Southern California Rapid Transit District

METRO RAIL PROJECT

SYSTEM OPERATING PLAN

FOR MOS-1

NOVEMBER 1987

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT

METRO RAIL PROJECT

SYSTEM OPERATING PLAN

FOR MOS-1

November 1987

TABLE OF CONTENTS

LIST OF EXHIBITS

1.0 INTRODUCTION

1.0 INTRODUCTION

The Southern California Rapid Transit District (SCRTD) is developing a 20-mile rail rapid transit system planned to run from downtown Los Angeles to the Wilshire District, Hollywood, and the San Fernando Valley. This system, called Metro Rail, will be the core element of a regional rail rapid transit network which will include both heavy and light rail modes. Funding limitations necessitate that the Metro Rail system be built in stages. Initially a 4-mile segment with five stations and yard and shop facilities will be constructed. This initial segment is identified as Minimum Operable Segment-1, or MOS-1.

This operating plan for MOS-1 has been developed in concert with the system design.[1] The plan documents the service characteristics, control and communications equipment, key staff requirements, and operating practices which will enable the Metro Rail system to run safely and efficiently. The plan does not provide detailed procedures for operating the system or for responding to emergency situations. Rather, it provides a general overview of operations from which rules and procedures can be prepared.

In addition to this introduction, the plan contains nine chapters:

- Chapter 2.0 provides a description of the MOS-1 system

- Chapter 3.0 presents passenger service characteristics and related data

- Chapter 4.0 outlines the staff organization and responsibilities for operations

- Chapter 5.0 describes the equipment to be used for controlling system operations

---

1 The operating plan for the full Metro Rail system is documented in SCRTD Metro Rail Project, Metro Rail System Operating Plan, October 1986. The plan for the full system reflects an earlier 18-mile alignment and will be updated once a route for a portion of the line system still under study have been selected.

- Chapter 6.0 describes the normal operating routine

- Chapter 7.0 discusses operational problems that may occur and presents mitigation measures

- Chapter 8.0 outlines fare collection equipment and practices

- Chapter 9.0 discusses the collection and processing of rail revenues

- Chapter 10.0 outlines the interaction between the Metro Rail operating and maintenance functions.[2]

LA1171013R

---

[2] Details on maintenance functions are contained in SCRTD Metro Rail Project, System Maintenance Plan, Draft, April 1987

2.0 SYSTEM DESCRIPTION

Red Line

MOS-1, the initial segment of the 20-mile Metro ~~Rail~~ ~~system~~, will be a 4-mile segment comprising a double-track mainline and a yard and shops area.

As shown in Exhibit 2-1, the MOS-1 mainline route will begin at Union Station, where it will turn southwest and run through the central business district along Hill Street. Turning on 7th Street, the route will head toward the west side of downtown, pass the Harbor Freeway, and continue to the Wilshire/Alvarado Station, where the line will terminate. The mainline will be entirely in subway, with line segments constructed by tunneling machines and stations and crossovers excavated by cut-and-cover construction techniques. Three double crossovers will be included in the mainline portion of MOS-1: one on each side of Union Station, and one on the east side of the Wilshire/Alvarado Station.

Additional subway and surface track will connect the mainline with the yard, southeast of Union Station. MOS-1 will include all yard and shop facilities planned for the full system, except for a portion of the yard storage tracks and some shop equipment that will be installed as warranted by system extension and fleet expansion.

MOS-1 will contain five stations. Four of the stations will be of a double-ended design with two mezzanines; the fifth station, Wilshire/Alvarado, will be of a single-center-mezzanine design. The station at 7th/Flower will be the transfer point between the Long Beach-Los Angeles light rail system and the Metro ~~Rail~~ *Red Line* ~~system.~~

A barrier-free, self-service fare collection system will be implemented on a trial basis for MOS-1. Each station mezzanine will contain automated ticket vending machines. Fare Inspectors will rove the system and conduct random checks of the validity of patrons' fare media. The fare structure for MOS-1 will be based on a single zone; however, the fare collection equipment will have a multi-zone capability to accommodate travel to light rail destinations as well as expansion of the Metro Rail system. Escalators, stairs, and elevators will provide normal vertical circulation between surface, mezzanine, and platform levels of Metro ~~Rail~~ stations.

Red Line

EXHIBIT 2-1
MOS-1 System Alignment
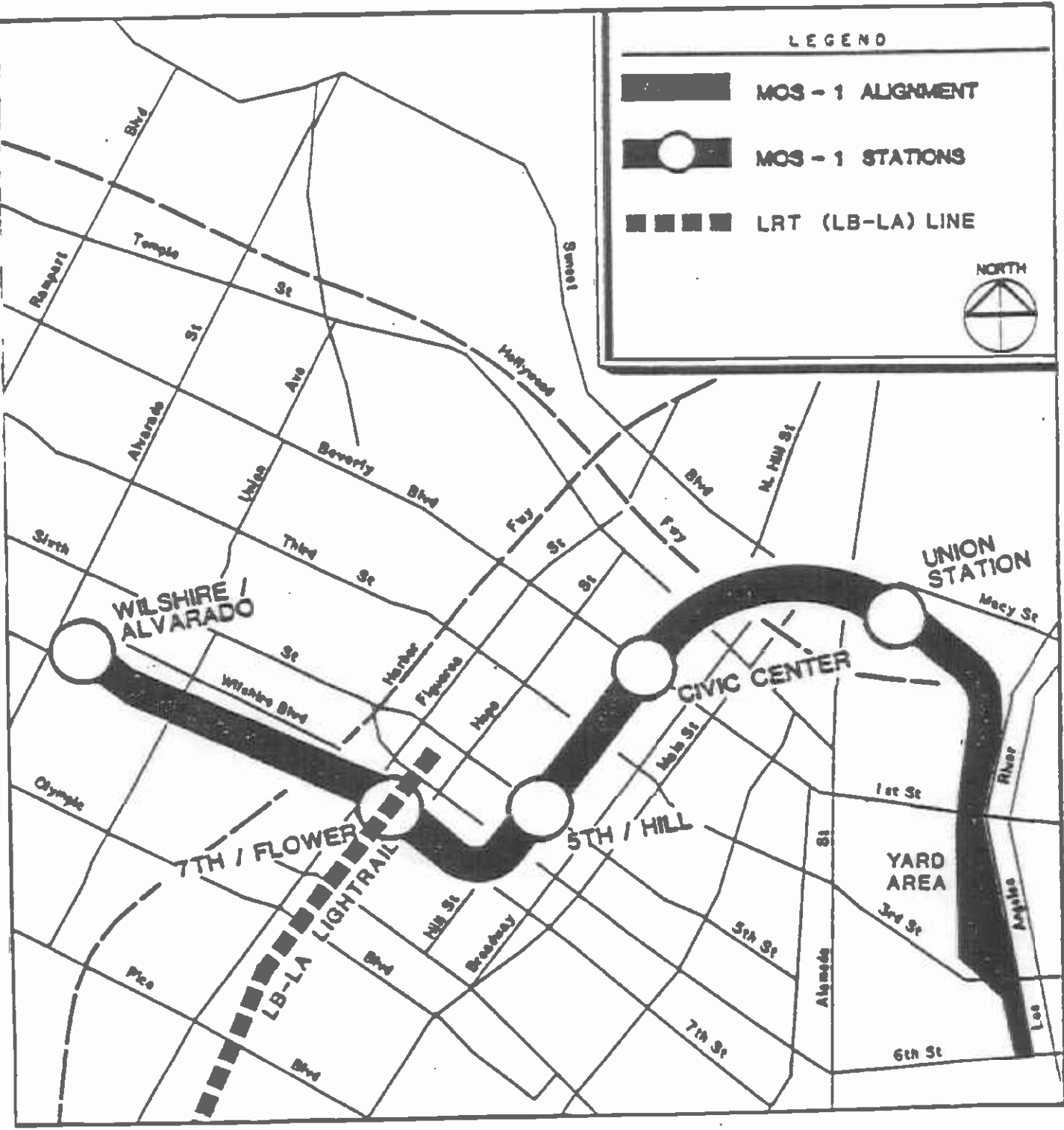
2.0 SYSTEM DESCRIPTION

Stations will be equipped 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.

The vehicles for the system will be stainless steel, standard gauge, 75-foot-long rail cars which will be configured in dependent pairs. They will be capable of operating at speeds up to 70 miles per hour and will operate on 750 VDC power supplied via third rail. Trains on the MOS-1 system will consist of four vehicles, although the system is being designed to accommodate a maximum train length of six vehicles. Each single vehicle will have a capacity of 59 seated passengers plus space for one wheelchair, up to 109 standing passengers at normal loads, and 160 standing passengers at crush loads.

Trains will have automatic train protection equipment to ensure safe speed and separation of trains. Automatic train operation equipment will also be included to regulate train speed and provide precise station stopping and train berthing verification for trains operating on the mainline. System operation will be centrally controlled from the Rail Control Center, located in the yard, using communication links with facilities and trains involving telephones, radios, closed-circuit televisions, and data transmission.

Ridership on MOS-1 by the year 2000 is projected to be approximately 54,000 per day.[1] An estimated two-thirds of these passengers will transfer to or from SCRTD buses serving the five Metro Rail stations. Maximum passenger loading on MOS-1 during peak hours will be from Union Station in the morning and to Union Station in the evening. The 24-hour loading pattern, however, shows relatively constant loadings on each of the links, with the heaviest travel volume occurring on the link between the Wilshire/Alvarado and 7th/Flower Stations.

LA1171014R

---

[1] Source: Keith L. Killough, SCRTD Memorandum, "Station-to-Station Trip Volumes--MOS-1 Option," October 3, 1984.

3.0 MOS-1 SERVICE CHARACTERISTICS

3.0 MOS-1 SERVICE CHARACTERISTICS

Chapter 3.0 describes the service characteristics of the MOS-1 system, including ridership forecasts, service requirements, travel times, train schedule, operating statistics, and fleet requirements. Two sets of data are provided for MOS-1 service characteristics: a limited-service plan for the initial period of MOS-1 operation; and a full-service plan for the MOS-1 system. The somewhat lower level of service to be provided in the initial operating period reflects an allowance for increased maintenance and testing following system start-up, as well as the lower level of passenger demand expected initially.

The time at which a transition will be made from initial operations to full-service operations on MOS-1 is undefined and will depend on actual operating and mainte-nance experience and on the growth in passenger demand. However, because full-service characteristics were developed on the basis of year 2000 passenger projections, they are for brevity referred to in the following pages as year 2000 data.

3.1 RIDERSHIP FORECASTS

Opening-day ridership estimates for the MOS-1 system have not been determined. However, patronage is expected to follow a growth curve leading to a total projected weekday patronage for MOS-1 of 54,218 by the year 2000. This estimate assumes that no extensions to the 4-mile MOS-1 system will have occurred by that time. Exhibit 3-1 shows the average daily volumes of passengers boarding and alight-ing in the year 2000 at the five MOS-1 stations, as well as the average daily volumes of passengers traveling in each direction on the line segments (links) between stations. Of the estimated daily average of 54,218 riders, 58 percent (29 percent in each direction) will pass through the maximum load point, the link between the 7th/Flower and Wilshire/ Alvarado Stations.

Passenger boardings, alightings, and link volumes during the morning and evening peak hours in the year 2000 are shown in Exhibits 3-2 and 3-3, respectively. These exhibits indicate that during the morning peak hour the link between Union Station and the Civic Center Station will be

EXHIBIT 3-1
MOS-1 System
Boarding, Alighting & Link Volumes by Direction:
Average Daily Volumes, Year 2000
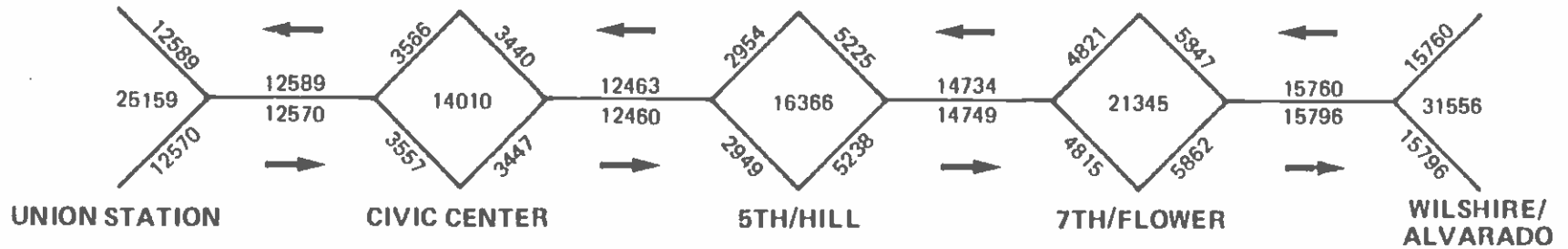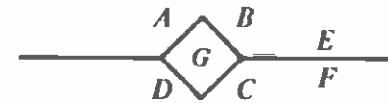
Station		
UNION STATION	12589 / 12570 — 25159 — 12589 / 12570	
CIVIC CENTER	3566 / 3557 — 14010 — 3440 / 3447	12463 / 12460
5TH/HILL	2954 / 2949 — 16366 — 5225 / 5238	14734 / 14749
7TH/FLOWER	4821 / 4815 — 21345 — 5847 / 5862	15760 / 15796
WILSHIRE/ALVARADO	15760 / 15796 — 31556	

KEY:

A: BOARD INBOUND
B: ALIGHT INBOUND
C: BOARD OUTBOUND
D: ALIGHT OUTBOUND
E: LINK INBOUND
F: LINK OUTBOUND
G: TOTAL STATION VOLUME

EXHIBIT 3-2
MOS-1 System
Boarding, Alighting & Link Volumes by Direction: A.M. Peak Hour Volumes, Year 2000

	UNION STATION	CIVIC CENTER	5TH/HILL	7TH/FLOWER	WILSHIRE/ALVARADO
Inbound top	495	234 / 240	59 / 668	224 / 761	1647
Link inbound	495	501	1110	1647	3044
Link outbound	3108	2670	2212	1397	1397
Station total	3603	1920	1815	2220	
Outbound bottom	3108	942 / 504	773 / 315	1025 / 210	1397

KEY:

- A: BOARD INBOUND
- B: ALIGHT INBOUND
- C: BOARD OUTBOUND
- D: ALIGHT OUTBOUND
- E: LINK INBOUND
- F: LINK OUTBOUND
- G: TOTAL STATION VOLUME

EXHIBIT 3-3
MOS-1 System
Boarding, Alighting & Link Volumes by Direction:
P.M. Peak Hour Volumes, Year 2000
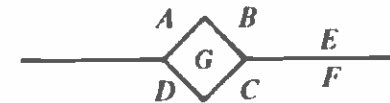
UNION STATION 2924 / 3646 / 722 / 2924 / 722 / 734 / 333 / 1638 / 291 / 280

CIVIC CENTER 2481 / 669 / 670 / 88 / 1745 / 365 / 622

5TH/HILL 2176 / 1203 / 1010 / 234 / 2220 / 350 / 626

7TH/FLOWER 1516 / 1595 / 1516 / 1595 / 3111

WILSHIRE/ ALVARADO

KEY:

A B
G
D C

E
F

A: BOARD INBOUND
B: ALIGHT INBOUND
C: BOARD OUTBOUND
D: ALIGHT OUTBOUND
E: LINK INBOUND
F: LINK OUTBOUND
G: TOTAL STATION VOLUME

the maximum load point in the outbound[1] direction, while the link between the 7th/Flower and Wilshire/Alvarado Stations will be the maximum load point in the inbound direction. During the evening peak hour, these trends will be reversed; i.e.,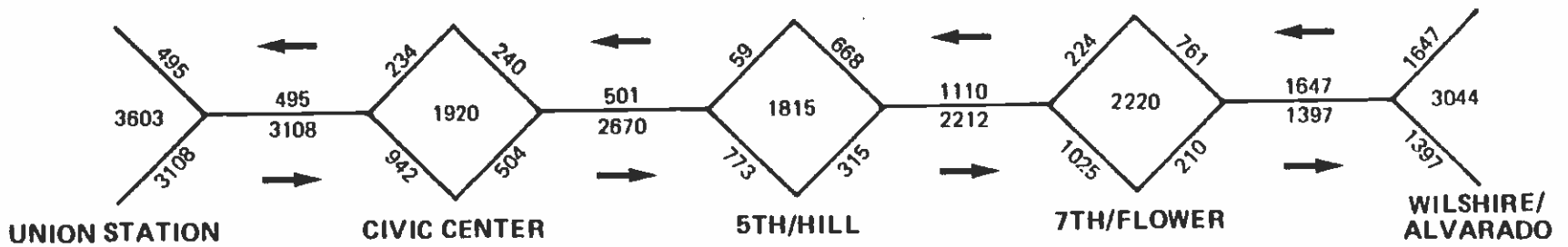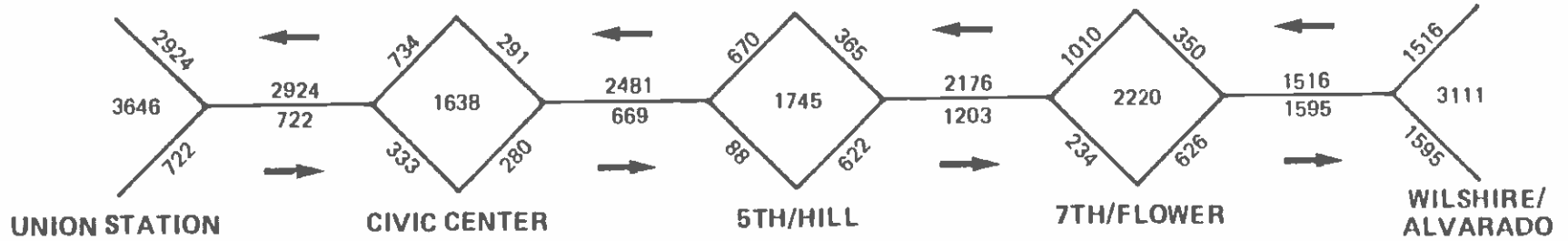 the link between the 7th/Flower and Wilshire/Alvarado Stations will be the maximum load point in the outbound direction, while the link between Union Station and the Civic Center Station will be the maximum load point in the inbound direction. The most heavily used station will be Wilshire/Alvarado, where 31,556 trips are expected to originate or terminate each day.

