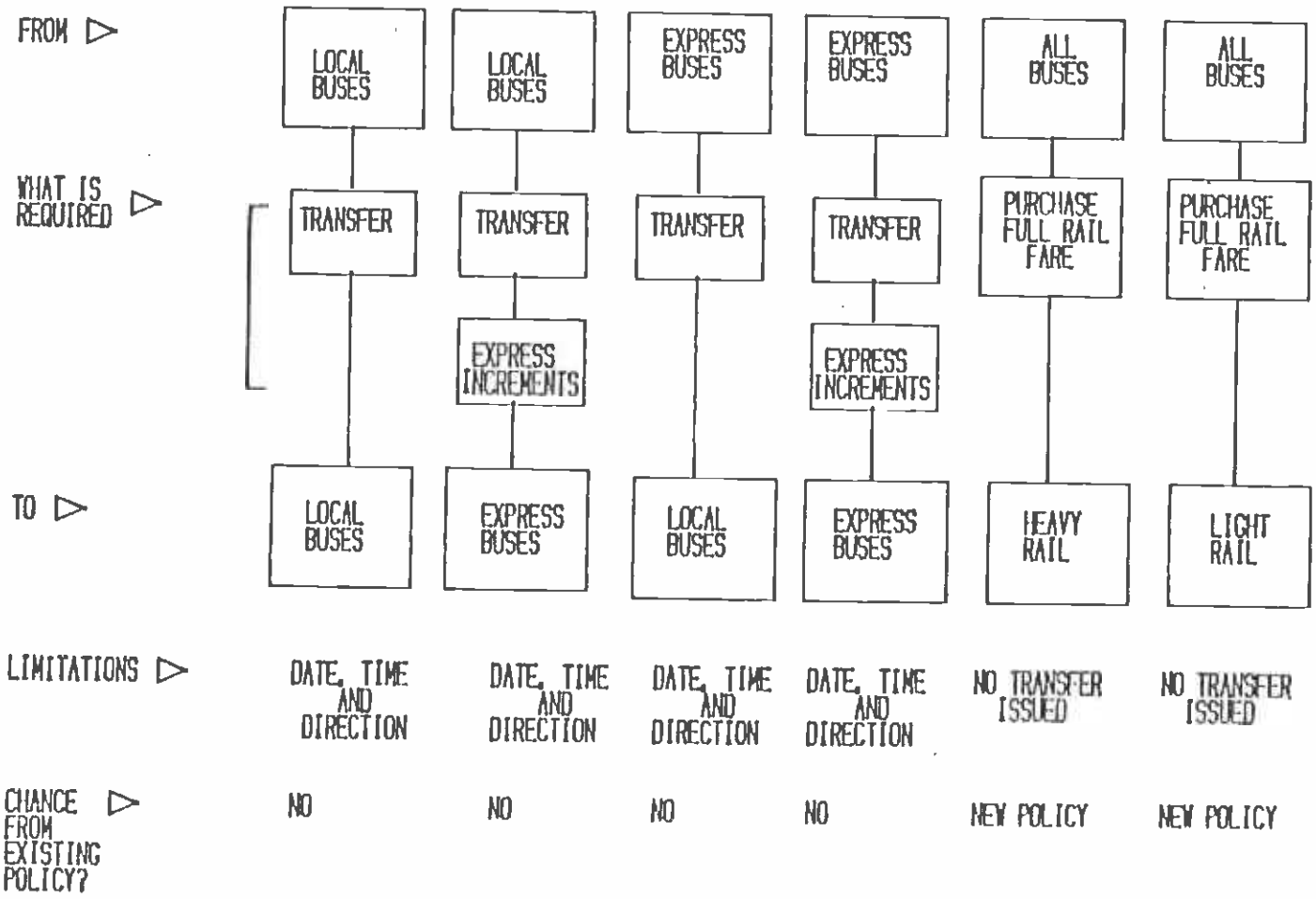
Supplement card (no value) with stamp for express bus service. Must be shown with bus/rail pass (stamps cannot be affixed to encoded media). Supplement card will also be used for light rail stamp, when purchased in conjunction with bus/rail pass. (printed)



Monthly Regional Pass good on all SCRTD service. (encoded)