3.2   SERVICE STANDARDS

Service standards establish minimum comfort and convenience levels for passenger service. The maximum vehicle loads, hours of service, and minimum frequency of service defined in this operating plan determine the maximum level of crowding and waiting time that a passenger can expect.

3.2.1   Vehicle Load Standards

Three vehicle load standards--off-peak, peak, and crush--have been established for Metro Rail operations. The first two vehicle load standards are used for scheduling purposes; the third is for analysis of failure management strategies.

Off-Peak Load Standard. An off-peak load standard of 90 passengers per vehicle has been established. This standard is based on a capacity of 59 seated passengers, 1 wheelchair passenger, and 30 standing passengers.

Peak Load Standard. A peak load standard of 169 passengers per vehicle has been established to provide adequate room for circulation among standees and aid in minimizing station dwell times. This standard comprises seating capacity for 59 passengers, 1 wheelchair location, and space for 109 standees. It is based on a standing density of 3.3 square feet per passenger. A standing density of 3.0 square feet per passenger is considered the minimum required for adequate circulation. A 10 percent contingency, resulting in 3.3 square feet per standee, was added to allow for imbalances in vehicle loading that may occur in peak periods.

---

1   In this context, outbound traffic is defined as that traffic proceeding toward Wilshire/Alvarado, and inbound traffic is defined as that traffic proceeding toward Union Station.

Crush Load Standard. A crush load standard of 220 passengers per car has been defined for emergency egress planning purposes (not for structural design purposes). The standard is based on a capacity of 59 seated positions, 1 wheelchair location, and 2.25 square feet per standee. This is an average density; actual densities throughout a train may range between 2.0 and 3.0 square feet.

3.2.2 Hours of Service

The Metro~~Rail system~~ *Red Line* is being designed to permit flexibility in the establishment of hours of service. This philosophy was used in defining the hours of service for the initial operating period and for the year 2000.

For the initial operating period, a 14-hour service day has been defined, starting at 6:00 a.m. and ending at 8:00 p.m. Rail service during the initial period will be provided on weekdays only.

Following system start-up, patronage on the Metro Rail system is expected to increase and gradually approach the year 2000 ridership projections. To meet the needs of this growing ridership, a 20-hour service day has been defined for the year 2000. Revenue operations will start at 5:30 a.m. and end at 1:30 a.m. daily, including Saturdays, Sundays, and holidays. These hours provide optimal service given that demand for rail service between the hours of 1:30 a.m. and 5:30 a.m. is expected to be low, and given that local bus service will be available in the corridor during that period.

For both the initial and year 2000 schedules, departure of the first train from the yard and arrival of the last train at the yard will occur slightly beyond the service hours. The period when trains are not in revenue service will be used for uninterrupted right-of-way maintenance, although not all right-of-way maintenance tasks will be confined to this period. Nothing in the design of the Metro~~Rail system~~ *Red Line* will preclude 24-hour operation if such service becomes appropriate.

3.2.3 Policy Headways

Red Line

Policy headways define the maximum amount of time that passengers will spend awaiting Metro~~Rail~~ trains during various periods of the day. The policy headways established for MOS-1 are given in Exhibit 3-4 for the year 2000. The same headways apply to the initial operating period, when adjusted to reflect that period's shorter service hours (6:00 a.m.- 8:00 p.m.) and absence of weekend/holiday service.

EXHIBIT 3-4
MOS-1 Recommended Policy Headways, Year 2000

Period		Maximum Schedule Headway (Minutes)	Number of Vehicles Per Train
Weekdays:			
Early morning	5:30 a.m. - 6:30 a.m.	10	4
Peak periods	6:30 a.m. - 8:30 a.m.	5	4
	3:30 p.m. - 5:30 p.m.	5	4
Midday	8:30 a.m. - 3:30 p.m.	10	4
Evening	5:30 p.m. - 8:00 p.m.	10	4
Night	8:00 p.m. - 1:30 a.m.	10	4
Weekends/Holidays:			
All day	5:30 a.m. - 1:30 a.m.	20	4

The policy headways have been established on the basis of projected demand levels along the MOS-1 corridor and an assessment of service levels provided by other systems. (Service frequencies on other systems range from 2 to 10 minutes between peak-period trains and from 5 to 10 minutes between midday trains.) Train service will be provided at policy headways unless additional service is required to meet vehicle load standards or to move trains to points where they are needed. Since the policy headways established for the MOS-1 system will, as discussed in Section 3.4, satisfy projected passenger demand without abridging vehicle load standards, the policy headways are planned headways for MOS-1. MOS-1 train frequencies may be adjusted following the initiation of service as actual ridership characteristics become apparent.

Exhibit 3-4 also indicates the size of trains that will operate on the MOS-1 system. The Metro Rail system is being designed to handle a maximum train length of six cars. For MOS-1, four-car trains will operate during all service periods. While the projected volume of passengers does not warrant a four-car consist during all service periods, SCRTD failure management strategy requires that each train comprise a minimum of two dependent pairs. If the passenger vehicles demonstrate a high level of reliability during revenue service operations, this strategy may be revised to permit the use of two-car trains during periods of low passenger demand.

3.3 TRAVEL TIMES

The times required for trains to make one-way and round trips have been estimated to permit an analysis of fleet requirements and the service schedule. Exhibit 3-5 shows the station-to-station run times and station dwell times for the morning peak period. The outbound and inbound trips are expected to take approximately 7 minutes. The minimum dwell time at terminal stations has been set at 3 minutes, for a nominal round-trip time of 20 minutes.

The estimated travel times have been based on the route alignment of the MOS-1 system and on the following Metro ~~Rail~~ vehicle performance characteristics:

A Red Line

- An initial acceleration rate of 2.7 mphps

- A signal brake rate of 2.2 mphps and a station brake rate of 2.0 mphps

- A maximum potential speed of 70 mph (a maximum actual speed of 55 mph will be attained on MOS-1)

EXHIBIT 3-5
MOS-1 Travel Times,
A.M. Peak Period, Year 2000

STATION	RUN TIMES (SECONDS)		DWELL TIMES (SECONDS)	
	OUTBOUND	INBOUND	OUTBOUND	INBOUND
Union Station			-	-
	102	111		
Civic Center			20	20
	58	58		
5th/Hill			20	20
	68	69		
7th/Flower			20	20
	131	122		
Wilshire/Alvarado			-	-
Total Run Time (seconds)	359	360		
Total Dwell Time (seconds)			60	60
One-Way Total, Including Dwells (minutes:seconds)			6:59	7:00

- A performance level of 85 percent

- Speed codes of 0, 8, 9, 25, 40, 45, 55, and 70 mph.

3.4 SERVICE REQUIREMENTS

The operating plan for the MOS-1 system is based on the following operating philosophy:

- All trains will stop at each station.

- Train service will be provided at policy headways unless additional service is required to meet vehicle load standards or to move trains to points where they are needed.

- Four-car trains will operate during all revenue service periods.

- Trains will be stored overnight at the yard and will be dispatched from Union Station.

The policies on train sizes and headways established for MOS-1 remain the same for the initial operating period and for the year 2000. Consequently, service requirements will remain the same in the two periods unless the increased level of passenger demand in the year 2000 imposes a need for more frequent train operation to maintain vehicle load standards. Year 2000 ridership projections were therefore used in evaluating MOS-1 service requirements, which are described below for peak and off-peak periods.

3.4.1 Peak-Period Service

During peak periods (6:30 a.m.-8:30 a.m. and 3:30 p.m.-5:30 p.m.), trains will operate at 5-minute head-ways. At this headway, 12 train trips per hour will be required in each direction. With a peak load standard of 169 passengers per car, or 676 passengers per four-car train, 12 train trips per hour will provide a capacity of 8,112 passengers in each direction. This capacity will be more than sufficient to handle peak-hour demands on the MOS-1 system in the year 2000 (3,108 outbound passengers at the maximum load point in the a.m. peak hour and 2,924 inbound passengers in the p.m. peak hour), as well as in the initial operating period.

Given a nominal round-trip time of 20 minutes, four 4-car trains will be needed to provide the required 12

train trips per hour in each direction.[2] Exhibit 3-6
provides an operating schedule for weekday morning service
on the MOS-1 system in the year 2000. The same schedule
applies in the initial operating period, as adjusted to
take account of system opening at 6:00 a.m., rather than
5:30 a.m.

3.4.2 Off-Peak Service

During midday (8:30 a.m.-3:30 p.m.) off-peak periods
on the MOS-1 system, trains will operate at 10-minute
headways, requiring six train trips per hour in each
direction. With an off-peak load standard of 90 passen-
gers per car, or 360 passengers per four-car train, six
train trips per hour will provide a capacity of 2,160
passengers in each direction. This capacity will be more
than sufficient to handle maximum off-peak demand in the
year 2000 (1,000 passengers per midday hour traveling in
each direction through the maximum load point), as well as
in the initial operating period. Two 4-car trains will be
required to provide this level of service. In evening
off-peak hours, two 4-car trains will operate at 10-minute
headways on the MOS-1 system both in the initial operating
period and the year 2000.

Night, weekend, and holiday service on the MOS-1
system will not be provided in the initial operating
period but will be instituted when the year 2000 service
plan is implemented. Following implementation of the
plan, at night (8:00 p.m.-1:30 a.m.), two 4-car trains
will operate at 10-minute headways. On weekends and
holidays, one 4-car train will operate at 20-minute
intervals.

3.5 OPERATING STATISTICS

Exhibits 3-7 and 3-8 summarize the weekday service to
be provided by the MOS-1 system for the initial operating
period and for the year 2000, respectively.

During the initial operating period, 110 train trips
will be operated in each direction during the 14-hour
operating day. Daily train trips will rise to 146 in each

---

2   The nominal round-trip time of 20 minutes includes
    3-minute dwells at terminal stations. These represent
    equipment dwell times, and not necessarily Train Operator
    layover times. Train Operator layover times are
    discussed in Chapter 6.0.

EXHIBIT 3-6
MOS-1 Weekday Morning Schedule, Year 2000

Run Number	Train Number	Depart Union Station	Arrive Wilshire/Alvarado	Depart Wilshire/Alvarado	Arrive Union Station
1	1*	5:30	5:37	5:40	5:47
2	2*	5:40	5:47	5:50	5:57
3	1	5:50	5:57	6:00	6:07
4	2	6:00	6:07	6:10	6:17
5	1	6:10	6:17	6:20	6:27
6	2	6:20	6:27	6:30	6:37
7	3*	6:25	6:32	6:35	6:42
8	1	6:30	6:37	6:40	6:47
9	4*	6:35	6:42	6:45	6:52
10	2	6:40	6:47	6:50	6:57
11	3	6:45	6:52	6:55	7:02
12	1	6:50	6:57	7:00	7:07
13	4	6:55	7:02	7:05	7:12
14	2	7:00	7:07	7:10	7:17
15	3	7:05	7:12	7:15	7:22
16	1	7:10	7:17	7:20	7:27
17	4	7:15	7:22	7:25	7:32
18	2	7:20	7:27	7:30	7:37
19	3	7:25	7:32	7:35	7:42
20	1	7:30	7:37	7:40	7:47
21	4	7:35	7:42	7:45	7:52
22	2	7:40	7:47	7:50	7:57
23	3	7:45	7:52	7:55	8:02
24	1	7:50	7:57	8:00	8:07
25	4	7:55	8:02	8:05	8:12
26	2	8:00	8:07	8:10	8:17
27	3	8:05	8:12	8:15	8:22
28	1	8:10	8:17	8:20	8:27
29	4**	8:15	8:22	8:25	8:32
30	2	8:20	8:27	8:30	8:37
31	3**	8:25	8:32	8:35	8:42
32	1	8:30	8:37	8:40	8:47
33	2	8:40	8:47	8:50	8:57
34	1	8:50	8:57	9:00	9:07
35	2	9:00	9:07	9:10	9:17
36	1	9:10	9:17	9:20	9:27
37	2	9:20	9:27	9:30	9:37

---

*   Train enters service
** Train leaves service

EXHIBIT 3-7
Summary of MOS-1 Weekday Service, Initial Operating Period

Period	Train Trips		Car Trips	
	Inbound	Outbound	Inbound	Outbound
6:00 a.m. - 6:30 a.m.	2	4	8	16
6:30 a.m. - 7:00 a.m.	6	6	24	24
7:00 a.m. - 7:30 a.m.	6	6	24	24
7:30 a.m. - 8:00 a.m.	6	6	24	24
8:00 a.m. - 8:30 a.m.	6	6	24	24
8:30 a.m. - 9:00 a.m.	4	3	16	12
9:00 a.m. - 9:30 a.m.	3	3	12	12
9:30 a.m. - 10:00 a.m.	3	3	12	12
10:00 a.m. - 3:00 p.m.	30	30	120	120
3:00 p.m. - 3:30 p.m.	3	4	12	16
3:30 p.m. - 4:00 p.m.	6	6	24	24
4:00 p.m. - 4:30 p.m.	6	6	24	24
4:30 p.m. - 5:00 p.m.	6	6	24	24
5:00 p.m. - 5:30 p.m.	6	6	24	24
5:30 p.m. - 6:00 p.m.	4	3	16	12
6:00 p.m. - 6:30 p.m.	3	3	12	12
6:30 p.m. - 7:00 p.m.	3	3	12	12
7:00 p.m. - 7:30 p.m.	3	3	12	12
7:30 p.m. - 8:00 p.m.	4	3	16	12
	110	110	440	440

EXHIBIT 3-8
Summary of MOS-1 Weekday Service, Year 2000

Period	Train Trips		Car Trips	
	Inbound	Outbound	Inbound	Outbound
5:30 a.m. - 6:00 a.m.	2	3	8	12
6:00 a.m. - 6:30 a.m.	3	4	12	16
6:30 a.m. - 7:00 a.m.	6	6	24	24
7:00 a.m. - 7:30 a.m.	6	6	24	24
7:30 a.m. - 8:00 a.m.	6	6	24	24
8:00 a.m. - 8:30 a.m.	6	6	24	24
8:30 a.m. - 9:00 a.m.	4	3	16	12
9:00 a.m. - 9:30 a.m.	3	3	12	12
9:30 a.m. - 10:00 a.m.	3	3	12	12
10:00 a.m. - 3:00 p.m.	30	30	120	120
3:00 p.m. - 3:30 p.m.	3	4	12	16
3:30 p.m. - 4:00 p.m.	6	6	24	24
4:00 p.m. - 4:30 p.m.	6	6	24	24
4:30 p.m. - 5:00 p.m.	6	6	24	24
5:00 p.m. - 5:30 p.m.	6	6	24	24
5:30 p.m. - 6:00 p.m.	4	3	16	12
6:00 p.m. - 6:30 p.m.	3	3	12	12
6:30 p.m. - 7:00 p.m.	3	3	12	12
7:00 p.m. - 7:30 p.m.	3	3	12	12
7:30 p.m. - 1:30 a.m.	37	36	148	144
	146	146	584	584

direction when the operating period is expanded to 20 hours in the year 2000.