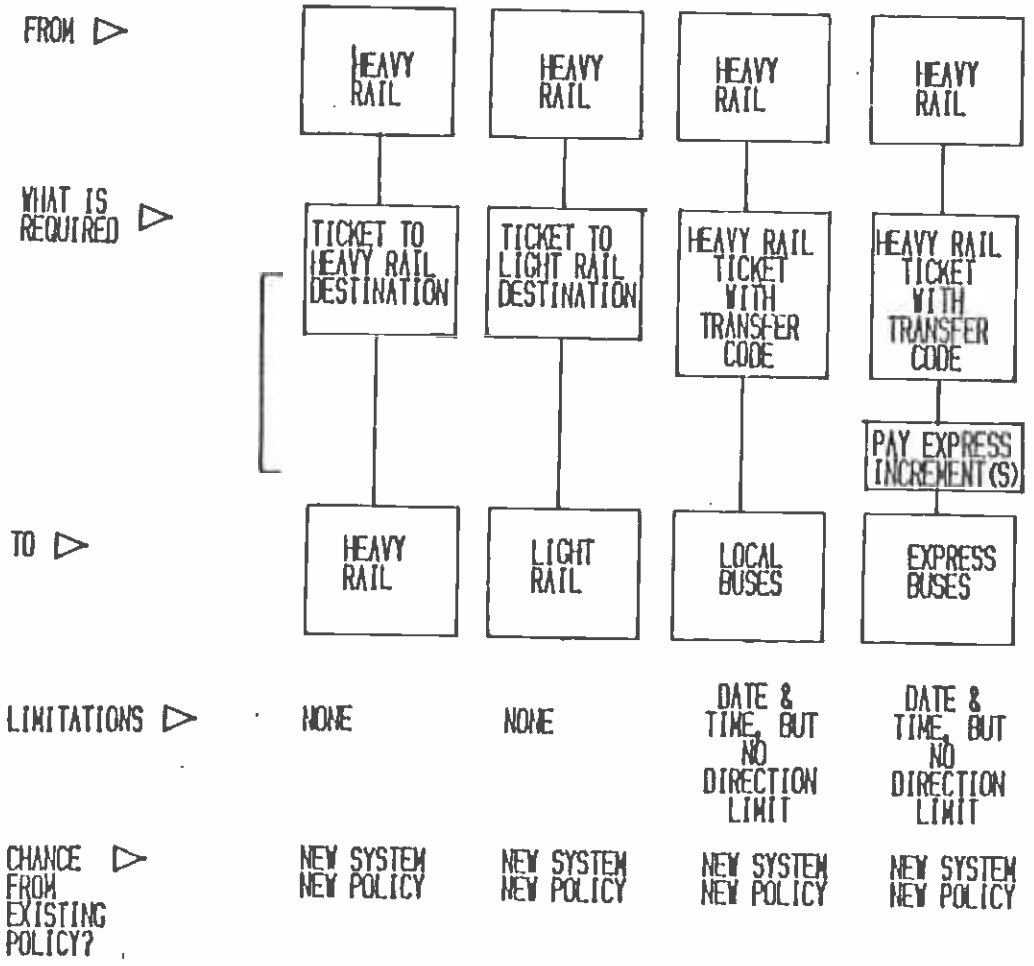
TRANSFER POLICY

FROM BUSES - CASH PAYMENT



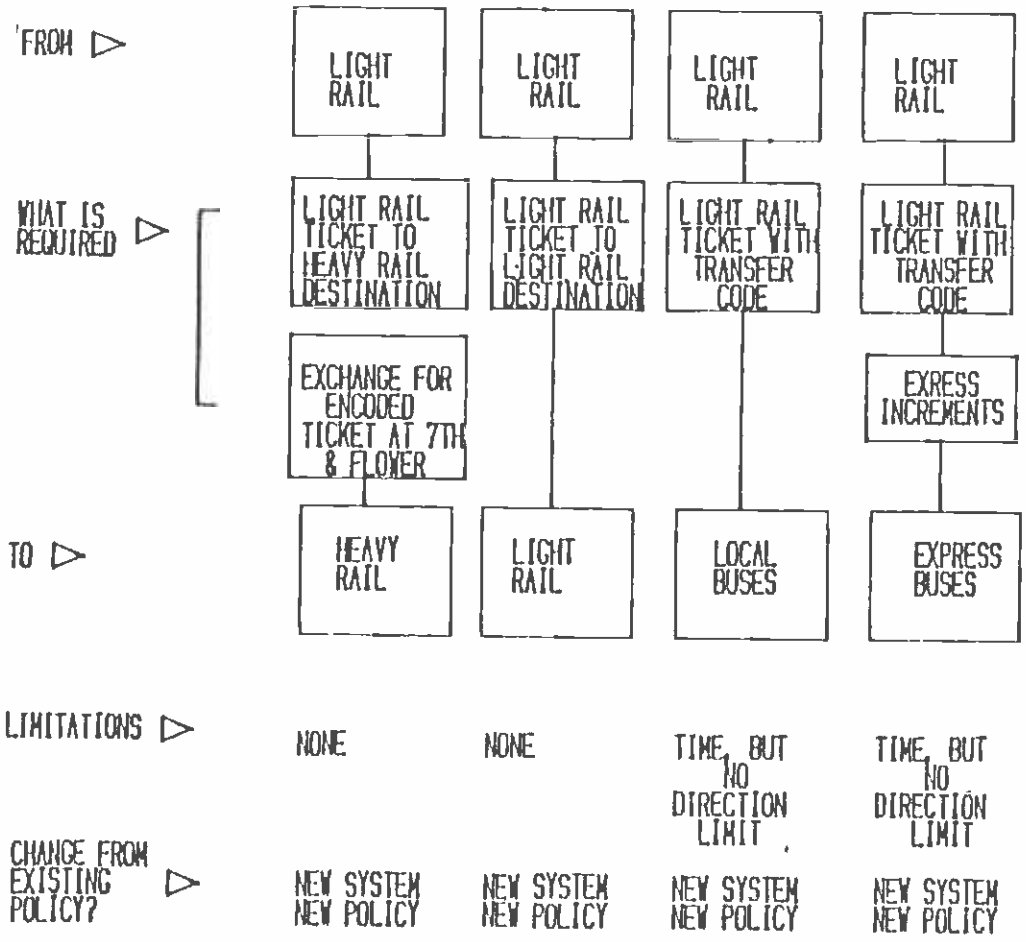
TRANSFER POLICY

FROM HEAVY RAIL – CASH PAYMENT



TRANSFER POLICY

FROM LIGHT RAIL - CASH PAYMENT



APPENDIX B

FARE COLLECTION SYSTEM ALTERNATIVES

FARE COLLECTION SYSTEM ALTERNATIVES

This appendix discusses the fare collection system alternatives which were considered during development of the baseline system. The alternatives all relate to differences in policies with respect to fare media and fare elements, and were considered separately from the broad fare policy alternatives which are addressed in the January 1985 Special Study.

The alternatives described below were suggested by a variety of sources including the practices of other transit properties, Metro Rail staff, and personnel from other SCRTD departments. Each of the alternatives is described and then reasons for their exclusion from the fare collection system for the initial 18-mile Metro Rail segment are discussed.

DESCRIPTION OF ALTERNATIVES

Five fare collection policy alternatives for the Metro Rail (MRT) and multi-modal fare collection systems were considered as follows:

- Round-trip rail tickets
- Discount fare MRT tickets vended at TVMs
- Fixed zone-pair MRT passes
- Rail (only) stored-value tickets
- Bus/rail stored-value tickets.