Revenue operating statistics are summarized in Exhibit 3-9 for the initial operating period and in Exhibit 3-10 for the year 2000. In both exhibits, train and car hours are based on average, not nominal, round-trip times. During the initial operating period, the MOS-1 system will annually log 28,050 train trips in each direction, 9,358 train hours, 37,434 car hours, and 659,736 car miles. These numbers will increase by roughly 56 percent when the year 2000 schedule is implemented. At that time, the MOS-1 system will annually log 43,830 train trips in each direction, 14,618 train hours, 58,474 car hours, and 1,030,876 car miles.

These statistics do not include yard, test, or other non-revenue movements. All scheduled train trips on the mainline will be operated as revenue service. No dead-heading will occur under normal conditions.

3.6 FLEET REQUIREMENTS

Fleet requirements are determined by peak-period service levels, which are identical for the initial operating period and year 2000 service. A total fleet size of 30 cars will be required for both periods. This fleet size will provide 16 cars for revenue service, 4 cars for a gap (standby) train, and 10 cars for mainte-nance spares.

LA1171015R

EXHIBIT 3-9
Summary of MOS-1 Revenue Operating
Characteristics, Initial Operating Period

Period	Days/Year	One-Way Train Trips	One-Way Car Trips	Train Hours	Car Hours	Car Miles
Weekdays	255	110	440	36.7	146.8	2,587.2
Annual*	255	28,050	112,200	9,358.5	37,434.0	659,736.0

* Annualization Factor = 255.

LA0171023R

EXHIBIT 3-10
Summary of MOS-1 Revenue Operating
Characteristics, Year 2000

Period	Days/Year	One-Way Train Trips	One-Way Car Trips	Train Hours	Car Hours	Car Miles
Weekdays	255	146	584	48.7	194.8	3,433.9
Saturdays/ Sundays/ Holidays	110	60	240	20	80	1,411.2
Annual*	365	43,830	175,320	14,618.5	58,474	1,030,876.5

* Annualization Factor = 300.

4.0 STAFF ORGANIZATION AND RESPONSIBILITIES

4.0 STAFF ORGANIZATION AND RESPONSIBILITIES

Chapter 4.0 identifies the staff required for MOS-1 operations, describes their organizational relationships, and outlines their responsibilities. This staffing plan has been developed for engineering and cost estimating purposes and will be revised to suit actual operating needs at the time of system opening. The chapter describes the responsibilities of operations staff within the SCRTD Transportation Department; the chapter also describes the responsibilities of security personnel within the Transit Police Department. The following categories of personnel are considered:

- Operations Management: SCRTD Superintendent of Rail Operations, Division Manager-Metro ~~Rail~~ Red Line Operations, support staff, and Instructors

- Metro ~~Rail~~ Red Line Operations Supervision: Operations Supervisor and Division Dispatcher

- Communications and Control Personnel: Yard Dispatcher, Train Dispatcher, and Closed-Circuit Television (CCTV) Operators

- Operations Personnel: Line Supervisors, Train Operators, and Station Agents

- Security Personnel: Transit Police Watch Commander, Police Radio Dispatcher, Transit Police Officers, Security Guards, and Fare Inspectors.

These personnel categories have been used for clarity in the following discussion and in some cases do not reflect official titles. For example, within the Transportation Department, the Instructors, Division Dispatcher, Yard Dispatcher, Train Dispatcher, and Line Supervisors will all hold the official rank of Transportation Operations Supervisor-Rail, and will be cross-qualified.

With regard to physical location, the Operations Supervisor, Train Dispatcher, and CCTV Operators will control and/or monitor Metro Rail operations from the Rail Control Center (RCC), which will be sited in the Main Shop

building within the yard.[1] The Transit Police Dispatch
Center, which will be staffed by the Police Watch Commander
and Radio Dispatcher, will be located at the light rail/bus
operations control center at Imperial Station on the Long
Beach-Los Angeles light rail line. Remaining categories of
staff will be at widely dispersed locations throughout the
system.

A preliminary functional organization chart for opera-
tions staff on the MOS-1 system is shown in Exhibits 4-1
and 4-2.[2] The organization is intended to provide clear
lines of authority and responsibility so that timely and
effective decisions can be made. However, as previously
noted, Metro Rail operations staff and equipment will be
widely dispersed. Accordingly, the managers and supervisors
from whom operations staff will receive direction may vary,
depending on the staff member's physical location in the
system and prevailing operational circumstances. Effective
communications and cooperation will be vital to safe and
efficient Metro Rail operations.

4.1 OPERATIONS MANAGEMENT

The Metro Rail operations organization will report to
the SCRTD Assistant General Manager of Operations through
the Director of Transportation. The Director of Transpor-
tation has the responsibility for all transit operations
and will ultimately be accountable for coordination among
the bus, Metro Rail, and light rail systems. Reporting to
the Director of Transportation, the Superintendent of Rail
Operations will manage both the light rail and Metro Rail
systems through a division manager for each mode. The
Superintendent of Rail Operations and the Division

---

1 Further information on the responsibilities of RCC
   personnel is contained in the Metro Rail Project Rail
   Control Center Functional Plan, Southern California
   Rapid Transit District/Metro Rail Transit Consultants,
   March 1987.

2 The design of the full Metro Rail system provides for a
   Communications Controller, who will report to the Opera-
   tions Supervisor and be responsible for supervising
   Station Agents and managing patron activity and plant
   facilities in support of safe and timely train opera-
   tions. The staffing of this position will be deferred
   for MOS-1, given the reduced requirements of the 4-mile
   system. The Operations Supervisor will perform the
   functions of the Communications Controller for MOS-1.

EXHIBIT 4-1
MOS-1 Operations Functional Organization

```
                        ┌──────────────┐
                        │   General    │
                        │   Manager    │
                        └──────┬───────┘
                        ┌──────┴───────┐
                        │  Assistant   │
                        │General Manager│
                        │  Operations  │
                        └──────┬───────┘
                        ┌──────┴───────┐
                        │ Director of  │
                        │Transportation│
                        └──────┬───────┘
                        ┌──────┴───────┐
                        │Superintendent│
                        │Rail Operations│
                        └──────┬───────┘
                        ┌──────┴───────┐
                        │Division Manager│
                        │  Metro Rail  │
                        │  Operations  │
                        └──────┬───────┘
         ┌─────────────────────┼─────────────────────┐
  ┌──────┴───────┐      ┌──────┴───────┐      ┌──────┴───────┐
  │   Division   │      │  Operations  │      │ Instructors  │
  │  Dispatcher  │      │  Supervisor  │      │              │
  └──────────────┘      └──────┬───────┘      └──────────────┘
   ┌──────┬────────────────────┼──────────────────────────────┐
┌──┴───┐ ┌─┴──────┐      ┌──────┴───────┐              ┌──────┴───────┐
│ Yard │ │ Train  │      │   Station    │              │    Line      │
│Dispa-│ │Dispatcher│    │   Agents     │              │ Supervisors  │
│tcher │ └─┬──────┘      └──────────────┘              └──────┬───────┘
└──┬───┘   │                                                  │
┌──┴───┐ ┌─┴──────────┐                              ┌────────┴──────┐
│ Yard │ │  Mainline  │                              │     CCTV      │
│Train │-│   Train    │                              │  Operators    │
│Opera-│ │ Operators  │                              │               │
│tors  │ └────────────┘                              └───────────────┘
└──────┘
```
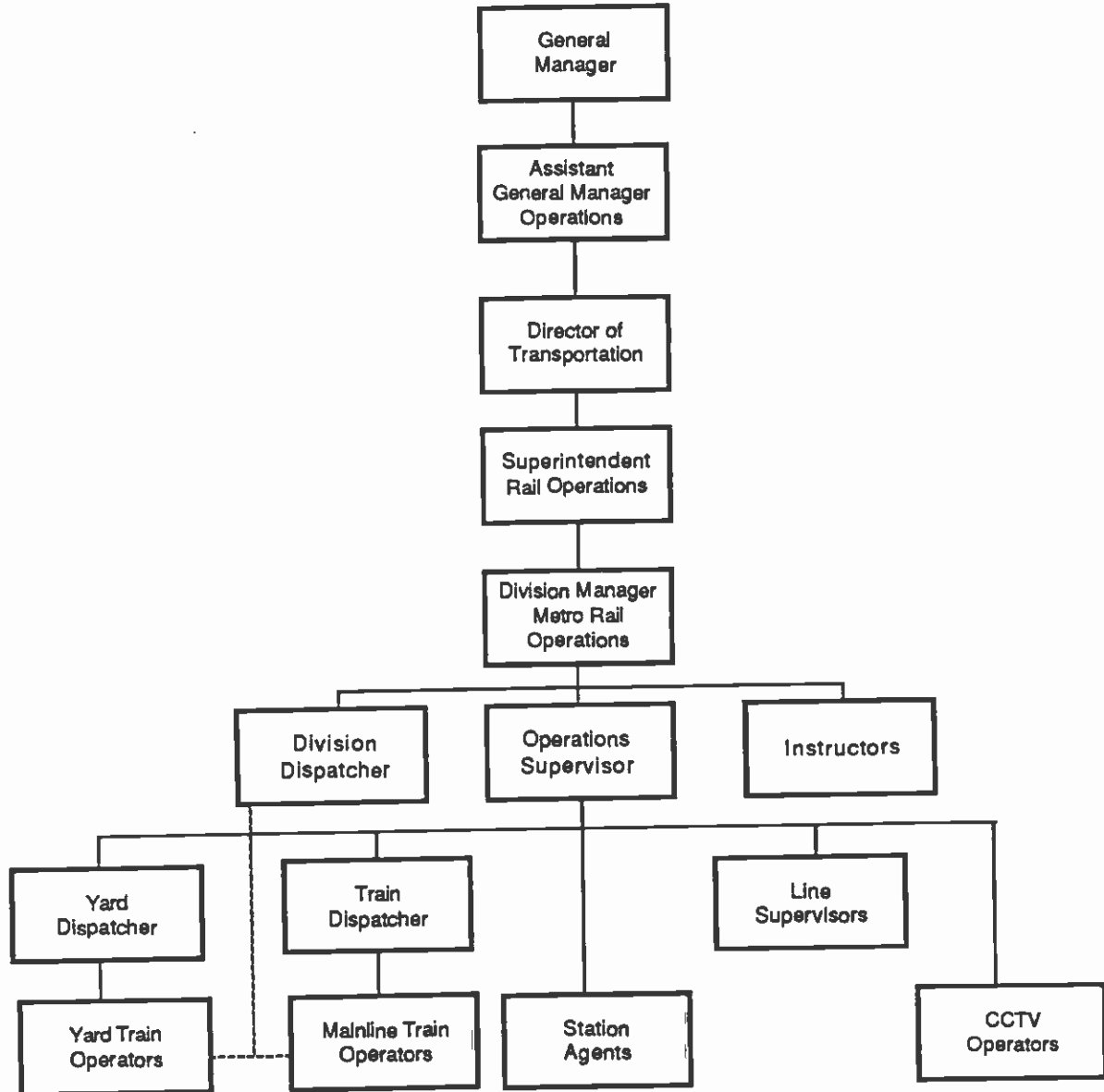
Note: Dashed Line (————)
denotes Administrative
relationship

EXHIBIT 4-2
MOS-1 Security Functional Organization

```
                    ┌──────────────┐
                    │   General    │
                    │   Manager    │
                    └──────────────┘
                            │
                    ┌──────────────┐
                    │   Transit    │
                    │ Police Chief │
                    └──────────────┘
                            │
                    ┌──────────────┐
                    │  Assistant   │
                    │   Transit    │
                    │ Police Chief │
                    └──────────────┘
                            │
         ┌──────────────────┤
┌──────────────┐    ┌──────────────┐
│  Captain -   │    │    Watch     │
│    Rail      │    │  Commander   │
│  Operations  │    └──────────────┘
└──────────────┘            │
                    ┌───────┴────────────────┐
            ┌──────────────┐         ┌──────────────┐
            │   Sergeant   │         │ Police Radio │
            │              │         │  Dispatcher  │
            └──────────────┘         └──────────────┘

┌──────────────┐    ┌──────────────┐     ┌──────────────┐
│     Fare     │    │Police Officers/│   │   Security   │
│  Inspectors  │    │ Investigators │    │    Guards    │
└──────────────┘    └──────────────┘     └──────────────┘
```
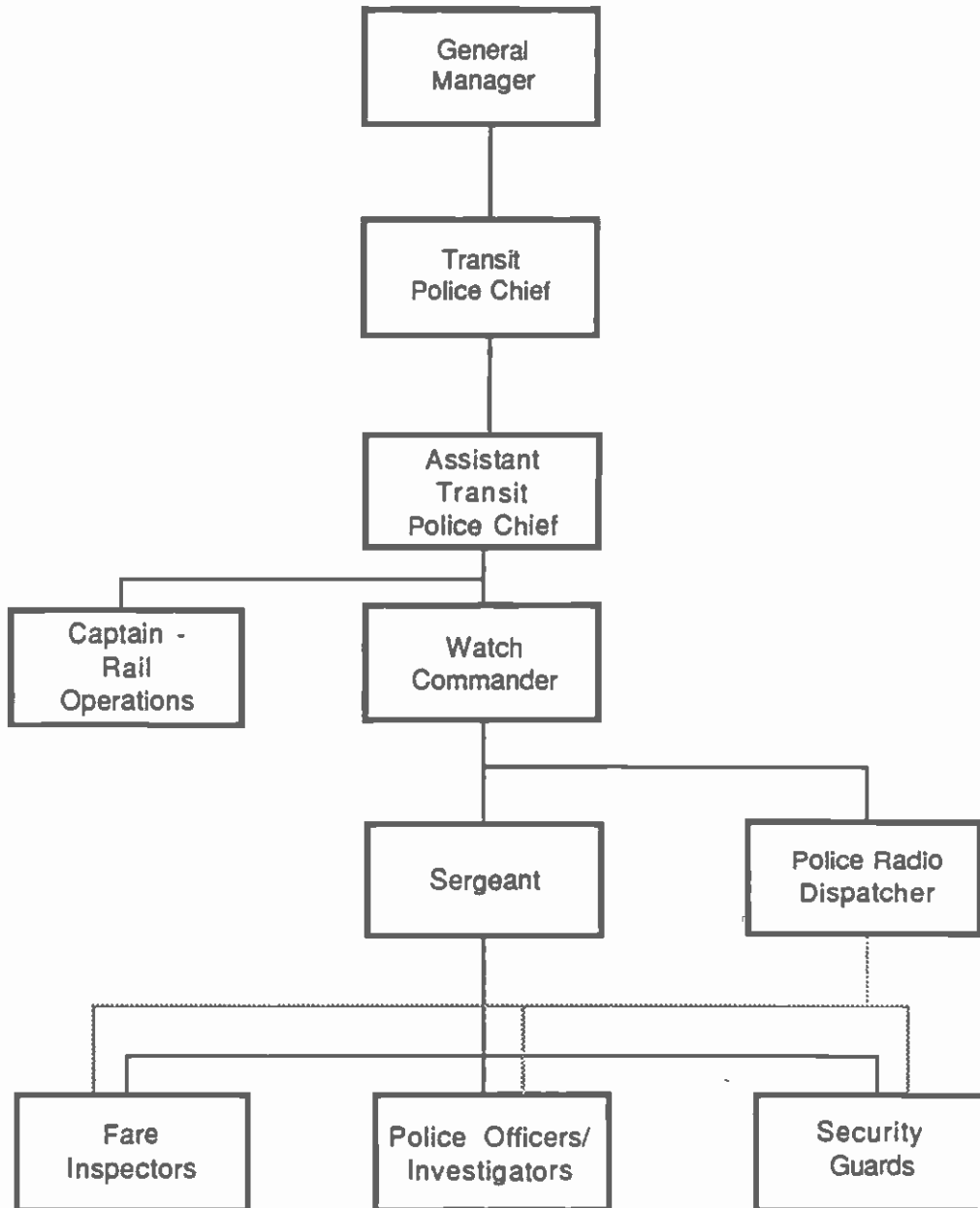
LEGEND:

——— Line of Authority

·········· Line of Field Communications

Red line

Manager-Metro~~-Rail~~ Operations will be assisted by support
staff and by instructors responsible for training Metro
~~Rail~~ operations personnel. Additional support to Metro
~~Rail~~ operations management will be provided by other SCRTD
departments, including the Scheduling Department, which
will prepare detailed train schedules and equipment-run
and operator assignment (work-run) sheets.