Each alternative is described in terms of primary impacts on media and fare collection equipment as shown in Exhibit B-1.

Round-trip tickets were considered because of the greater convenience to travelers and the potential savings associated with reduced equipment requirements. To vend round-trip tickets in addition to single-trip tickets would require differentiation by ticket type on both encoded and printed information. Encoded information would be required to enable MRT exit gates to return tickets required for the remaining trip. Printed information would be required for enforcement by bus drivers (in the case of rail tickets with transfer to bus) and by LRT fare inspectors.

EXHIBIT B-1
Fare Collection Policy Alternatives*

Alternative		Fare Media	Fare Collection Equipment
I	Round-trip tickets	MRT and LRT tickets designated for round-trip use	MRT and LRT TVMs vend round-trip tickets; MRT exit gates return tickets with trip remaining
II	TVM reduced fare MRT tickets	Pre-encoded reduced fare permits	MRT TVMs read permits and vend reduced fare tickets
III	Fixed zone-pair MRT passes	MRT passes pre-encoded for specified zone pairs	MRT TVMs upgrade origin and/or destination zones.
IV	Rail stored-value tickets	Pre-encoded rail tickets for multi-dollar denominations	LRT TVMs with magnetic encoders/readers.
V	Bus/rail stored-value tickets	Pre-encoded bus/rail tickets for multi-dollar denominations	LRT TVMs with magnetic encoders/readers; on-board bus encoders/readers.

* Alternatives are described in terms of primary changes to the baseline system.

The vending of discount fare MRT tickets at station TVMs would increase convenience to the occasional rider eligible for a discount fare, but would require pre-encoded discount fare permits. Upon insertion of these permits, the TVM would display the proper fare required based on the discount fare schedule. To control abuse of fare discounts, permits would require a magnetic strip on the back of a photo I.D. and would have time controls to limit the number of tickets purchased at one time.

The baseline system involves multi-zone passes on Metro Rail which permit travel for a given number of zones. The fixed zone-pair alternative would involve passes valid for travel between specified origin and destination zones, as is currently envisioned for the LRT stamp. This was considered because it would provide consistency with the light rail passes. Under this system, MRT TVMs would be required to have the capability to upgrade origin and/or destination zones (or, alternatively, to not permit upgrading of origin zones). Under the baseline, TVMs simply encode the number of valid zones rather than specific origin and destination zones, as would be required under the fixed zone-pair alternative.

Rail stored-value tickets were considered because of their greater revenue capture potential relative to monthly passes. These tickets would be offered as high value media for dollar denominations such as $10 or $20. As each trip is made, the value for that trip would be deducted. On MRT, the entry and exit gates would deduct the value automatically. Use of stored-value tickets on LRT would require LRT vendors with read/write capability so that the value of the trip "purchased" could be deducted from the stored-value ticket. The LRT TVMs would also need to provide patrons with a printed receipt for the trip for inspection by fare enforcement personnel.

Bus/rail stored-value tickets would operate in the same fashion as rail stored-value tickets on MRT and LRT but would also be used on bus. This would require on-board encoders/readers which would deduct the value of each bus trip taken. Systemwide equipment compatibility would also allow stored-value ticket holders to make bus-to-rail transfers at a reduced transfer charge, since the rail equipment could easily credit the base fare to passengers from feeder buses.

In the next section, the impacts of these alternatives on the objectives defined for the fare collection system are discussed.

EVALUATION OF ALTERNATIVES

The alternatives were evaluated in terms of the following criteria which reflect the objectives of the fare collection system:

- System integration
- Patron convenience
- Operational compatibility
- System dependability
- Cost-effectiveness
- Technological risk.

The discussion is organized by alternative so that each alternative may be compared singly to the baseline.

Alternative I

The first alternative, round-trip tickets, has the greatest impact on operational compatibility. The increase in possible media types increases significantly the burden on bus drivers. Patrons purchasing round-trip tickets with a transfer to bus would also use that ticket as a valid ticket for boarding the bus on the return trip. Hence, bus drivers would need to verify both MRT and LRT tickets and be required to return the tickets to the patron for future use on rail. Moreover, since rail tickets under the baseline show the zones of travel in both directions, a round-trip LRT ticket would become in essence a daily pass since LRT fare inspectors would have no means of knowing the direction of travel in which the originating trip was made. The alternative would be to vend uni-directional tickets, but this would require a far more complex ticket vendor.

The advantages of round-trip tickets lie in the areas of patron convenience and dependability. It is certainly more convenient for patrons to purchase a single round-trip ticket rather than two bi-directional single-trip tickets. Similarly, there are maintenance advantages associated with fewer transactions at the TVMs. However, these advantages are outweighed by the significant adverse impacts on operational compatibility. Hence, this alternative was excluded from the baseline fare collection system.

Alternative II

The sale of discount fare tickets at MRT TVMs has a slight positive impact on patron convenience, but large negative impacts on system dependability and cost. While this system would enhance the convenience to discount fare cash patrons, these patrons account for only 1% of total riders. The dependability of the equipment will be

negatively affected since the TVMs will need to read encoded IDs and will be more complex in that the discount fare schedule must be programmed in addition to regular fares. Moveover, the tickets will need to be encoded and printed as discount fare media for enforcement purposes. TVMs will also need to encode the transaction on the discount fare permit for control purposes. There will also be costs associated with providing discount fare patrons with encoded photo I.D.s. These costs include not only the cost of the I.D., but also the administrative costs associated with processing applications and annual renewals. These adverse impacts outweigh the benefit received by the very small proportion of riders, and therefore, this alternative was excluded from the baseline system definition.

Alternative III

The use of zone-to-zone MRT passes negatively impacts patron convenience, system dependability, and cost. Multi-zone passes provide the greatest convenience since any trip involving an equal number of or fewer zones can be made with the same pass. With fixed zone-pair passes, many more patrons will need to upgrade their pass for irregular trips, increasing the number of equipment failures. The number of types of passes to be pre-encoded will also be significantly greater, increasing costs associated with adminsitration of pass sales. In summary, the use of fixed zone-pair MRT passes has major disadvantages which outweigh the minor advantage associated with consistency with LRT passes, and therefore was rejected in favor of multi-zone passes.

Alternative IV

The primary advantages of rail stored-value tickets lie in the areas of system integration and convenience to patrons transferring from LRT to MRT. With compatible equipment on both rail systems, there will be no need for special interface procedures for patrons transferring from LRT to MRT. Moreover, stored-value tickets result in greater revenue capture relative to passes valid for unlimited rides. However, the more sophisticated LRT TVMs mean significantly higher capital and O&M costs as well as significantly reduced reliability. In addition, media costs will be higher since magnetically encoded stock is more expensive than paper stock. The rail media would also be inconsistent with bus media (i.e., passes), although the stored-value ticket itself could serve as a flash pass on bus. These disadvantages outweigh the improvements in convenience to the very small proportion (0.40 percent) of patrons transferring to MRT from LRT and in system integration, leading to rejection of this alternative.

Alternative V

Bus/rail stored-value tickets have the same impacts as the previous alternative and an additional set of impacts relating to their use on bus. First, on-board encoders/readers have not been proved in revenue service to date and therefore introduce a technological risk which is contrary to the requirement adopted for the Metro Rail project. Second, the cost of installing these devices on buses is quite high particularly in light of the large SCRTD bus fleet. Third, the maintainance requirements for such equipment would be considerable, adversely affecting bus operations as well as dependability. Fourth, the transaction time for deducting value would also negatively impact bus operations since each transaction involves considerably more time than flashing a pass. This also reflects the negative impact on patron convenience. While system integration would be improved since bus-to-rail transfers could be provided, it is expected that single-trip tickets would still be offered. Therefore, the integration would only be achieved for those patrons holding high value media, which is already the case for bus/rail pass holders.

It is clear from the impacts described above, that the disadvantages of this alternative far outweigh any benefit. Therefore, this alternative was excluded from the baseline system.

APPENDIX C

FARE MEDIA ENCODED AND PRINTED INFORMATION

FARE MEDIA ENCODED AND PRINTED INFORMATION

Information requirements for fare media are based on the fare collection equipment, the controls necessary to avoid misuse of media, and administrative requirements. In general, four types of information are required:

- Media Type--Media type information refers to the mode (bus, rail); type of media (single-trip ticket, pass); the fare category (regular, discount, free); transfer information (with or without transfer to bus); and peak or off-peak (if adopted).

- Trip Information--Trip information refers to the rail system destination, zones traveled on rail, and distance steps on express bus.

- Period of Validity--Period of validity includes date(s) and time for which the ticket, transfer, or pass is valid for use.

- Control Information--Control data include entry and exit codes for magnetically encoded media; restrictions on use such as passback control; and security controls. In order to maintain an audit trail for pre-encoded/pre-printed media, a serial number will be assigned to all these media.

A passback control will be provided by the entry/exit and time/date codes encoded by the fare gate to ensure that passes are not handed back to others. All encoded fare media will have valid entry and exit codes which will be initiated by TVMs and add fare machines and will be completed by entry and exit gates. In the case of certain employee passes, this passback control will be excluded to allow designated SCRTD personnel to use their passes for special visitors or to check fare gates.

All MRT tickets to be returned to the patron for use on LRT or bus will have the origin station, date, and time printed on the face of the ticket by the entry gate.

The information encoded and printed on each type of fare media under the baseline system is summarized in Exhibit C-1.

EXHIBIT C-1
Fare Media Information Requirements

Media	Encoded Information	Printed Information	How Encoded/ Printed
Magnetically Encoded Media			
Regular Fare MRT Single-Trip Ticket	Media type Rail system destination Number of zones Valid entry/exit code	Media type Zone to zones	TVM
	Origin station Date Time Entry code	Origin station Date Time (printed only on tickets with transfer to bus or to LRT station)	Entry fare gate
	Destination zone	—	AFM
	Exit code	—	Exit fare gate
Discount Fare MRT Single-Trip Ticket	Media type Rail system destination Number of zones Serial number Valid entry/exit code	Media type Zone to zones Serial number	Central ticket encoder; pre-printed
	Origin station Date Time Entry code	Origin station Date Time (printed only on ticket with transfer to bus or to LRT station)	Entry fare gate
	Destination zone	—	AFM
	Exit code	—	Exit fare gate

EXHIBIT C-1
Fare Media Information Requirements

Media	Encoded Information	Printed Information	How Encoded/ Printed
LRT-MRT Exit Card	Media type Number of zones Date Time Serial number Valid entry/exit code	Media type Zone to zones Date Time Serial number	7th/Flower station encoder
	Destination station	—	AFM
	Exit code	—	Exit fare gate
Monthly Encoded Passes (Bus/Rail Pass and Regional Pass)	Media type Number of zones Period of validity Serial number Valid entry/exit code	Media type Number of zones Period of validity Serial number	Central ticket encoder; pre-printed
	Number of zones*	—	TVM
	Origin station Date Time Entry code	—	Entry fare gate
	Number of zones*	—	AFM
	Destination station Date Time Exit code	—	Exit fare gate
MRT Emergency Exit Card	Media type Valid exit code Serial number	"Good for One Exit Only" Serial number	Central ticket encoder; pre-printed

* For upgrading value of pass on single trip; therefore applicable only to bus/rail pass, not to regional pass which is valid for systemwide travel.