4.1.1 Superintendent of Rail Operations

The Superintendent of Rail Operations will have over-
all responsibility for the conduct and coordination of *Red and Blue line*
operations on both the Metro ~~Rail and light-rail~~ transit
systems. In conjunction with the Director of Transporta-
tion, the Superintendent will evaluate all rail operations
trends and will conduct short-range and long-range planning
for personnel, equipment, and service requirements. In
addition, the Superintendent will have the following
duties:

- Implementing and enforcing the policy directions
  of SCRTD management

- Establishing management direction to enhance the
  safety, reliability, and efficiency of the ~~Light~~
  ~~rail and Metro-Rail systems~~ *Red and Blue lines.*

- Directing the activities of the division managers
  for ~~light rail and~~ Metro ~~Rail~~ operations *Red and Blue line*

- Supervising the activities of support staff.

The Superintendent will be on duty at SCRTD head-
quarters during normal working hours and will be on call
at all times for emergencies. *Red line*

4.1.2 Division Manager-Metro Rail Operations

Red line

The Division Manager-Metro Rail Operations will have
overall responsibility for the safe and effective operation
of the system and for the efficient performance of opera-
tions staff. The Division Manager's major duties will
include:

- Establishing procedures and guidelines to
  achieve Metro ~~Rail~~ safety and performance goals
  Red line

- Assessing operations personnel requirements and
  ensuring the availability of properly trained
  staff; as part of this duty, the Manager will
  administer the training program for operations
  staff

Red line

- Ensuring that the Metro ~~Rail~~ operations organization has clear lines of responsibility and communication

- Arranging for the provision of up-to-date operating manuals and rulebooks for operations staff. _Red line_

The Division Manager-Metro ~~Rail~~ Operations will be on duty during normal working hours at the transportation offices located on the second floor of the Main Shop building, and will be on call at all times for emergencies.

4.1.3 Rail Support

Support to SCRTD management will be provided by personnel within the Transportation Department, whose responsibilities will include analyzing operating statistics to identify problems and/or opportunities for service improvements, and preparing reports required by SCRTD management or outside agencies.

4.1.4 Instructors

Red line

Instructors, under the direction of the Division Manager-Metro ~~Rail~~ Operations, will train operations personnel in the safe and efficient performance of their duties. Instructors, as noted previously, will hold the official title of Transportation Operations Supervisor (TOS)-Rail. Therefore, while certain TOSs will serve as a dedicated staff of Instructors, Line Supervisors and other TOSs may as necessary fill in as Instructors. Conversely, when conditions so require, Instructors may be sent out to serve as Line Supervisors or other TOSs.

Red line

4.2 METRO ~~RAIL~~ OPERATIONS SUPERVISORS

Metro ~~Rail~~ operations staff will be directed by the Operations Supervisor and the Division Dispatcher. The split in authority between these two supervisors is clearly defined. The Operations Supervisor will have authority over all mainline train movements and over operations personnel. The Division Dispatcher will be responsible for ensuring the availability of sufficient operations personnel to meet service requirements; for supervising "extra board" personnel; and for maintaining payroll records. The duties of the Operations Supervisor and the Division Dispatcher are described below.

4.2.1 Operations Supervisor

The Operations Supervisor will be the principal decision-maker on moment-to-moment problems affecting rail operations, patron safety, and system performance. The Operations Supervisor will be authorized to make a wide variety of decisions and commitments affecting Metro Rail [Red Line] operations. Furthermore, the Operations Supervisor will control the resources to identify and correct or compensate for abnormal occurrences. For the MOS-1 system, one Operations Supervisor will be on duty in the RCC at all times. The duties of the Operations Supervisor will include:

- Supervising Metro Rail [Red Line] operations by directing the activities of the Yard Dispatcher, Train Dispatcher, Line Supervisors, Train Operators, Station Agents, and CCTV Operators

- Directing schedule adjustments to minimize patron delays during service disruptions

- When necessary, ensuring that police, fire, ambulance, and maintenance organizations are promptly notified that support services are required

- Determining the procedures to be implemented during emergency situations, in accordance with the requirements of the Emergency Preparedness Plan and in conjunction with the responsible emergency response agency; and directing the response of Metro Rail [Red Line] operations staff

- Ensuring that light rail operations personnel are aware of hazardous conditions in the 7th/ Flower Station or adjacent trainways that may affect light rail operations. The Operations Supervisor will also coordinate the response to those conditions

- Ensuring that bus operations personnel are notified of conditions that will affect bus scheduling or require alternative service[3]

---

3 Alternative service cannot be instituted rapidly and will therefore be used only when a failure on the Metro Rail system [Red Line] is likely to interrupt service for an extended period of time.

- Recommending changes to operating procedures to improve Metro ~~Rail~~ service and response to emergency conditions _Red Line_

In addition, as noted previously, on the MOS-1 system the Operations Supervisor will perform the functions of Communications Controller. These duties include:

- Monitoring equipment status and fire, life safety, and security alarms

- Controlling the status of certain equipment, such as ticket vending machines

- Supervising Station Agents, including monitoring their reporting in and out and informing the Division Dispatcher of the status of station staffing for each shift

- Receiving calls made from emergency telephones in the Metro ~~Rail system~~ _Red line_

- Making public address announcements to inform patrons of service disruptions and schedule changes

- Informing the Maintenance Control Center (see Chapter 10.0) of conditions requiring maintenance on Metro ~~Rail~~ equipment and emergency systems _Red line_

- Monitoring and supporting field maintenance work, including control of work trains and the traction power subsystem during non-revenue service hours.

4.2.2 Division Dispatcher

The Division Dispatcher will be responsible for ensuring the availability of sufficient operations personnel to meet service requirements. One Division Dispatcher will be on duty during all shifts. The Division Dispatcher, who will be located in the Main Shop building, will have major responsibilities that include:

- Checking that personnel report for work and leave as scheduled

- Making provisions to ensure no shift or location is left unstaffed

- Supervising unassigned Train Operators

- Informing mainline Train Operators of their train equipment number and its location in the yard

- Arranging transportation for personnel to and from the yard and their assigned work locations

- Maintaining payroll records.

4.3 COMMUNICATIONS AND CONTROL PERSONNEL

This section discusses the responsibilities of the Yard Dispatcher, Train Dispatcher, and CCTV Operators.

4.3.1 Yard Dispatcher

The Yard Dispatcher will be stationed in the Yard Tower and will be responsible for all train movements in the yard and for dispatching trains to the mainline to meet schedule requirements. One Yard Dispatcher will be on duty at all times. The Yard Dispatcher's duties will include:

- Directing train consist make-up and assigning revenue-service run numbers

- Directing the train movement activities of Train Operators who are assigned to the yard

- Planning and coordinating with the Equipment Maintenance Department's Main Shop Supervisor for the transfer of vehicles between storage and shop

- Monitoring and controlling the traction power system in the yard

- Preparing routes between the mainline transfer point and storage or shop locations

- Coordinating with the Train Dispatcher for unscheduled train movements to and from the mainline transfer point

- Notifying the Train Dispatcher of any incidents or conditions that might affect train service

- Responding to changes in service schedules resulting from abnormal operations

- If required, informing the Division Dispatcher of additional Train Operators required for yard duty

- Informing the Maintenance Control Center (see Chapter 10.0) of conditions or equipment in the yard requiring maintenance

- Receiving calls made from emergency telephones in the yard

- Coordinating the response to yard emergencies with the RCC.

4.3.2   Train Dispatcher

The Train Dispatcher, located in the RCC, will monitor all mainline operations to ensure that schedules and service levels are maintained and to implement corrective actions during service disruptions. The Train Dispatcher will be directed by, and work closely with, the Operations Supervisor.

Normally, one Train Dispatcher will be on duty during all revenue hours and will serve as the primary point of communications and coordination between the RCC and mainline Train Operators. The Train Dispatcher's responsibilities will include:

- Monitoring train movement on the mainline and at the transfer point to the yard

- Monitoring and controlling traction power and auxiliary power systems on the mainline

- Implementing corrective action plans (including temporary schedule and route changes) to accommodate equipment failures, operating staff errors, or other perturbations

- Communicating with Train Operators to obtain information on problems with train functions, patron behavior, and track conditions

- Providing direction to Train Operators regarding troubleshooting and corrective action for in-service equipment failures

- Instructing Train Operators on manual control actions to be taken

- Monitoring and supervising the dispatching of trains from transfer and terminal points

- Coordinating with the Yard Dispatcher for unscheduled train movements to and from the transfer point

- Notifying the Operations Supervisor of reports of abnormal conditions

- Notifying the Maintenance Control Center (see Chapter 10.0) of all in-service failures to rail vehicles, train control equipment, and mainline power distribution equipment

- Coordinating with the light rail control center in response to abnormal conditions in the 7th/ Flower Station

- Advising Line Supervisors, when on site, of strategies for the management of abnormal operations

- Logging reports on operations and incidents on the mainline.

4.3.3 Closed-Circuit Television Operators

Closed-Circuit Television (CCTV) Operators will be responsible for monitoring selected station areas and for informing the Operations Supervisor and/or the Transit Police Radio Dispatcher of abnormal conditions. CCTV Operators will staff the RCC at all times, although the number on duty will vary according to Metro Rail service levels. The duties of CCTV Operators will include:

- Monitoring patron flows and activities

- Using the patron assistance intercom to assist patrons requiring information and/or having problems with fare collection equipment

- Making public address announcements at stations to inform, assist, direct, or warn patrons observed on the CCTV

- Receiving calls made from publicly available emergency telephones in the patron areas of stations and forwarding relevant calls to the Operations Supervisor for emergency response coordination

- Advising the Operations Supervisor of over-
  crowding or other situations that may affect
  safety or service

- Advising the Operations Supervisor of failures
  in fare collection, CCTV, or voice communications
  equipment

- Reporting security incidents to the Police Radio
  Dispatcher.

4.4 OPERATIONS PERSONNEL

Staff members who will be located in the field and
will be directly involved in the operation of Metro Rail ~~Red Line~~
trains and stations are discussed in this section. They
are the Line Supervisors, Train Operators, and Station
Agents.

4.4.1 Line Supervisors

Red Line

Line Supervisors will rove the Metro ~~Rail System,~~
providing on-site supervision of station and train opera-
tions and field response to abnormal events affecting
operations. Line Supervisors will be qualified to operate
Red Line Metro ~~Rail~~ trains and will be able to relieve Train
Operators in emergency situations. Reporting functionally
to the Operations Supervisor, Line Supervisors will have
the following duties:

- Monitoring Train Operator performance and
  enforcing operating rules

- Monitoring and coordinating service at terminal
  and midline stations

- Directing and assisting Train Operators during
  equipment or service disruptions, including
  helping in reverse or storage maneuvers

- Monitoring Station Agent performance and
  directing and assisting Station Agents as
  necessary

- As necessary, fulfilling the duties of Station
  Agents at unattended stations

- Reporting abnormal conditions to the Operations
  Supervisor

- Providing limited troubleshooting of failures to
  vehicle and station equipment

- Assisting in the response to emergencies and managing station evacuation procedures, as directed by the RCC.

Line Supervisors will be deployed during all Metro ~~Rail~~ operating hours, although the number on duty will vary according to overall service levels.

[handwritten in left margin: Red Line]

4.4.2 Train Operators

Train Operators will be responsible for the safe operation of trains, on the mainline and in the yard, in accordance with service and performance standards, rules, operating procedures, and schedule. Train Operators will perform the following duties:

- Operating trains on the mainline in the mode specified by the Train Dispatcher or Line Supervisor

- Obeying wayside signals and speed command indications when operating trains in the manual mode

- Ensuring that trains are correctly berthed at a station before opening doors, and ensuring that all doors are properly closed before the train leaves a station

- Accepting, acknowledging, and responding to the instructions of the Train Dispatcher, Line Supervisors, or Yard Dispatcher

- Responding to emergency situations on trains so as to minimize injuries, damage to equipment, and disruption to service

- Ensuring the safety of patrons, staff, and the general public at all times

- Informing the Train Dispatcher of equipment problems or abnormal conditions on the mainline

- Diagnosing and correcting minor equipment faults, with assistance from RCC staff

- During yard assignments, making up train consists and moving trains as directed by the Yard Dispatcher

- During yard assignments, checking to ensure that the assigned train is ready for passenger service before it is dispatched, and informing the Yard Dispatcher of any problems

- When emergency conditions prevail, responding to the directions of RCC personnel or Line Supervisors or, when conditions warrant, responding directly to on-site emergency response agency personnel.

Train Operators with assignments will report to the Division Dispatcher in the Main Shop for mainline or yard duty. Unassigned extra-board Train Operators will report to the Division Dispatcher to await assignment. No distinction will be made in the qualifications or responsibilities of Train Operators assigned to the mainline or the yard. Train Operators must be prepared to undertake any train operating assignment necessary to provide Metro ~~Rail~~ service.

Red line

4.4.3 Station Agents'

Red line

Metro ~~Rail~~ stations will be equipped for attended and unattended operation. For planning purposes, it is assumed that all MOS-1 stations will be unattended, except for the 7th/Flower Station. The 7th/Flower Station will be the transfer point between the Metro ~~Rail~~ and Long Beach-Los Angeles ~~Light Rail~~ line. Given the complexities of this ~~transfer~~ station, one Station Agent will be on duty at the station during each of the two daytime shifts to assist patrons and monitor conditions within the station. The Station Agents will report to the Operations Supervisor. Their duties will include:

Blue

- Monitoring passenger flow and activities

- Reversing escalator direction to accommodate changes in passenger flows

- Assisting patrons requiring information or having difficulty with fare collection equipment

- Clearing minor coin or ticket jams in fare collection equipment

- Making public address announcements at the station to inform, assist, direct, or warn patrons

- Responding to the directions of the Operations Supervisor or Line Supervisors

- Advising the Operations Supervisor of over-crowding or other situations that might affect safety or train operations

- Advising the Operations Supervisor of failures in fare collection or other station equipment

- When emergency conditions prevail, responding to the directions of the Operations Supervisor or Line Supervisors, or, when conditions warrant, responding directly to on-site emergency response agency personnel.

Station Agents will report directly to the 7th/Flower Station and will notify the Operations Supervisor by telephone of their arrival and departure at the start and end of a shift.

4.5 SECURITY PERSONNEL

Redline

To ensure a secure environment for Metro Rail patrons, the SCRTD Transit Police will have their responsibilities expanded to include rail system law enforcement. The Transit Police Dispatch Center will serve as the central location for monitoring and directing the daily activities of Transit Police personnel roving the SCRTD's bus and rail systems. The following Transit Police staff will work closely with the rail operations staff to provide fare collection enforcement and to ensure the security of Metro Rail patrons, employees, and property.

4.5.1 Captain-Rail Operations

The Transit Police Captain-Rail Operations will report to the Assistant Transit Police Chief and will be responsible for the administration and coordination of security personnel assigned to the Metro Rail and light rail systems. The Captain-Rail Operations will be located at the Transit Police Headquarters and will have the following major duties:

- Implementing the policy direction of SCRTD management, as directed by the SCRTD Transit Police Chief

- Providing administrative direction to enhance the security of the light rail and Metro Rail systems

- Developing and implementing strategies for fare inspection

- Assigning Fare Inspectors, Security Guards, and Transit Police Officers throughout the Metro ~~Rail~~ *Red Line* and light rail systems.

4.5.2 Police Watch Commander/Lieutenant

The Police Watch Commander is currently the ranking officer on duty and as such provides direction to all SCRTD Security Guards and Transit Police Officers on duty. With the advent of light rail and Metro ~~Rail~~ operations, the Watch Commander will be responsible for supervising all security personnel on duty in the SCRTD bus/rail system, including Fare Inspectors. One Watch Commander will be on duty in the Transit Police Dispatch Center during each shift. Metro ~~Rail~~-related *Red Line* duties of the Watch Commander will include:

- Directing the response to security incidents which occur on the Metro Rail system

- Coordinating closely with the Operations Supervisor and other RCC staff to ensure patron, employee, and property safety and security

- Coordinating with other law enforcement and security agencies to respond to security incidents.

4.5.3 Police Radio Dispatcher

Police Radio Dispatchers will be responsible for communications with all Transit Police forces. The Radio Dispatchers' main duties for the Metro ~~Rail system~~ *Red Line* will include:

- Receiving and transmitting direction and/or information concerning Metro ~~Rail~~ *Red Line* security incidents

- Providing advice to Metro ~~Rail~~ staff involved in security incidents

- Dispatching Transit Police Officers to the location of security incidents

- Coordinating with the Operations Supervisor and CCTV Operators in responding to security incidents.

During the day and evening shifts, a Radio Dispatcher will be dedicated to monitoring and coordinating Transit Police activity in the rail system. At night, a Radio

Dispatcher may cover both bus and rail system activities. An Auxiliary Dispatcher will be present at all times to answer telephone calls and handle other duties in support of the radio dispatch function.

4.5.4   Sergeant

Transit Police Sergeants will provide first-line supervision to all Metro Rail-assigned Transit Police personnel on duty, including Transit Police Officers, Investigators, Security Guards, and Fare Inspectors.   One Sergeant will be on duty during each shift.   The Sergeant's Metro Rail-related duties will include:

  Checking in personnel reporting for duty. (Field checks will be conducted of Security Guards reporting directly to the Metro Rail yard and shops.)