EXHIBIT C-1
Fare Media Information Requirements

Media	Encoded Information	Printed Information	How Encoded/ Printed
Printed Media			
LRT Single-Trip Ticket (Regular and Discount Fare)	--	Zone to zone Media type Origin station Date Time	TVM
Light Rail Stamp	--	Media type Period of validity Number of zones Serial number	Pre-printed (specific zones of travel written in at time of purchase)
Express Bus Stamp	--	Media type Period of validity Number of distance steps Serial number	Pre-printed
Bus-Bus Transfer	--	Media type Serial number Date Time Route Direction	Pre-printed (Time, Route punched during bus run)
Emergency Transfer	--	Media type Serial number	Pre-printed
		Bus or LRT destination Date Time	Written on transfer by station agent or line supervisor at time of issue.

APPENDIX D

SEQUENCES OF PATRON INTERACTIONS WITH THE BASELINE FARE COLLECTION SYSTEM

SEQUENCES OF PATRON INTERACTIONS WITH THE BASELINE FARE COLLECTION SYSTEM

This appendix summarizes the step-by-step sequences patrons will follow in using the baseline fare collection system. To simplify the presentation, sequences are identified separately in Exhibit D-1 for the following trip types:

- Bus only
- Metro Rail (MRT) only
- LRT only
- Rail/rail (MRT/LRT)
- Bus/rail
- Rail/bus.

For each of these trip types, sequences are identified for ticketholders and for passholders, and for regular and discount fare patrons.

EXHIBIT D-1
Step-by-Step Interactions With
Baseline Fare Collection System

	Trip Type	Patron Type	Sequence
1.	Bus Only, Cash Fare	Regular and Discount Fare Patrons	(1) Board bus. (2) Pay, in cash or tokens, base fare on local bus and base fare plus distance step charges on express bus. [See note (a)] If traveling on local bus, skip step 3. (3) If traveling on express bus: • After paying fare, receive from bus driver a color-coded ticket to desired destination zone • Surrender ticket to driver when bus enters desired destination zone. (4) Alight at destination.
2.	Bus Only, Local Bus Pass	Regular and Discount Fare Patrons	(1) Purchase local bus pass from SCRTD Service Center sales outlet. (2) Board bus and show pass. If traveling on local bus, skip step 3. (3) On express bus, show pass and distance step charges, and then follow step 3 of trip type 1. (4) Alight at destination.
3.	Bus Only, Pass (Local Bus or Bus/ Rail) With Express Bus Stamp	Regular and Discount Fare Patrons	(1) Purchase pass with stamp for desired express bus distance steps from SCRTD service center/sales outlet.

	Trip Type	Patron Type	Sequence
			(2) Board bus and show pass and stamp (on separate supplement card if bus/rail pass was purchased). If traveling on local bus or within express bus distance steps for which express bus stamp is valid, skip step 3. (3) Follow step 3 of trip type 1. If traveling on express bus beyond distance steps for which stamp is valid, pay incremental charges. (4) Alight at destination.
4.	Bus Only, Regional Pass	Regular and Discount Fare Patrons	(1) Purchase regional pass from SCRTD sales outlet. (2) Board any bus and show pass. (3) Alight at destination.
5.	MRT Only, Single-Trip Tickets [See note (b)]	Regular Fare Patrons	(1) Obtain coins from bill changer machine (BCM), if necessary. (2) Go to ticket vending machine (TVM) and purchase magnetically encoded ticket: • Select travel zone (1, 2, 3, or 4 or more zones), using map on TVM for assistance • Insert displayed amount in U.S. coins • Retrieve ticket, and change if due (3) Insert ticket in entry gate. [See note (c)] (4) Enter turnstile; retrieve ticket. (5) Board train. (6) Alight at destination station.

	Trip Type	Patron Type	Sequence
			(7) If trip was beyond zone for which ticket is valid, go to add fare machine: • Insert ticket • Insert displayed amount in U.S. coins (obtain coins from BCM, if necessary) • Retrieve ticket, and change if due. (8) Insert ticket in exit gate. (9) Exit turnstile.
6.	MRT Only Single-Trip Tickets	Discount Fare Patrons	(1) Purchase magnetically pre-encoded ticket from SCRTD sales outlet. (2) Remaining steps same as trip type 5, steps 3 through 9.
7.	MRT Only, Bus/Rail Pass	Regular and Discount Fare Patrons	(1) Purchase magnetically pre-encoded bus/rail pass from SCRTD sales outlet, selecting desired number of Metro Rail travel zones (1, 2, or 3). (2) Insert pass in MRT entry gate. (3) Enter turnstile; retrieve pass. (4) Board train. (5) Alight at destination station. (6) If trip was beyond zones for which pass is valid, go to add fare machine: • Insert pass • Insert displayed amount in U.S. coins (obtain coins from BCM, if necessary) • Retrieve pass, and change if due. (7) Insert pass in exit gate. (8) Exit turnstile; retrieve pass.

	Trip Type	Patron Type	Sequence
8.	MRT Only, Regional Pass	Regular and Discount Fare Patron	(1) Purchase magnetically pre-encoded regional pass (if regularly traveling 4 or more zones) from SCRTD sales outlet. (2) Insert pass in MRT entry gate. (3) Board train. (4) Alight any Metro Rail destination station. (5) Insert pass in exit gate. (6) Exit turnstile; retrieve pass.
9.	LRT Only, Single-Trip Tickets	Regular and Discount Fare Patrons	(1) Obtain coins from BCM, if necessary. (2) Go to LRT TVM and purchase printed ticket: • Select travel zone (1, 2, 3, or 4 or more zones), using map on TVM for assistance • Select regular or discount fare • Insert displayed amount in U.S. coins • Retrieve ticket, and change if due. (3) Board train; show ticket to fare inspector, if requested. (4) Alight at station within ticketed destination zone.
10.	LRT Only, Pass (local bus only or bus/rail) with Light Rail Stamp	Regular and Discount Fare Patrons	(1) Purchase pass plus light rail stamp from SCRTD sales outlet, specifying LRT zones for which the stamp will be valid. (Stamp will be affixed to a separate supplement card if bus/rail pass is purchased).