- Providing field supervision of personnel on duty.

Current plans call for the Sergeant to have an office in an as-yet-unspecified location in downtown Los Angeles.   When in the field, the Sergeant's presence will augment security coverage of the Metro Rail system provided by Officers and Investigators.

4.5.5   Transit Police Officers and Investigators

Transit Police Officers and Investigators, who are senior in rank to the Officers, will be assigned to rove the Metro Rail system to monitor operations and quickly respond to security incidents.   The principal responsibilities of these personnel will be:

- Patrolling the Metro Rail system to deter crime

- Assisting Fare Inspectors, when necessary

- Arresting suspects for violation of laws and SCRTD ordinances

- Responding to directions received from the Police Radio Dispatcher or Transit Police Sergeant

- Opening and closing Metro Rail stations at the start and end of the operating day.

These sworn officers may be assigned to work in uniform or undercover. Transit Police Officers and Investigators assigned to Metro Rail duty report to the Sergeant in charge of Metro Rail-assigned personnel.

Red line

4.5.6 Fare Inspectors

Because a self-service, barrier-free fare collection system will be implemented on a trial basis on the MOS-1 system, Fare Inspectors will be used to monitor and ensure patron compliance with fare requirements. Although Fare Inspectors will not be sworn officers, they will be members of the Transit Police organization and will be given some police powers. Fare Inspectors will be assigned by the Captain-Rail Operations and will report to the Sergeant in charge of Metro Rail-assigned personnel. The principal duties of Fare Inspectors will include:

Red line

- Assisting Metro Rail passengers requiring information or having difficulty with the fare collection system

- Conducting random checks of patrons' proof-of-payment in the paid area of station mezzanines, on station platforms, and aboard rail vehicles

- Capturing invalid fare media

- Issuing citations to fare evaders

- Notifying the Transit Police Dispatcher when habitual fare evaders for whom warrants have been issued are encountered, or when other security problems are identified

- Notifying the RCC of any observed facility or equipment problems.

The number of Fare Inspectors on duty within the rail system will vary depending on time of day and the fare inspection strategies developed by the Captain-Rail Operations. For example, the number of inspectors may be increased at certain times of the operating day to respond to increased passenger levels, may be concentrated from time to time at specific locations to provide saturation checking, or may be fairly evenly dispersed throughout the rail system.

4.5.7 Security Guards

Security Guards will be members of the Transit Police organization and will be assigned to provide security to

revenue operations and at the Metro Rail yard and shops area. *Red line*

Security Guards will typically report directly to the locations to which they have been assigned. Security Guards will:

- Staff the guardhouse at the main entrance to the Metro Rail yard and shops area *Red line*

- Patrol the perimeter of the Metro Rail yard and shops area

- Accompany Equipment Servicers during revenue servicing of rail station fare collection equipment (see Chapter 8.0)

- Provide security at the central cash-counting facility and the ticket stockroom at SCRTD headquarters, as they presently do (see Chapter 9.0).

LA1171016R

5.0 EQUIPMENT FOR SYSTEM OPERATIONS

5.0 EQUIPMENT FOR SYSTEM OPERATIONS

Red Line

The Metro ~~Rail system~~ will require equipment to provide train protection, to control train movements, to supervise train schedules, to monitor and control fixed facilities, and to ensure a timely exchange of information among all elements of the system. This equipment will be installed in many locations: on vehicles, in tunnels, in stations, in the RCC, and in the yard. This chapter first provides a brief overview of the control and communications *Red Line* equipment that will be required for Metro ~~Rail~~ operations, and then describes the specific equipment that will be installed at each major location within the system.

5.1 OVERVIEW

Automatic train control equipment and a variety of communications equipment will enable operating personnel *Red Line* to constantly monitor and control the operation of Metro ~~Rail~~ trains, stations, subsystems, and equipment. The types and functions of the control and communications equipment that will be used are summarized below.

5.1.1 Train Control Equipment

Red Line Metro ~~Rail~~ trains will normally operate on the mainline and between the transfer point and the mainline under the control of Automatic Train Control (ATC) equipment. ATC equipment will perform the functions of Automatic Train Protection (ATP), Automatic Train Operation (ATO), and Automatic Train Supervision (ATS). These functions will enforce train safety, control train motion, and permit supervision of train operations on the mainline. The ATP function will ensure safe train operation; the ATO and ATS functions will be entirely subordinate to the ATP function. Each is discussed below.

ATP equipment will enforce train safety. The equipment will:

- Enforce speed limits through the use of speed codes along the track, causing the service brakes to be applied whenever a train exceeds the safe speed limit

- Provide brake assurance by commanding the emergency brakes to be applied whenever deceleration is commanded but not confirmed

- Generate track occupancy data to ensure the establishment of safe speed profiles for following trains

- Prevent conflicting train routings or movements

- Ensure safe separation of trains

- Detect broken rails

- Prevent a Train Operator from opening doors unless a train is stopped, and prevent a train from moving when vehicle doors are open.

ATO equipment will control train movements. The equipment will:

- Automatically regulate speed by controlling propulsion and brake equipment when a train is operating in the ATO mode

- Perform programmed station stopping functions when a train is operating in the ATO mode

- Perform berthing verification at station platforms.

ATS equipment will support the monitoring and direction of train operations. The equipment will:

- Communicate train identity, destination, and status information via the train-to-wayside radio

- Communicate dwell-expired signals via the train-to-wayside radio

- Store and transmit route requests consistent with interlocking availability

- Enable local control of interlockings and other remotely commanded equipment

- Adjust station dwell time by transmitting changes from the RCC to the vehicle

- Provide routing through interlockings, including alternate routing at turnback zones.

The ATS equipment design includes a provision for automatic modification of train performance levels to respond to schedule delays. This feature will not be used in initial system operations; however, controls in the passenger vehicle cab will enable the Train Operator to manually set performance levels.

ATC-related equipment will be located on passenger vehicles, along the wayside, in train control and communications (TC&C) rooms, in the RCC, and in the yard. Data will be transmitted to and from the equipment at these various locations and the Supervisory Control and Data Acquisition (SCADA) subsystem by the Cable Transmission subsystem (CTS).

Within the RCC will be the SCADA ATC-related displays and controls necessary for remote supervision of train operations on the mainline and at the transfer point to the yard. Control signals from the RCC will be transmitted by the SCADA subsystem to remote terminals in station TC&C rooms, and thence to wayside and passenger vehicle ATC equipment. Operating data will be transmitted back to the RCC via the same link. Local control panels within the station TC&C rooms will enable manual operation in the event of loss of remote control from the RCC.

ATC-related equipment will be installed in the yard to enable the Yard Dispatcher to monitor and control train movements to and from, and within, the yard.

5.1.2 Communications Equipment

Elements of the communications system that will be used in support of Metro ~~Rail~~ *Red Line* operations will include the following:

- Radio subsystem, including mobile and portable radios, to provide two-way voice and data communication among fixed facilities, passenger and maintenance rail vehicles, other mobile equipment, and line and yard personnel

- PABX telephone subsystem, to provide administrative and emergency telephone service and Passenger Assistance Intercom (PAI) communications

- Public Address (PA) subsystem, for announcements in stations, vehicles, the RCC, and the yard

- Closed-Circuit TV (CCTV) subsystem, to display selected station areas to CCTV Operators and the Operations Supervisor in the RCC, and to the Transit Police Dispatcher in the Transit Police Dispatch Center

- Cable Transmission subsystem, to serve as the primary transmission medium between the RCC and other locations

- Supervisory Control and Data Acquisition (SCADA) subsystem, to remotely control and monitor operating subsystems of Metro Rail

- Gas Monitoring and Seismic Activity Detection subsystem, to alert RCC staff to potentially hazardous conditions

- Fire and Emergency Management subsystem, to provide system-wide detection and reporting for management and control of fire, other emergency, and security incidents

- Power subsystem, to provide uninterrupted power for communications equipment.

Components of these communications systems, as well as ATC-related equipment, will be located on Metro ~~Rail~~ Red Line passenger vehicles and in tunnels, stations, the RCC, and the yard. Equipment at each of these locations is described in the following sections of this chapter.

5.2 PASSENGER VEHICLE EQUIPMENT Red Line

ATC-related equipment on Metro ~~Rail~~ passenger vehicles will include relays, tachometer, antennas, and logic circuits to control the traction motors, brakes, and doors. Within the cab of each vehicle will be the Train Operator's console, which will include a speedometer, speed limit readout, manual controller, control mode switches, emergency stop controls, indicators, overspeed alarm, and sealed bypass switches and cutouts. The control mode switches will enable the Train Operator to select either ATO mode or a manual mode of operations, as follows:

- Automatic (ATO) Mode. This mode will provide automatic train operation under full ATP. ATO Red Line will be the normal mode for mainline Metro ~~Rail~~ operations. In the ATO mode, the vehicle ATO equipment will regulate the speed of the train to conform with the ATP speed limit. Station

stops and command speed changes will occur automatically.

- Manual (MTO) Mode. This mode will normally provide manual train operation with full ATP and Train Operator regulation of train speed below the ATP speed limit. In addition, MTO has three submodes:

  - Restricted Manual Submode. When no command speed is being received by the vehicle equipment and the MTO mode has been selected, this submode will restrict train speed to a maximum of 10 mph. It can be selected only after the vehicle has been fully stopped. It will be the normal mode for yard operations.

  - Wash/Couple Submode. Train speed will be automatically regulated to approximately 2 mph in this submode. The manual controller must be in the "full service brake" position and the Wash/Couple pushbutton must be depressed. This submode will also permit limited reverse motion of up to 9 feet during uncoupling operations. The Automatic Uncouple pushbutton must be depressed for this activity.

  - Emergency Manual Operation (EMO) Submode. This submode will be used as a failure recovery means when a train is not operable because of an ATP failure. Train speed in the EMO submode will be limited to 25 mph. To enter this submode, the mode selection switch on the Train Operator's console must be in the "Manual" position, and a sealed ATP bypass switch in the cab must be activated.

A pushbutton on the operator's console will allow the Train Operator to command an emergency brake application in any of the above modes. The command for an emergency brake application cannot be canceled after the pushbutton has been depressed.

Except in the ATO mode and the Wash/Couple submode, the Train Operator will control train movement by operation of the manual controller, which will have an integral "deadman" switch. This switch must be continuously activated by the Train Operator to avoid a brake application.

Red Line

In addition to the above ATC-related equipment, Metro
~~Rail~~ trains will contain communications equipment to
permit the Train Operator to communicate with the Train
Dispatcher or Yard Dispatcher, with Line Supervisors, and
with train passengers. The cab will contain a
communications control panel for operating the train
radio, the train PA system, the patron intercom, and the
cab-to-cab intercom; there will also be a patch-through
capability for RCC-to-train PA announcements. The Train
Operator will normally use a portable radio for voice
communications with the RCC; the train radio will
primarily be used for data transmission, but will be
available as a back-up means of voice communication should
the portable radio fail. The Train Operator will use the
intercoms and PA system as needed to respond to passenger
needs and RCC direction.

Within the passenger area of vehicles will be PA
speakers and patron intercom units. The patron intercom
units will enable patrons to contact the Train Operator.
Patrons will press a button to signal the Train Operator,
who will accept the call by acknowledging the signal. The
passenger area will also contain, at each set of doors,
controls that will allow the Train Operator to cut out and
lock the doors.

5.3 WAYSIDE EQUIPMENT

Wayside ATC equipment will include block track
circuits, antennas, track switch controller circuits and
indicators, wayside signal lights, and, on the mainline,
station stopping apparatus. This equipment will provide
position information and will relay information to and
from Metro ~~Rail~~ trains. Emergency trip stations will be
located throughout the Metro ~~Rail system~~. These stations
will each contain a multifunction Metro Rail telephone
providing administrative and emergency telephone service;
a fire services telephone (FTEL) jack[1]; and a pushbutton
for de-energizing traction power in the local power zone.
Additional FTEL jacks will be located in tunnels, cross
passages, traction power substations, and other key
locations.

5.4 STATION EQUIPMENT

Red Line

Metro ~~Rail~~ stations will contain a variety of control
and communications equipment, much of which will be
centered at Emergency Management Panels (EMPs) and Command

---

1 FTEL equipment is provided as part of the Fire and
   Emergency Management subsystem.

Posts. EMPs will be located near the main entrance of each station; Command Posts will be located at all other station entrances.

Each EMP will contain a multifunction Metro Rail telephone, providing administrative and emergency service; a PA microphone; and two FTEL handsets for access to the right and left tunnel circuits. Controls will enable connecting FTEL circuits with other telephone circuits. The EMP will also include ventilation controls; escalator and elevator controls; annunciators for gas, seismic, and fire alarms; and fare collection and door intrusion alarms. All indications and alarms will be sent to the RCC except door intrusion alarms, which will be sent to the Transit Police Dispatch Center for security response. Each Command Post will include a PA microphone, a multifunction Metro Rail telephone, two FTEL handsets, and escalator and elevator controls.

A hands-free Passenger Assistance Intercom (PAI) will be located on each station mezzanine adjacent to Metro Rail ticket vending machines. In addition, the public areas of Metro Rail stations will contain CCTV cameras for surveillance, PA speakers, pay telephones, and emergency telephone sets. A patron seeking assistance will use a PAI, while a patron with an emergency may use either a PAI or an emergency telephone. Emergency trip stations will be located at the platform ends of stations.

Intrusion alarms will be located on specific doors and on fare collection equipment.

ATC-related equipment, including remote SCADA terminals, will be housed in the TC&C rooms of stations. Control panels in these rooms will enable manual control of local equipment in the event of loss of remote control functions from the RCC.

5.5 RCC EQUIPMENT

The RCC, located on the second floor of the Main Shop building, will serve as the nerve center of the Metro Rail (sic) system and will contain the displays, controls, and communications equipment necessary for central supervision and control of system operations. This equipment will include control consoles for the Train Dispatcher, Operations Supervisor, and Communications Controller; and CCTV Operator consoles. As was noted previously, the position of Communications Controller will be deferred for MOS-1. The Operations Supervisor will fulfill the functions of the Communications Controller for the MOS-1 system and will, therefore, be seated at the System Communications console.

The RCC facility will also contain two central SCADA computers (primary and back-up), SCADA printers, fare collection microcomputers, associated data transmission equipment, and standby power support equipment to ensure an uninterruptible power supply.

The design of the RCC provides for the possible future addition of a system status board. The system status board will provide a dynamic representation of the status of the ATC system and the traction power contact rail for mainline track and yard leads. The board will be used to monitor the operation of trains and will be positioned such that an unobstructed view will be available from the Train Dispatcher and Operations Supervisor consoles. For MOS-1, the CRT units at the consoles will fulfill the function of the system status board.

5.5.1 Train Dispatcher Console

Equipment at the Train Dispatcher console will allow the Train Dispatcher to execute all ATC and mainline traction power system control actions and to monitor operations on the mainline and at the transfer point to the yard. The Train Dispatcher console will contain one workstation. A second Train Dispatcher console may be added in the future as the system expands and if conditions warrant. The Train Dispatcher console will be designed to be operated from a seated position, as will all other consoles within the RCC.

Equipment at the Train Dispatcher console will include:

- Two SCADA CRT units with data and graphics capability to provide detailed line or power section schematics and to display system status messages and acknowledge Train Dispatcher commands of switches, signals, train performance, power distribution system components, etc.

- A keyboard to provide control of switches, signals, train performance, and power distribution system equipment.

- Electronic telephone set with alphanumeric display. This equipment will function as a communications keyboard, providing control over radio, telephone, and RCC intercom. As a telephone, it will provide access to administrative telephone lines; as an intercom,

it will provide direct-line communications to the Yard Tower, as well as to other consoles in the RCC.

- Radio channel(s) speaker to give selected radio channel audio while the Train Dispatcher is using another communications medium.

The CRTs at the Train Dispatcher console will permit display of such indications as:

- Track occupancy and track circuit indications for a requested line section, with the identification number of each train.

- Route alignment and traffic direction for a requested line section; approach interlocking limits; switch correspondence; and fixed signal aspects.

- Requests for transfer of control to local control panels.

- Mode and status of terminal dispatch equipment and trains.

- System and subsystem alarms.

The Train Dispatcher will be able to display the entire system, or any portion of the system, on the CRTs.

5.5.2 System Communications Console

The System Communications console will be the focal point for control of Metro Rail communications, supervision of station operations and equipment, and monitoring of fire and life safety equipment throughout the system. The System Communications console will contain two workstations. On the MOS-1 system, one workstation will be staffed at all times by the Operations Supervisor. The other workstation will serve as a Fire Department Liaison position and may be staffed by Fire Department or other emergency-response agency personnel during emergencies.