Trip Type	Patron Type	Sequence
		(2) Board train; show pass and stamp to fare inspector, if requested. (3) Alight at destination station within LRT zone for which stamp is valid. [See note (d)]
11. LRT Only, Regional Pass	Regular and Discount Fare Patrons	(1) Purchase regional pass (if regularly traveling 4 or more zones) from SCRTD sales outlet. (2) Board LRT train, and show pass to fare inspector, if requested. (3) Alight at any LRT destination station.
12. MRT to LRT, Single-Trip Tickets	Regular and Discount Fare Patrons	(1) Purchase magnetically pre-encoded MRT ticket to LRT destination at SCRTD sales outlet if discount fare patron; if regular fare patron, purchase ticket at MRT station TVM: • Select "To LRT" button • Select travel zone (1, 2, 3, or 4 or more), using map on TVM for assistance • Insert displayed amount in U.S. coins (obtain coins from BCM, if necessary) • Retrieve ticket, and change if due. (2) Insert ticket in MRT entry gate. (3) Enter turnstile; retrieve ticket. (4) Board MRT train. (5) Alight at 7th/Flower station. (6) Insert ticket in exit gate. (7) Exit turnstile; retrieve ticket.

Trip Type	Patron Type	Sequence
		(8) Board LRT train; show ticket to fare inspector, if requested. (9) Alight at ticketed LRT destination station.
13. MRT to LRT, Bus/Rail Pass With Light Rail Stamp	Regular and Reduced Fare Patrons	(1) Purchase magnetically pre-encoded bus/rail pass from SCRTD sales outlet, selecting desired number of Metro Rail travel zones (1, 2, or 3) and selecting specific zones on light rail stamp. (Stamp will be affixed to a supplement card.) (2) Insert bus/rail pass in MRT entry gate. (3) Enter turnstile; retrieve pass. (4) Board MRT train. (5) Alight at 7th/Flower station. (6) If Metro Rail was beyond zones for which pass is valid, go to add fare machines: • Insert pass • Insert displayed amount in U.S. coins (obtain coins from BCM, if necessary) • Retreive pass, and change if due. (7) Insert pass in exit gate. (8) Exit turnstile; retrieve pass. (9) Board LRT train; show bus/rail pass and supplement card with light rail stamp to fare inspector, if requested. (10) Alight at LRT destination station.

	Trip Type	Patron Type	Sequence
14.	MRT to LRT, Regional Pass	Regular and Reduced Fare Patrons	(1) Purchase magnetically pre-encoded regional pass at SCRTD sales outlet. (2) Next steps same as trip type 13, steps 3 through 6 and steps 8 through 11, except read "regional pass" for "bus/rail pass and supplement card with light rail stamp."
15.	LRT to MRT, Single-Trip Tickets	Regular and Discount Fare Patrons	(1) Obtains coins from BCM, if necessary. (2) Go to LRT TVM and purchase ticket: • Select "To MRT" button • Select travel zones (1, 2, 3, 4 or more), using map on TVM for assistance • Select regular or discount fare • Insert amount displayed in U.S. coins • Retrieve ticket, and change if due. (3) Board LRT train; show ticket to fare inspector, if requested. (4) Alight train at 7th/Flower station. (5) Exchange printed tickets for magnetically encoded MRT exit card at 7th/Flower agent booth. (6) Insert card in entry gate. (7) Enter turnstile; retrieve card. (8) Board MRT train. (9) Alight at MRT destination station.

Trip Type	Patron Type	Sequence
		(10) If MRT trip was beyond zones for which card is valid, go to MRT add fare machine and upgrade value of card. See trip type 13, step 7, for sequence. (11) Insert card in exit gate. (12) Exit turnstile.
16. LRT to MRT, Bus/Rail Pass With Light Rail Stamp	Regular and Reduced Fare Patrons	(1) Purchase magnetically pre-encoded bus/rail pass at SCRTD sales outlet, specifying number of zones to be traveled on Metro Rail, and obtain light rail stamp, specifying specific zones on LRT. (Light rail stamp will be affixed to separate supplement card.) (2) Board LRT train; show bus/rail pass and supplement card with light rail stamp to fare inspector, if requested. (3) Alight at 7th/Flower station. (4) Insert bus/rail pass in MRT entry gate. (5) Enter turnstile; retrieve pass. (6) Board MRT train. (7) Alight at MRT destination station. (8) If Metro Rail trip was beyond zones for which bus/rail pass is valid, go to add fare machine and upgrade value. See trip type 13, step 7, for sequence. (9) Insert pass in exit gate. (10) Exit turnstile; retrieve pass.

	Trip Type	Patron Type	Sequence
17.	LRT to MRT, Regional Pass	Regular and Reduced Fare Patrons	(1) Purchase magnetically pre-encoded regional pass at SCRTD sales outlet. (2) Next steps same as trip type 16, steps 2 through 7 and steps 9 and 10, except read "regional pass" for "bus/rail pass and supplement card with light rail stamp."
18.	Bus to Rail (MRT or LRT)	Regular and Discount Fare Patrons	No transfer provisions. Follow procedures for bus-only trips, and then rail-only (MRT or LRT) trips.
19.	Bus to MRT, Bus/Rail Pass	Regular and Discount Fare Patrons	(1) Purchase magnetically pre-encoded bus/rail pass, specifying desired zones of travel on Metro Rail. (2) Follow trip type 2, steps 2 through 4, except read "bus/rail pass" for "local bus pass." (3) Follow trip type 7, steps 2 through 8.
20.	Bus to MRT, Regional Pass	Regular and Discount Fare Patrons	(1) Purchase magnetically pre-encoded regional pass from SCRTD sales outlet. (2) Board bus (local or express) and show pass. (3) Alight at destination. (4) Insert pass in MRT entry gate. (5) Enter turnstile; retrieve pass. (6) Board train. (7) Alight at any MRT destination station. (8) Insert pass in exit gate. (9) Exit turnstile; retrieve pass.

	Trip Type	Patron Type	Sequence
21.	Bus to LRT, Pass (Bus-only, or Bus/Rail) With Light Rail Stamp	Regular and Discount Fare Patrons	(1) Purchase pass plus light rail stamp from SCRTD sales outlet, specifying LRT zones for which this stamp will be valid. (Stamp will be affixed to a separate supplement card if bus/rail pass is purchased.) (2) Board bus and show pass and stamp. If travelling on local bus, skip step 3. (3) If travelling on express bus: • Pay incremental distance-step charges (pass is good for base fare) • Receive from driver a color-coded ticket to desired destination zone • Surrender ticket to driver when bus enters desired destination zone. (4) Alight at destination. (5) Board LRT train; show pass and light rail stamp to LRT fare inspector, if requested. (6) Alight at station destination within LRT zone for which pass is valid.
22.	Bus to LRT, Regional Pass	Regular and Discount Fare Patrons	(1) Follow trip type 20, steps 1 through 3. (2) Board LRT train; show pass to LRT fare inspection, if requested. (3) Alight at LRT destination station.

Trip Type	Patron Type	Sequence
23. MRT to Bus, Single-Trip Tickets	Regular and Discount Fare Patrons	(1) Purchase magnetically pre-encoded MRT ticket with transfer to bus at SCRTD sales outlet if discount fare patron; if regular fare patron, purchase magnetically encoded MRT ticket with transfer at station TVM: • Select destination (MRT or LRT) • Select travel zone (1, 2, 3, or 4 or more zones using map on TVM for assistance • Select transfer to bus • Insert displayed amount in U.S. coins (obtain coins from BCM, if necessary) • Retrieve ticket and change if due. (2) At conclusion of MRT trip (see trip type 5, steps 3 through 8, for MRT sequence), exit turnstile and retrieve ticket with transfer. (3) Board bus and surrender ticket with transfer to bus driver If traveling on local bus, skip step 4 and go to step 5. (4) If traveling on express bus: • Pay bus driver additional fare to desired bus destination zone and receive color-coded ticket • Surrender ticket to driver when bus enters destination zone. (5) Alight bus at destination.

	Trip Type	Patron Type	Sequence
24.	MRT to Bus, Bus/Rail Pass	Regular and Discount Fare Patrons	(1) Purchase magnetically pre-encoded bus/rail pass from SCRTD sales outlet, selecting desired number of Metro Rail travel zones (1, 2, or 3). (2) Follow trip type 7, steps 2 through 8. (3) Follow trip type 21, steps 2 through 4.
25.	MRT to Bus, Bus/Rail Pass with Express Bus Stamp	Regular and Discount Fare Patrons	(1) Purchase magnetically pre-encoded bus/rail pass from SCRTD sales outlet, specifying number of zones to be traveled on Metro Rail, and purchase express bus stamp, specifying number of distance steps. (Stamp will be affixed to Separate Supplement card.) (2) Follow trip type 7, steps 2 through 8. (3) Board bus, showing bus/rail pass on local bus and bus rail pass plus supplemental card with express bus stamp. If traveling on local bus, skip step 4. (4) If traveling on express bus: • Pay incremental charges if traveling beyond distance stop for which express bus stop is valid • Receive from his driver a color-coded ticket to desired destination zone • Surrender ticket to driver when bus enters desired destination zone. (5) Alight at destination.

	Trip Type	Patron Type	Sequence
26.	MRT to Bus, Regional Pass	Regular and Discount Fare Patrons	(1) Purchase regional pass from SCRTD sales outlet. (2) Follow trip type 20, steps 4 through 9. (3) Board any bus. (4) Alight at destination.
27.	LRT to Bus, Single-Trip Tickets	Regular and Discount Fare Patrons	(1) Purchase LRT printed ticket with transfer to bus at LRT station TVM: • Select destination (LRT or MRT) • Select travel zones (1, 2, 3, or 4 or more) using map on TVM for assistance • Select transfer to bus • Select regular or discount fare • Insert displayed amount in U.S. coins (obtain coins from BCM, if necessary) • Retrieve ticket, and change if due. (2) Board LRT train; show ticket to fare inspector, if requested. (3) Alight at station within ticketed destination zone. (4) Follow trip type 23, steps 3 through 5.
28.	LRT to Bus, Pass (Bus-Only or Bus/Rail) with Light Rail Stamp	Regular and Discount Fare Patrons	(1) Purchase pass and light rail stamp from SCRTD sales outlet, specifying specific light rail zones for which stamp is to be valid. (Stamp will be affixed to separate supplement card if bus/rail pass is purchased.)

Trip Type	Patron Type	Sequence
		(2) Follow trip type 10, steps 2 and 3. (3) Board bus, showing pass. If traveling on local bus, skip step 4. (4) If traveling on express bus: • Pay incremental charges (pass valid for base fare) • Receive from bus driver a color-coded ticket to desired destination zone • Surrender ticket to driver when bus enters desired destination zone. (5) Alight at destination.
29. LRT to Bus, Pass (Bus-Only with Light Rail Stamp, plus Express Bus Stamp)	Regular and Discount Fare Patrons	(1) Purchase from SCRTD sales outlet a local bus-only pass with light rail stamp, choosing specific LRT zones desired. Purchase also an express bus stamp (which will be affixed to a separate supplemental card), selecting desired number of distance steps. (2) Follow trip type 10, steps 2 and 3. (3) Follow trip type 25, steps 3 through 5, except read "bus only pass" for "bus/rail pass."
30. LRT to Bus, Regional Pass	Regular and Discount Fare Patrons	(1) Follow trip type 11, steps 1 through 3. (2) Board any bus. (3) Alight at destination.