The equipment at each workstation will include:

- Two SCADA CRT units with data and graphics capability to provide detailed system schematics and/or diagrams, to display system status messages and acknowledge commands, and to enable incident data to be entered.

- CCTV call-up monitor to permit viewing of selected station areas.

- A keyboard to provide system and subsystem control for equipment at stations and other facilities and to control image display on the CCTV call-up monitor.

- Electronic telephone set with alphanumeric display. This equipment will function as a communications keyboard providing control over radio, PA, RCC intercom, and telephone. As a telephone, it will provide access to administrative and emergency telephone lines, and will provide displays of emergency telephone and PAI calls to indicate the origin of the call. The equipment will also provide direct-line communications to key SCRTD operations and maintenance offices and to area emergency service agencies.

- Two speakers, one for selected radio channel(s) audio and the other for audio on those radio channel(s) not selected at the console.

- PA system announcement recording and broadcast equipment to allow the Operations Supervisor to create a message and broadcast it to designated station(s).

The CRTs at each workstation will provide status and alarm displays and access to control functions for selected equipment and subsystems, including the following:

- Status display and alarms for the Gas Monitoring and Seismic Activity Detection subsystem, Fire and Emergency Management subsystem, fare collection equipment, station elevators and escalators, station and mid-tunnel ventilation equipment, AC power supply equipment, and intrusion detectors.

- Remote controls for fare collection equipment, gas monitoring equipment, ventilating equipment, fire suppression equipment, and AC power equipment.

In addition, the CRTs at the workstation staffed by the Operations Supervisor will provide the capability for performing all Train Dispatcher functions. (This capability will not be provided at the Fire Department Liaison Position.) Adjacent to the System Communications

console will be a fare collection microcomputer which will enable the Operations Supervisor to access information on the operational status of station ticket vending machines.

5.5.3 Operations Supervisor Console

The Operations Supervisor console will contain a single workstation with equipment similar to that at the Train Dispatcher console. The Operations Supervisor console will not normally be used on the MOS-1 system, but will serve as back-up equipment in case of failure at other consoles.

5.5.4 CCTV Operator Consoles

Closed-circuit television will be used to monitor station conditions. Two CCTV Operator consoles will be provided for MOS-1: one console will have two workstations, and the other will have one workstation. Each workstation will be equipped with 12 CCTV monitors and a large call-up monitor. There will be provisions for switching selected station video to any workstation monitor. In addition, the equipment at each CCTV Operator workstation will include:

- A keyboard to control image display on CCTV monitors

- Electronic telephone set. This equipment will provide the CCTV Operator with control of station PA equipment, the RCC intercom, and emergency and administrative telephone lines. It will provide displays of PAI and emergency telephone calls and allow the CCTV Operator to handle the call or redirect it as necessary.

- PA system announcement recording and broadcast equipment which will allow the CCTV Operator to record the required message and broadcast it to the designated station(s).

In addition to this equipment, a fare collection microcomputer will be available to CCTV Operators to enable them to confirm patron reports of problems with ticket vending machines.

For MOS-1, during system operating hours, two CCTV Operators will staff the CCTV Operator consoles. One CCTV Operator will monitor two stations at the one-workstation console, while the other Operator will monitor the 7th/Flower Station and the remaining two MOS-1 stations at the two-workstation console. Six CCTV monitors will be

(Red Line & Blue Line

used to observe each station, except for the 7th/Flower
Station, which will require 12 monitors to cover both the
~~light rail and~~ Metro ~~Rail~~ areas of that transfer station.
The monitors will normally be used to cover activity on
the platforms and at the ticket vending arrays on the
mezzanines, although the CCTV Operators will be able to
switch the monitors to other CCTV cameras in the stations.

In the non-revenue period when MOS-1 stations are
closed, one CCTV Operator will be sufficient. The monitors
will normally be switched to CCTV cameras covering the locked
station entrances. If the 7th/Flower Station remains open
for light rail operations, the CCTV Operator will continue
to monitor mezzanine and platform activity.

the   Red Line

When Metro ~~Rail~~ is extended beyond MOS-1 and station
activity increases, additional CCTV workstations will be
installed. Each CCTV workstation will then be staffed by
a CCTV Operator who will monitor two stations.

5.6   TRANSIT POLICE DISPATCH CENTER EQUIPMENT

Within the Transit Police Dispatch Center at Imperial
Station on the Long Beach-Los Angeles ~~light rail~~ line will
be a Police Radio Dispatcher console.   *Blue*

The Police Radio Dispatcher console will be equipped
with:

- Transit Police Incident Processing CRT to
  display incident data, and a keyboard to control
  the CRT and to enter incident data.

- A CRT to display intrusion detection alarms, and
  a controlled-access system keyboard.

- A computer terminal to provide access to the
  California Crime Information Service and the
  National Crime Information Service.

- Electronic telephone set with alphanumeric
  display. This equipment will function as the
  communications keyboard providing Police Radio
  Dispatcher control of radio, intercom, and
  telephone. It will provide access to
  administrative and emergency telephone and PAI
  lines, and direct-line access to area emergency
  service agencies.

- Selected radio channel(s) speaker to provide
  radio channel audio when the Police Radio
  Dispatcher is using another communications
  medium.

- CCTV call-up monitor to permit viewing of selected station activity.

5.7 YARD EQUIPMENT

The Yard Tower will be located atop the Main Shop building. Within the Yard Tower will be a console for the Yard Dispatcher with the displays, controls, and communications equipment needed to monitor and coordinate the movement of trains entering and exiting the yard, and also to monitor and coordinate train movement within the yard. The Yard Dispatcher console will have a single workstation which will include a SCADA CRT and keyboard control and will provide displays and alarms of, and controls for, the yard ATC and traction power systems. Routes within the yard will be established by activating pushbuttons on the console that identify the entrance and exit of the desired route.

An electronic telephone set with alphanumeric display will provide the Yard Dispatcher with control of radio, administrative and emergency telephone, intercom, and yard PA functions. A separate yard operations radio channel will be provided by the radio subsystem. A radio channel speaker will enable the Yard Dispatcher to monitor yard radio audio while using another communications medium.

Also within the Main Shop building will be the Division Dispatcher's office. The Division Dispatcher will be provided with an electronic telephone set and with a SCADA terminal.

Emergency trip stations will be located throughout the yard, each containing an emergency telephone handset and a pushbutton to de-energize traction power in the local power zone. In addition, PA speakers will be located in the yard.

At the main entrance to the yard and shops area, off Santa Fe Avenue, will be a guardhouse equipped with a multifunction telephone.

LA1171017R

6.0 NORMAL SYSTEM OPERATIONS

6.0 NORMAL SYSTEM OPERATIONS

Red Line

Chapter 6.0 describes the activities necessary to provide passenger service according to the planned Metro ~~Rail~~ operating schedule. The detailed operating schedule is described in Chapter 3.0 of this plan.

Daily Metro ~~Rail~~ *Red Line* operation will consist of three phases:

- System opening
- Revenue operations
- System shutdown.

Each of these phases is described in the following sections of this chapter. There is some overlap among the phases. The nature of rail transit operations requires that the number of trains in revenue service must be varied according to passenger demand. Accordingly, trains will be introduced into, or removed from, revenue service operations throughout the day. Those portions of the plan that describe the introduction or removal of trains from service, and staff reporting and checkout, can apply to each of the three phases.

6.1 SYSTEM OPENING

Prior to the start of revenue operations, there are several activities which must be accomplished:

- Operating staff must report for duty

- Trains must be prepared for service

- The line must be cleared of work crews and work trains

- If necessary, wayside equipment must be re-energized

- Stations must be opened

- Trains must be introduced into service.

Each of these activities is described in this section.

6.1.1 Staff Reporting

Prior to the start of service and/or their individual shift assignments, all operations staff will report to their designated locations and supervisors. Shifts will overlap sufficiently to enable operations staff to read notices and bulletins and to be briefed on any problems or special needs.

The Train Dispatcher and CCTV Operators will report in to the Operations Supervisor at the RCC. Fare Inspectors and Transit Police Officers/Investigators will report in to the Sergeant in charge of Metro Rail-assigned personnel in downtown Los Angeles and will then proceed to their assigned location of duty within the rail system. Security Guards will report directly to their assigned locations and will notify the Sergeant by telephone of their arrival.

Red Line

The Yard Dispatcher, Line Supervisors, and Train Operators will report in to the Division Dispatcher at the Main Shop. The Division Dispatcher will inform mainline Train Operators of their train number and its location in the yard, and will arrange transportation for Line Supervisors from the yard to the mainline.

Station Agents will report directly to the 7th/Flower Station and will notify the Operations Supervisor by telephone of their arrival. The Operations Supervisor will inform the Division Dispatcher of the staffing status at the start of each shift.

The Division Dispatcher will have access to crew schedules and vehicle availability and maintenance data. The Division Dispatcher will record the arrival times of personnel for payroll purposes, will supervise unassigned extra-board Train Operators, and will as necessary assign extra-board personnel to fulfill the duties of absentee staff. To cover other staff absences, including RCC staff, the Division Dispatcher will contact on-call personnel to report in and fulfill the duties of the absentee staff member. The replacement of absentee staff will be facilitated by the cross-training of all TOSs, as noted in Chapter 4.0.

6.1.2 Train Preparation

Trains will be prepared and assigned to runs by the Yard Dispatcher based on data supplied by the Maintenance Department. Under the Yard Dispatcher's direction, Train Operators assigned to yard duty will prepare, make up, and position the required number of trains for revenue

service. A Yard Operator will board the rear cab of each train and will walk through the train to inspect for cleanliness, vandalism, or vagrants. The Yard Operator will also perform various predeparture tests, including those prescribed in the Operator's Rulebook and/or operating procedures. These tests will include checking status indicators and the proper functioning of doors, brakes, horn, and lights.

Once prepared and positioned, trains will be boarded by their mainline Train Operators, who will move the trains to the mainline in accordance with the procedures described in Section 6.1.5.

6.1.3 Wayside Equipment Preparation

The RCC staff will ensure that the power and train control equipment is active and will note and initiate a response to any deficiencies or problems. These start-up activities will be coordinated with maintenance crews working along the right-of-way. If any work trains are still on the mainline tracks, the RCC will provide the instructions necessary to remove the trains or initiate an alternative course of action.

6.1.4 Station Opening

The Transit Police will open and inspect all Metro Rail stations and will turn on station escalators and elevators. As each station is opened, the Transit Police will inform the Operations Supervisor of the event and of any problems which have been noticed. Each station will be opened no more than 30 minutes before the scheduled arrival of the first train of the day at that station.

6.1.5 Introduction of Trains into Revenue Service

Following their preparation for revenue service, trains will be dispatched on to the mainline according to a published schedule. The schedule prescribes the train consist, route required, transfer track to be used, and the scheduled departure time.

Using the schedule, the Yard Dispatcher will align a route through the yard to the transfer point. When the train has arrived at that point, responsibility for the train will transfer to the Train Dispatcher in the RCC.

Prior to departure from the yard, the mainline Train Operator will perform certain specified equipment checks (e.g., of brakes); will enter his badge number, train run number, and trip destination into the key pad on his

console; and will set up the portable radio for communication with the Yard Dispatcher. Upon instruction from the Yard Dispatcher, the Train Operator will move the train in the Restricted Manual submode through the yard to the transfer point, where he will switch radio communications from the Yard Dispatcher to the Train Dispatcher. After receiving a proceed indication at the transfer point, the Train Operator will move the train on to the mainline in MTO mode. When the train has arrived at Union Station, the Train Operator will normally switch to the ATO mode for revenue service operation.

6.2   REVENUE OPERATIONS

During revenue operations, all activities will be directed to provide safe and dependable service to passengers according to the train schedule. This section describes those activities.

6.2.1   Train Operation

Normally, Metro Rail trains will operate in the ATO mode under the supervision of the Train Operator. However, once each shift, each Train Operator will make a scheduled end-to-end run in the MTO mode. The MTO mode trip is intended to ensure that the equipment for manual running is in satisfactory condition and that Train Operators maintain their skills in train handling.

Under normal operating conditions, all trains will stop at each Metro Rail station. Center-of-platform will be the normal berthing position for Metro Rail trains, and platforms will be marked to indicate centering positions for two-car, four-car, and six-car trains. However, at the Wilshire/Alvarado Station, trains will berth at the incoming end, rather than the center, of the platform. Use of this berthing position will ensure there is sufficient stopping distance to the end of the line for trains experiencing train control difficulties.

In the ATO mode, the train will automatically decelerate to a smooth stop at the station platform. In the manual mode, the Train Operator will brake the train to a stop within the limits of the station platform. Forward position adjustments may be required to ensure that trains are properly berthed. These adjustments will be made in the MTO mode.

A "Train Berthed" indicator will light when the train is stopped entirely within the limits of the platform and is receiving a signal from the station ATC equipment that will permit car doors to be opened. The Train Operator

will open the doors by pressing the Door Open pushbutton on the correct side of the train, and will observe passengers boarding and exiting the train.

The station dwell will be timed by the SCADA equipment and will be adjustable from the RCC. When the dwell has expired, an audible and visible "Dwell Expired" indicator will annunciate in the cab. When the Train Operator has pressed the Door Close pushbutton, the Door Close chimes will sound and the train doors will begin to close. The Train Operator must watch the doors to ensure that all people are safely clear of the doors.

Doors will be equipped to detect obstructions. If a door does not properly close within a fixed time interval, the door will automatically cease to exert closing force for a period of up to 2 seconds so that any obstruction may be removed. Closing force will then be reapplied, and this cycle will continue until the door is completely closed. When indication is received that all doors are closed, the train will automatically depart if it is in the ATO mode. In other modes, the Train Operator will use the manual controller to move the train.

Union Station and Wilshire/Alvarado terminals will be the line ends of the MOS-1 system. Both terminals will use crossovers as the means of train turnback. The normal method of train turnback will be via the crossover in front of the station. Trains will alternate between crossing over as they enter and as they depart the station, and will therefore berth at alternate sides of the station platform. That is, inbound train "A" will cross over in front of the terminal station, will stop on the outbound side of the platform for passenger unloading and loading, and will depart on the normal outbound route. Inbound train "B" will stop at the inbound side of the platform for passenger unloading and loading, will depart on the inbound tracks, and will cross over to the normal outbound route after leaving the station. Train control equipment will provide for automatic route selection to either platform side. RCC personnel will be able to control route selection via SCADA.

When a train has arrived and been safely berthed at a terminal station, the Train Operator will open the doors to enable passengers to exit and enter the train. The Train Operator will then shut down the cab, move to the cab at the opposite end of the train, and prepare the equipment for departure (including entering his badge number, train run number, and trip destination). At the scheduled departure time, the Dwell Expired indicator in the cab will notify the Train Operator to close the

doors. Once all doors have been safely closed, the train will depart on its scheduled route.

Dropback operator rotation will be used at one or both of the terminal stations when the scheduled layover for Train Operators exceeds the terminal dwell time of the equipment.[1] Dropback operator rotation involves an exchange of operators. After a train has been berthed at Union Station, the Train Operator will open the doors, shut down the cab, leave the train along with the passengers and, after the layover period, will await the arrival of the next train. As the original Train Operator is leaving the train, an awaiting Train Operator will enter the cab at the opposite end of the train and will prepare the equipment for departure. At the scheduled departure time, the Dwell Expired indicator in the cab will notify the Train Operator to close the doors, and the train will leave the station.

Relief of Train Operators because of illness will require the use of extra-board personnel from the yard. The Line Supervisors and Division Dispatcher will coordinate to arrange such relief.

6.2.2 Station Operation

Metro ~~Rail~~ *Red line* stations will be equipped for attended and unattended operation. For planning purposes, it is assumed that all MOS-1 stations will be unattended except for the 7th/Flower Station. At the 7th/Flower Station, the transfer point between the Metro ~~Rail~~ and light rail lines, *Blue* one Station Agent will be present during each of the two daytime shifts. The Station Agent will provide assistance and directions to patrons and may conduct "finger tip" maintenance on fare collection equipment. At unattended stations, CCTV Operators will assist patrons requiring information or experiencing problems. Line Supervisors may also provide patron assistance and limited troubleshooting of fare collection equipment at Metro ~~Rail~~ *Red line* stations. Fare collection system operations are discussed in detail in Chapter 8.0.

---

1 The current SCRTD contract with bus drivers guarantees a minimum layover of 6 minutes at each end of a bus route. If similar provisions are negotiated into a contract with Train Operators, dropback operator rotation may be needed at both Union Station and the Wilshire/Alvarado Station, or the train schedule shown in Chapter 3.0 may need revision, or some combination may be required.

Station Agent relief for illness will be coordinated by the Operations Supervisor. The Station Agent will request relief by telephoning the Operations Supervisor, who may ask the Division Dispatcher to supply a replacement for the relief period or for the remainder of the shift.

Patron security will be provided by CCTV and by roving Transit Police. The Transit Police will maintain high visibility in Metro Rail stations and on trains to deter crime and vandalism and to respond quickly to security incidents. *Red line*

6.2.3 Changes in Mainline Fleet Size

To begin daily system start-up, a sufficient number of four-car trains will be dispatched from the yard in order to begin revenue service from Union Station. The build-up for peak periods will be accomplished by dispatching the proper number of trains from the yard. After the peak periods, an appropriate number of trains will be removed from service and will be placed in storage in the yard.

The SCADA subsystem will maintain the schedule of Metro Rail operations and of corresponding increases and reductions in mainline fleet size. Additions to the mainline fleet will be made using the same procedure used to start Metro Rail service. *Red line*

Trains leaving mainline service according to the operating schedule will have their departure routes established by the SCADA subsystem. Trains will depart from Union Station in the MTO mode and will proceed to the signal at the transfer point, where the trains will automatically be brought to a stop and the Train Operators will switch radio communications from the Train Dispatcher to the Yard Dispatcher. The Yard Dispatcher will establish a route within the yard to move the train to a final storage location. After receiving a proceed indication at the transfer point, the Train Operator will move the train in Restricted Manual submode to the appropriate location in the yard for cleaning, maintenance, and/or storage.

6.3 SYSTEM SHUTDOWN

At the close of revenue operations, several activities will need to be accomplished:

- Passengers must be informed

- Stations must be closed

- Trains must be removed from service and stored

- Staff must check out

- The system must be configured for non-revenue service activities.

Each of these activities is described below.

6.3.1 Passenger Announcements

Signs showing the departure times of the first and last trains of the day will be located on station mezzanines. In addition, PA announcements will begin to be made at a reasonable time before system closing to alert patrons to the scheduled end of Metro ~~Rail~~ *Red Line* operations. Such announcements will be made periodically at each station and on each train.

During the service run of the last train of the day, frequent announcements will be made at each station to inform patrons of its scheduled departure time and to notify patrons that the station will close after the train's departure. A similar announcement will be made aboard the train itself.

6.3.2 Station Closing

Following the departure of the last train of the day, each station will be inspected by the Transit Police to ensure no patrons or other unauthorized people are in the station. When the station is empty, the Transit Police will turn off station escalators and elevators and will close the public entrances. Closing of each Metro ~~Rail~~ *Red Line* station will be accomplished within 30 minutes after the last train of the day has departed from the station.

6.3.3 Train Removal

At the end of their revenue service runs, trains will be taken to the yard to be made ready for the next morning's service. The Train Operator will depart Union Station in the MTO mode and will proceed in that mode to the transfer point. At the transfer point, the Train Operator will switch radio communications to the yard frequency and will receive instructions from the Yard Dispatcher. After receiving a signal to proceed at the transfer point, the Train Operator will move the train in Restricted Manual submode along a route established by the Yard Dispatcher to a final storage location. The routing may involve movement through the carwash, in which case the Train Operator will stop the train, depress a

post-mounted pushbutton to activate the carwash, and switch to the Wash/Couple submode to move through the carwash. Once the train is clear of the carwash, the Train Operator will return to Restricted Manual submode to move the train to its final storage location.

After shutting down the train, the Train Operator will walk through the train to inspect it and to ensure that no passengers remain aboard. The Train Operator will collect any "Defect Cards" noting train maintenance needs and will deliver the cards to the Division Dispatcher. (See Chapter 10.0 for details on trouble reporting.)

6.3.4 Staff Checkout   *Red line*

At the end of their shifts, all Metro ~~Rail~~ personnel will report back to the location from which they received their shift assignment. The Yard Dispatcher, Train Operators, and Line Supervisors will report back to the Division Dispatcher at the Main Shop. Station Agents will telephone the Operations Supervisor, who will in turn telephone the Division Dispatcher to report staff checkout. Transit Police Officers/Investigators and Fare Inspectors will report to the Sergeant in charge of Metro *Red line* ~~Rail~~-assigned personnel in downtown Los Angeles. Security Guards will report to the Sergeant by telephone. RCC staff will report to the Operations Supervisor.

6.3.5 Non-Service Hours

Non-revenue service hours will provide for track and wayside maintenance activities that are not interrupted by revenue operations. These activities may require the use of work trains and the removal of power from some sections of track. The Operations Supervisor will monitor and coordinate with maintenance crews working along the mainline. In addition, a CCTV Operator will monitor the status of stations.

7.0 ABNORMAL SYSTEM OPERATIONS

7.0 ABNORMAL SYSTEM OPERATIONS

Chapter 7.0 discusses operation of the Metro Rail system during equipment failures and similar events that could cause schedule delays or lower service levels. The discussion is limited to mainline operations during abnormal conditions internal to the Metro ~~Rail System~~ *Red Line*. Abnormal conditions in the yard will primarily require a maintenance response and so are addressed in Chapter 10.0. Operations during emergency conditions, including commercial power outages, floods, fire, and seismic events, are addressed in detail in the Metro Rail *(nc)* Emergency Preparedness Plan and are not considered herein.

The following section of this chapter describes the general causes of abnormal operating conditions and briefly identifies the types of actions that may be taken by operating staff to minimize service disruptions. Details on operational responses to abnormal conditions are given in the second section of this chapter. The chapter concludes with a discussion of schedule recovery methods and restoration of full service. All operational *Red Line* responses to abnormal mainline conditions on the Metro ~~Rail system~~ will be managed by the Train Dispatcher under the direction of the Operations Supervisor.

7.1 CAUSES OF ABNORMAL OPERATIONS

Five general types of events that may cause schedule delays or service disruptions on the Metro ~~Rail system~~ are addressed in this section: *Red Line*

- Wayside equipment failures
- RCC/SCADA equipment failures
- Track failures
- Train failures
- Patron actions.

Each is discussed in turn in the following paragraphs.

7.1.1 Wayside Equipment Failures

Wayside equipment failures can be generalized into three classes:

- Loss-of-routing
- Local wayside signal failures
- Station stopping equipment failures.

Loss-of-routing may occur because a switch cannot be moved or is not locked, or because a signal cannot be cleared or a trip stop lowered. Loss-of-routing at interlockings can be temporarily resolved by securing the affected switches in place, permitting reduced-speed operations.

Wayside signal failures resulting in train stoppages at a specific track location can be caused by many different wayside equipment failures, including false occupancies and loss of speed commands. The fail-safe nature of the train control system will cause the train approaching the affected zone to come to a stop. The Train Dispatcher, possibly in conjunction with maintenance personnel, must then determine the nature of the equipment failure that has occurred. Once this has been determined, the train can move through the affected zone in the Restricted Manual submode, returning to automatic operation after clearing the affected zone. The required distance of the manual move will typically be 500 to 2,000 feet.

Extended train berthing and dwell times may be caused by a loss of the Door Open and Door Close commands, or by a failure of the appropriate station stop control signals. Loss of the Door Open signal from wayside will require the Train Operator, after receiving permission from the Train Dispatcher, to operate a bypass switch which will enable the doors to open.

When station stop control signals have been lost, train berthing times will be extended since trains will have to be berthed by Train Operators in manual, rather than automatic, mode. However, the first train to enter the station after loss of the stop control signals may run through the station.[1] If the Train Operator cannot decelerate the train in time to enable safe manual berthing (see Section 7.2.1), the train must proceed to the next station. In such a case, the Train Operator will make an announcement over the train PA system to inform passengers of the station run-through and to instruct those passengers destined for the run-through station to disembark at the next station, where they must board a train in the opposite direction to reach their original destination. The Operations Supervisor will ensure that Fare Inspectors are notified of the run-through, since

---

1 Station run-through will not compromise train safety, since ATP equipment will remain operational and preclude a train from entering an occupied section of track.

patrons will not hold valid fare media for the return to the run-through station.

The Train Dispatcher will notify all other Train Operators that stop control signals have been lost at the station and will instruct them to enter MTO mode as they approach the station and manually berth the trains.

7.1.2 RCC/SCADA Equipment Failures

Considerable redundancy is being designed into the SCADA subsystem to minimize the likelihood that an equipment failure will seriously degrade the RCC's ability to monitor and control system operations. Should equipment failure result in a loss of some RCC/SCADA functions, equipment at station EMPs and at control panels within station TC&C rooms will enable operating personnel to assume local control over those functions (see Section 7.2.6).

Complete loss of RCC/SCADA functions is extremely unlikely and would result only from the simultaneous failure of two or more pieces of equipment, such as the failure of both SCADA computers or the failure of all remote terminals.

7.1.3 Track Failures

Passage through a section of track may be blocked by a power outage, objects on the track, a derailment, or a broken rail.

A derailed train may block a mainline track or both tracks if the derailment occurs at a crossover, or it may block one or more tracks leading to the yard throat and transfer points. Loss of power or objects on the track can cause similarly extensive blockages. A broken rail will generally block a single track.

In any case, blockages of a track or tracks will result in a major disruption of scheduled service. A modified service, provided by single-track operations or alternative service, must be arranged (see Sections 7.2.2 and 7.2.7).

7.1.4 Train Failures

Train failures can be grouped into six classes:

- Train cannot move at all
- Train can move only in EMO submode
- Train cannot move in ATO mode

- Train can move in ATO/MTO only in one direction
- Train can operate only at reduced speed
- Station dwell is extended.

Few train equipment failures will result in a train's being unable to move under its own power for more than 15 minutes. To minimize the need for single-track operations, trains recognized as unable to move will, if possible, be pushed off the revenue service track by a following train. Passengers will be discharged from each train at the nearest station.

During peak periods, single-track operations will be conducted if it is determined that a failed train will be unable to move or be pushed out within 15 minutes of failure. During off-peak periods, when failure of a train will leave only one train in revenue service, single-track operations will be initiated almost immediately. In any case, the Yard Dispatcher will be notified of the need for a replacement train. If necessary, passengers in the failed train will be evacuated using the method decided upon by the Operations Supervisor and under his direction, as detailed in the Metro Rail Emergency Preparedness Plan.
(sic)

Failures of trainlines or the lead pair's ATP will require operation in the EMO submode, in which ATP equipment is entirely cut out from operation. In this circumstance, a train is likely to be delayed for no more than 10 minutes for problem diagnosis and determination of corrective action. After authorization is radioed from the Train Dispatcher, the Train Operator will proceed in EMO submode, under manual control and rule and non-vital 25 mph speed protection, to the next station on the line. After all passengers are discharged at the station, the train will proceed off the revenue service track.

Failures of the ATO equipment can cause a train to be operable in the MTO mode only. Such trains are likely to experience a delay of less than 5 minutes for problem diagnosis. After authorization from the Train Dispatcher, the Train Operator will switch to MTO mode and will remain in revenue service.

An equipment failure in the lead cab may leave a train able to operate in ATO/MTO only in the direction opposite to its scheduled route. In some circumstances, a train experiencing such a failure may leave the revenue service track without causing a significant disruption to revenue service operations. If the distance back to a terminal station is not too great, and if a route can be cleared, the train may be brought off the revenue service track into storage under control of the working cab. All

11/87
Revision 0   7-4

passengers must be offloaded at the first possible station. If such a procedure is not possible, train pushout or single-track operations must be undertaken.

Propulsion, traction power, or certain braking failures can result in a train's running at reduced speeds. Some failures will lead only to a slight reduction in speed, which will not necessitate the removal of a train from service. If the failure causes a significant reduction in speed, the train will generally discharge all passengers at the next station on the line and then leave the revenue service track at an average speed of about 25 mph or less.

Braking failures which reduce the available emergency braking capacity below the design limit will require the Train Dispatcher to align a safe route and maintain an adequate extended safe braking distance between the failed train and all other trains. The failed train must discharge all passengers at the first station reached after the occurrence of the failure.

Extended station dwells may occur because of failures of door control equipment or station stop equipment. The duration of the failure may be short if it can be cleared by the Train Operator. However, if the passenger doors must be closed manually, then the delay may be a few minutes while the Train Operator closes and locks out the failed doors. Problems with the vehicle ATO equipment and/or with the vehicle brakes may cause a train to berth incorrectly at a station. If the train undershoots the platform, the Train Operator will need to enter MTO mode and correctly berth the train manually. If the train overshoots the platform so that all but the first doors are on the platform, the Train Operator will need to lock out the first doors before opening the remaining doors. If the train significantly overshoots the platform, the Train Operator must proceed to the next station.

7.1.5 Patron Action

Patron action can extend station stops beyond planned durations. Disruptive actions may include:

- Slow entry/exit of passengers due to crowding or physical disability

- Medical emergency or death

- Emergency traction power trip.

The resulting delays may range from a few seconds to an hour or more. Major problems such as medical emergencies, suicides, etc., will require assistance from the Transit Police, SCRTD Maintenance Departments, Los Angeles Police Department, Los Angeles Fire Department, or other outside agencies. The length and nature of the delay will dictate the corrective action to be taken. Minor delays may be recovered by modifying station dwell and terminal layover times.

7.2 CORRECTIVE ACTIONS

Red line The Train Dispatcher will monitor the status of Metro Rail mainline operations using the available displays and communication networks. When a problem occurs, the Train Dispatcher will, with the concurrence of the Operations Supervisor, direct the corrective action that is to be taken. Corrective actions include:

- Platform undershoot/overshoot correction
- Single-track operations
- Replacement of failed train
- Equipment bypass or cutout
- Pushout
- Operation of local control panels
- Alternative service.

The actions may be taken singly or together. Each is described below.

7.2.1 Platform Undershoot/Overshoot Correction

Equipment failures or Train Operator errors can cause abnormal berthing at a station, which is programmed to be accurate within inches. If a train does not stop correctly in a station, the Train Operator must take corrective action.

If a train stops short without fully entering the station platform, the Train Operator will enter (or continue in) the MTO mode and move the train farther down the track until it is safely and correctly positioned within the platform limits.

If the train overshoots the platform slightly, so that all but the first doors are on the platform, the Train Operator will notify the RCC. Following RCC authorization, the Train Operator will shut down equipment in the cab and will walk back and cut out the first doors so that they remain closed. The Train Operator will then return to the cab, activate the cab equipment and the Berthing Signal Bypass switch, and open the remaining

doors to enable passengers to enter and exit the train. At the annunciation of the Dwell Expired signal, the Train Operator will close the doors and the train will depart from the station. When the train is safely berthed at the next station on the line, the Train Operator will return the cut-out doors to normal operation.

If a train overshoots the platform by more than the first set of doors, the Train Operator will:

- Notify the Train Dispatcher of the situation

- Announce to the passengers that the train cannot be exited at this station. Passengers destined for the station must proceed to the next station and return on a train traveling in the opposite direction

- Continue to the next station in MTO mode. At the next station, the Train Operator will return to ATO mode, if required by the schedule.

The Train Operator will not move the train against the established direction after overshooting.

7.2.2 Single-Track Operations

When a track is blocked by a train or otherwise impaired, the Train Dispatcher can establish single-track operations. When single-track operations are instituted in peak periods, three trains will operate in alternation on the unblocked track. (See Exhibit 7-1 for an illustration of this procedure.) During midday and evening off-peak periods, two trains will operate on the unblocked track; during nights, weekends, and holidays, one train will shuttle on the unblocked track between the terminal stations.

## 7.2.3 Replacement of a Failed Train

A train which has experienced equipment failure may be withdrawn from service and replaced by another train. Depending on the nature of the equipment failure, the train may be removed from service either immediately, at the end of a revenue trip, or upon return to the yard.