FOOTNOTES TO EXHIBIT D-1

(a) In all cases, discount fare patrons must show proper identification when purchasing or showing for inspection discount media.

(b) To prevent fare abuse, Metro Rail station TVMs vend only regular fare tickets. Discount fare patrons must purchase their fare media at SCRTD sales outlets, presenting proper identification at the time of purchase. However, once the discount fare media (tickets or passes) have been purchased, their value may be upgraded in Metro Rail equipment, since discounts are available only on base fares.

(c) If patron is handicapped, Metro Rail handicapped entry and exit gates should be used as needed. The handicapped gate will only be released upon insertion of media encoded as handicapped media (or certain types of employee passes). A patron with a single-trip ticket requiring use of the handicapped gate will need to call the agent or CCTV operator to release the gate. Upon insertion of the ticket, however, the gate will encode the media as valid for use in the handicapped gate when the patron exits the system.

(d) The LRT system, as a proof-of-payment, barrier-free system, will not include add fare machines. Patrons wishing to continue on LRT beyond the destination zone for which their fare media are valid must therefore disembark in the original destination zone and purchase a new LRT ticket, paying the full fare amount.

APPENDIX E

INCIDENCE OF PATRON TYPES

INCIDENCE OF PATRON TYPES

This appendix presents the patron incidence rates and describes the derivation of those rates. Several sources of patronage data and a number of assumptions were used to determine these incidence rates or scenario weights:

- Year 2000 average daily Metro Rail (MRT) boardings by mode of access for the original baseline fare structure (i.e., reduced bus-to-rail transfer charge) were available from MRTC Design Directive DD-001, November 1983.

- Year 2000 average daily boardings for LRT were reported in the Long Beach-Los Angeles Light Rail Project Environmental Impact Report, May 1984. The patronage estimates assume the implementation of Metro Rail and several other planned transportation improvements. Mode-of-access data (including movements of patrons from MRT to LRT at 7th/Flower) were available only for the morning peak hour. LACTC recommends that the peak hour mode-of-access distribution be assumed for all hours of service.

- The impact of the elimination of reduced bus-to-rail transfer charge on projected patronage was determined in the Special Study of Fare Policy Alternatives, Final Report, January 1985, prepared by Booz, Allen and Hamilton, Inc.

It is assumed that, on an all-day basis, equal number of patrons will make bus-to-MRT and MRT-to-bus trips and, similarly, that equal numbers of patrons will make LRT-to-MRT trips and MRT-to-LRT trips. We further assume that bus-to-MRT-to-bus trips represent a share of bus-to-MRT trips. These trips were assumed to represent two-thirds of bus-to-MRT trips destined for zones outside the downtown (zone 1).

Given the distribution of patrons by mode, further assumptions were required on the distribution of patron types. Two variables are relevant in making these assumptions:

- The distribution of pass versus cash payment

- The share of cash patrons eligible for discount (i.e., elderly and handicapped) fares.

The best source of data on method of payment and fare category is SCRTD bus patronage. Because the year 2000 fare structure will be more comparable to fares prevailing before Proposition A, data for May 1982 ridership were used. The distribution at that time was as follows: regular cash fare, 43 percent; discount cash fare, 3 percent; pass and free fare: 54 percent. It should be noted that this distribution is applicable for a fare structure requiring payment of only one base fare and, therefore, including a reduced (nominal) bus-to-rail transfer charge. To account for the elimination of bus-to-rail transfers, it is assumed that 5 percent of the affected cash users would switch to passes. The remaining cash users were further reduced to reflect the relative fare increase imposed by the new policy eliminating bus-to-rail transfers. In addition, a lower proportion of discount fare cash patrons is expected on Metro Rail relative to the bus system, just as very few elderly and handicapped currently ride express buses. Hence, it is assumed that no more than 4 percent of cash patrons are eligible for a discount fare (versus 6.5 percent of total bus cash riders in May 1982). The resulting number of riders in each category is shown in Exhibit E-1.

It is further assumed that half of all cash users will purchase two single-trip tickets during the first half of their round trip. Therefore, 25 percent of cash patrons (half of half) will have a prepurchased ticket for their return trip. Finally, the distribution of patron types by method of payment and fare category is assumed to hold for each mode. The resulting incidence of patron types is shown in Exhibit E-2.

EXHIBIT E-1
Year 2000 Metro Rail Daily Ridership By
Mode and Fare Type

Mode	Fare Type			
	Pass*	Regular Cash	Discount Cash	Total
Bus-to-MRT	67,135	46,164	1,923	115,222
MRT-to-Bus	67,135	46,164	1,923	115,222
Bus-to-MRT-to-Bus	39,793	27,362	1,140	68,295
MRT (only)	29,827	24,392	1,016	55,235
MRT-to-LRT	1,710	1,399	58	3,167
LRT-to-MRT	1,710	1,399	58	3,167
Total	207,310	146,880	6,118	360,308

* Includes passengers riding free.

EXHIBIT E-2
Year 2000 Metro Rail Ridership:
Incidence of Patron Types
(Percent)

Mode	Method of Payment					
	Pass*	Pre-Purchased Single-Trip Ticket		Single-Trip Ticket Purchased at Time of Travel		Total
		Regular	Discount	Regular	Discount	
Bus-to-MRT	18.63	3.20	0.13	9.61	0.40	31.97
MRT-to-Bus	18.63	3.20	0.13	9.61	0.40	31.97
Bus-to-MRT-to-Bus	11.04	1.90	0.08	5.70	0.24	18.96
MRT (only)	8.28	1.69	0.07	5.08	0.22	15.34
MRT-to-LRT	0.48	0.10	0.00	0.29	0.01	0.88
LRT-to-MRT	0.48	0.00	0.00	0.39	0.01	0.88
Total	57.54	10.09	0.41	30.68	1.28	100.00

* Includes passengers riding free.