In the yard, a train will be held ready to enter revenue service and replace a failed train. The procedure for dispatching the replacement train will be initiated by the Train Dispatcher, who will notify the Yard Dispatcher of the need to enter the replacement train into revenue service. The Train Dispatcher will also inform the Yard Dispatcher to expect the failed train.
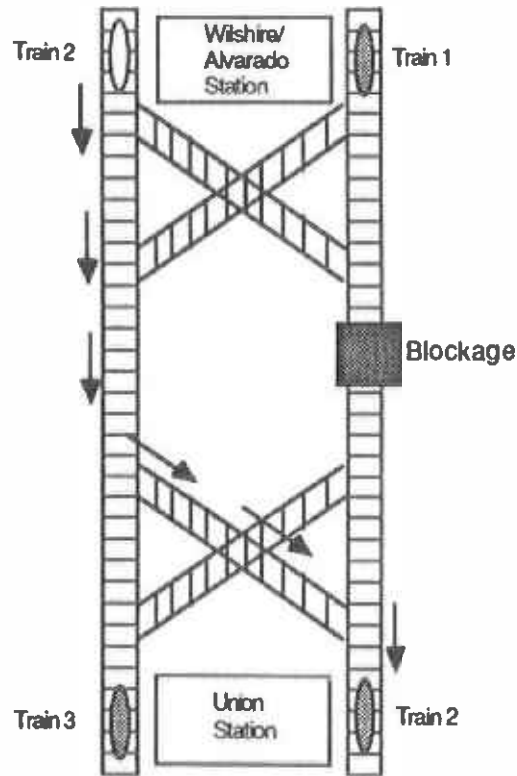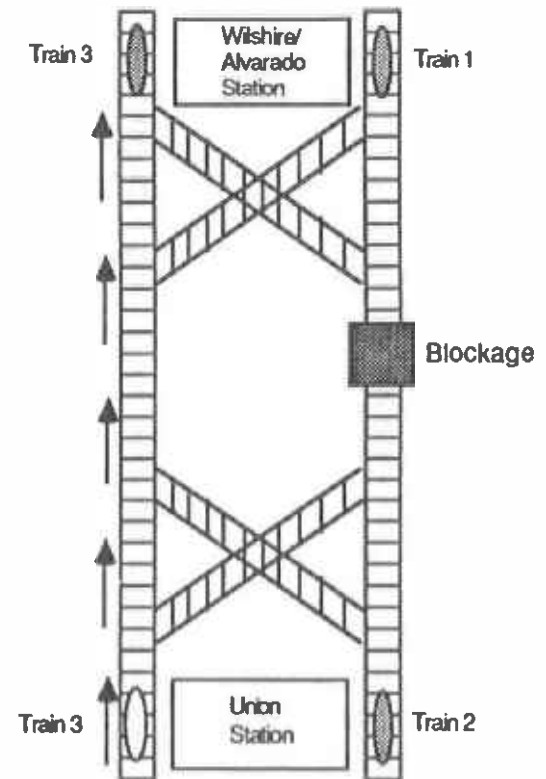
EXHIBIT 7-1
Operation of Three Trains on a Single Track
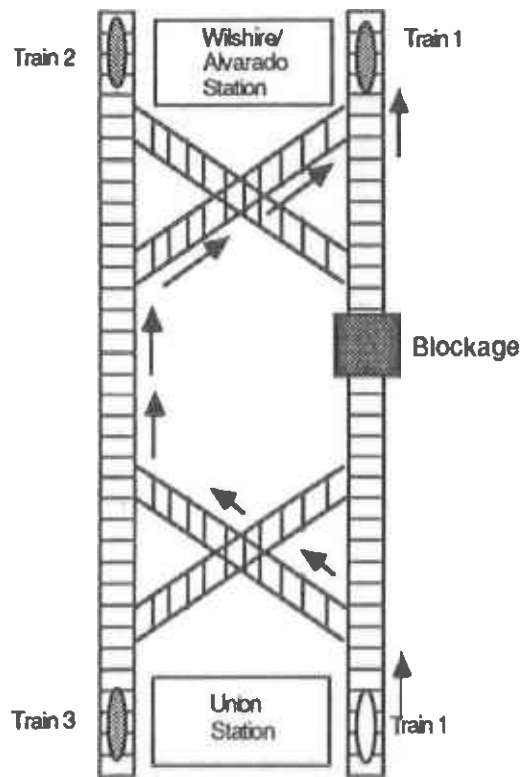
Train 1 leaves Union Station, crosses over to unblocked track, and proceeds to Wilshire/Alvarado, crossing over again to berth at vacant platform.

Train 2 leaves Wilshire/Alvarado Station and proceeds to Union Station, crossing over to berth at vacant side of platform

Train 3 proceeds directly from Union Station to Wilshire/Alvarado Station

7.2.4 Equipment Bypass or Cutout

If the impact of a failure can be controlled through the use of equipment cutouts and/or bypasses, the Train Dispatcher will instruct the Train Operator to take appropriate actions. As directed by the Train Dispatcher, Line Supervisors may assist in troubleshooting the equipment failure either at the point of detection or at some other location if the train continues in service. Equipment cutout and/or bypasses may include:

- Cutting out propulsion and/or electric braking on the affected vehicle(s). Independent controls will be provided for propulsion and electric braking.

- Cutting out the friction brakes of a truck or a complete vehicle. Air pipe cocks will enable defective components to be cut out. The Train Operator will need to leave the operating cab and reach under the train to activate the cutout cock.

- Using the Restricted Manual submode to enable the train to move. The train will be limited to a maximum speed of 10 mph. In the Restricted Manual submode, the Train Operator will need to manually berth the train at stations, as in the MTO mode.

- Cutting out passenger doors. If the doors do not operate automatically when the Door Open pushbutton is pressed, the Train Operator must ensure the train is correctly berthed within the limits of the platform. The Train Operator will then operate the Berthing Signal Bypass or Zero Speed Bypass switch, as appropriate, to open the doors, and will restore the switch to its normal position before closing the doors.

  If the train cannot leave a station because a door is indicated as open, the Train Operator must ensure that all doors are actually closed. If all doors are closed and the Door Open indicator remains lit, the Train Operator will notify passengers to leave the train. After all passengers have disembarked, the Train Operator will operate the Door Closed Bypass switch, and the train will proceed to the yard for service.

If a door remains open because of equipment
malfunction, the Train Operator will shut down
equipment in the cab, walk back to the door, and
then lock the door out. After the Train
Operator has re-energized equipment in the cab,
the train will continue in service.

- Using EMO in case of ATP equipment failure. If
a train must operate in EMO submode, all passen-
gers will be offloaded at the next station. The
Train Operator will then proceed off the revenue
track at a safe operating speed (the lower of
either the 25 mph non-vital EMO speed limit or
the posted speed limit). Because the train
speed cannot be guaranteed by equipment, rules
may require longer than normal train separations
to be operated.

7.2.5 Pushout

When a train cannot be moved under its own power, it
can be pushed out by another revenue train or by a mainte-
nance vehicle. In no case will either the pushed or the
pushing train carry passengers past a station while in
pushout operation. If possible, the pushing train will
discharge its passengers before the pushout operation
begins. The failed train will be pushed to the nearest
station and discharge its passengers. The Train Dis-
patcher will establish a clear route for the pushout
operation, and will notify the Operations Supervisor of
the need for appropriate announcements both on board the
trains and at stations to instruct train passengers to
leave the trains and to warn patrons at stations not to
board.

Pushout will then continue and the failed train will
be removed from the revenue service track. The failed
train either will be stored temporarily at the Wilshire/
Alvarado Station until it can be repaired, or will be
pushed to the yard. If the defective train is stored at
the Wilshire/Alvarado Station, normal operations will use
the other side of the station platform.

During a pushout, the Train Operator of the disabled
train will remain in the leading cab so as to be able to
apply the emergency brakes in case of a track obstruc-
tion. If the lead cab emergency brake pushbutton is not
working, the Train Operator of the pushing train must be
prepared to apply his emergency brakes as notified (over
radio or intercom) by the Train Operator of the failed
train.

7.2.6 Operation of Local Control Panels

If an equipment failure causes loss of RCC/SCADA train supervision and control functions, the Train Dispatcher will notify Train Operators of the problem and will provide necessary instructions. If the loss of functions occurs at a time during which trains are scheduled to enter or be removed from service, a Line Supervisor will be dispatched to Union Station to assume manual control of functions at the local control panel. Close radio communications will be maintained between the Train Dispatcher and the Line Supervisor at the local control panel, and between the Train Dispatcher and Train Operators.

If an equipment failure causes loss of RCC/SCADA fire/life safety monitoring and control functions, trained personnel will be dispatched to each station EMP panel to monitor gas, seismic, fire, and intrusion alarms and, if necessary, to control ventilating equipment and station escalators and elevators. Close communications will be maintained by radio or telephone between the personnel at EMPs and the Operations Supervisor.

7.2.7 Alternative Service

If an abnormal operating condition is expected to interrupt Metro Rail service for an extended period of time, the Director of Transportation may order alternative bus service to transport passengers along the Metro Rail route. The Operations Supervisor will coordinate with the bus dispatch center.

7.3 RESTORATION OF FULL SERVICE

After a train delay has occurred, there are three principal methods which can be used for schedule recovery:

- Changes to the station dwell time
- Changes to the terminal layover time
- Station run-throughs.

Station dwells will be nominally set at 20 seconds. Station dwells may be adjusted by the Train Dispatcher or by the Train Operator as directed by the Train Dispatcher. The Train Dispatcher can adjust the duration of the dwell command given to the train through the ATS equipment. Dwells for schedule recovery may be adjusted within the range of 10 to 60 seconds to advance late or retard early trains.

Terminal turnback times are scheduled to be approximately 3 minutes. However, the Train Dispatcher can direct the Train Operator to dispatch the train from the terminal as quickly as possible, or to delay the train's dispatch.

The upper limit on terminal turnback time for schedule recovery is set by the need to keep at least one track available for the next incoming train, and the need to maintain the headway service standard. The lower limit on terminal turnback time is established by the time taken for the train to be berthed and to discharge and load passengers; for the Train Operator to shut down the equipment in one cab and energize the cab at the opposite end of the train; and for the train to be dispatched.

Station run-throughs may sometimes be instituted for schedule recovery. When directed by the Train Dispatcher to run through a station, the Train Operator will switch from the ATO to the MTO mode. This switch to MTO mode will preclude the train from receiving stop control signals at the affected station or stations. Once past the station or stations to be run through, the Train Operator will return the train to the ATO mode.

LA1171019R

8.0 FARE COLLECTION SYSTEM OPERATIONS

8.0 FARE COLLECTION SYSTEM OPERATIONS

Chapter 8.0 briefly describes the elements that will compose the Metro Rail fare collection system, and then describes the procedures for system operation under normal and abnormal conditions.

8.1 FARE COLLECTION SYSTEM DESCRIPTION

SCRTD policy specifies a distance-based fare structure. Fixed zones of travel will be established for the rail system (both Metro Rail and light rail). All MOS-1 stations will fall within one fare zone. It is assumed that the 22-mile Long Beach-Los Angeles light rail line will have six fixed fare zones. A base fare will be charged for travel within one rail zone, and incremental zone charges will be incurred for travel beyond the base zone (to either Metro Rail or light rail destinations). A maximum rail fare has been established, equivalent to four zones of travel.

Payment of a nominal transfer charge, in addition to the base fare (and any zone charges) will enable rail passengers to transfer to or from bus during a continuous trip. However, the transfer to or from bus must be made within a limited time interval after the completion of the first leg of the trip. Discounted base fares will be provided to elderly and disabled citizens; a reduced rate on monthly fares will be provided to students.

These fare elements will be incorporated into the fare structure through the following types of fare media:

- Single-trip rail tickets--Printed paper tickets to any rail (Metro Rail or light rail) destination zone will be sold by ticket vending machines in each station for:

    - Regular-fare patrons

    - Discount-fare patrons (elderly and disabled citizens).

- Rail-to-bus transfers--Single-trip rail tickets that include a transfer to bus will have an appropriate code printed on the face of the ticket; therefore, a separate fare medium for rail-to-bus transfers will not be required

- Bus-to-rail transfers--Printed paper transfers will be provided by bus drivers to patrons upon payment of a nominal transfer fee.

- Monthly rail passes--Printed monthly passes (one-zone, two-zone, three-zone, and regional) will be sold at SCRTD service centers and sales outlets for:

  - Regular-fare patrons

  - Discount-fare patrons (elderly and disabled citizens)

  - Students.

- Zone upgrade tickets--Printed paper tickets will be vended by station ticket vending machines for patrons with bus-to-rail transfers or monthly passes whose destination is beyond the zone for which the fare medium is valid.

- Fare eligibility permits--Printed photo permits will be available at SCRTD for elderly and disabled citizens and students purchasing monthly student passes.

A fare collection system of the self-service, barrier-free type will be implemented on the MOS-1 system. The same type of system will be implemented on the light rail line. In Metro Rail stations, automated ticket vending machines (TVMs) will be located on each station mezzanine. The line between the "free" and "paid" areas of each mezzanine will be clearly marked; in addition, signs will advise patrons of entry to the paid area. Patrons in the paid area of stations and aboard rail vehicles will be subject to random checks of their fare media by roving Fare Inspectors. Patrons without valid fare media will be issued citations.

8.2 NORMAL FARE COLLECTION OPERATIONS

Under normal system operations, patrons will use the fare collection equipment with limited assistance from operations personnel. Procedures under normal conditions are described below.

8.2.1 Patron Use of Fare Collection System

Patrons will purchase monthly passes at SCRTD sales outlets and service centers, and will purchase single-trip tickets at station TVMs. Rail passes will be printed with

all stations on the Metro
Red
line.

an expiration date and will be valid for one-zone, two-zone, three-zone, or regional travel. Patrons purchasing zone passes will need to identify the specific zone or zones of travel they desire; the specified zone or zones will be written on the pass to enable Fare Inspectors to verify that the pass is valid for the trip being made. ~~In addition,~~ passes will be coded to denote fare category (regular fare, discount fare for the elderly/disabled, and reduced fare for students). Patrons wishing to purchase discount-fare media or monthly student passes must first obtain a fare eligibility permit--a printed photo identification--from the SCRTD. A patron must show a valid fare eligibility permit in order to purchase a discount-fare or student pass; in addition, when traveling on the rail system, the patron must show the permit along with the fare medium when requested to do so by a Fare Inspector.

Patrons purchasing single-trip tickets will do so from the TVMs located in the free area of station mezzanines. The TVMs will accept U.S. coins (nickels, dimes, quarters, and Susan B. Anthony dollars), $1 and $5 bills, and SCRTD tokens, and will vend single-trip tickets to any Metro ~~Rail or light rail~~ station, with or without a transfer to bus. The TVMs will vend both regular-fare tickets and discount-fare tickets for elderly and disabled citizens. Discount-fare patrons must carry valid fare eligibility permits. Patrons will use buttons located on the face of the TVM to select their appropriate passenger category (regular fare or discount fare), destination *station* ~~zone,~~ and transfer to bus, if desired. The TVM will display the appropriate fare and will dispense the ticket (and any change owed) upon receipt of the required amount.

Patrons transferring from bus to rail will pay a nominal transfer fee aboard bus and will be given a printed transfer. This transfer ~~will be valid for travel within one rail zone, and~~ will contain sufficient information on its face (time, direction of travel, rail origin station) to enable Fare Inspectors to check its validity. ~~Patrons with bus-to-rail transfers desiring to travel beyond one rail zone will purchase a zone upgrade ticket at the station TVM.~~ The patron will press a "transfer upgrade" button on the TVM and select the desired destination zone; the TVM will display the appropriate incremental zone charges and, upon payment by the patron, will issue the zone upgrade ticket.

Patrons with monthly zone passes who desire to travel between zones different from those specified on their monthly passes will similarly use station TVMs to obtain zone upgrade tickets. The patron will press a "pass upgrade" button on the TVM and will respond to TVM prompts

as to the zones of travel for which the pass is valid, and the new zones of travel desired. Upon paying the appropriate fare, the patron will be issued a zone upgrade ticket.

Station TVMs will print necessary information on the face of tickets, including:

- Destination
  ~~Number of zones purchased~~

- Origin station name

- Date (Day/month/year)

- Time

- Passenger category (Regular fare or discount fare for elderly/disabled citizens)

- Fare type (single-trip or zone upgrade ticket)

- Fare value

- TVM number.

Patrons with valid fare media will enter the paid area of stations to await and board trains. Patrons will be subject to random checks by Fare Inspectors in the paid areas of station mezzanines, on station platforms, and aboard trains. When requested to do so by a Fare Inspector, patrons must present proof-of-payment (ticket, pass, transfer, ~~and, if appropriate, zone upgrade ticket)~~, and fare eligibility permit for discount-fare media and reduced-fare student passes.

Upon reaching their destination, patrons will alight the vehicles and exit the stations without having to relinquish their fare media.

8.2.2 Patron Assistance

Assistance to patrons will be provided remotely by RCC personnel or in person by Station Agents or Line Supervisors.

CCTV Operators at the RCC will be responsible for responding to patron assistance calls. CCTV Operators will visually monitor the fare collection equipment and patrons using the equipment. When a patron requires assistance and no Station Agent or Line Supervisor is available, the patron will contact a CCTV Operator via the "hands free" Patron Assistance Intercom (PAI) located near TVMs in the free area of station mezzanines.

The Operations Supervisor at the RCC will be responsible for remotely monitoring the status of fare collection equipment and for receiving calls concerning equipment malfunctions made by Station Agents, Line Supervisors, maintenance personnel, and other SCRTD staff.

8.3 DETECTION AND RESPONSES TO INCIDENTS

This section describes the procedures to be followed to assist patrons experiencing problems with fare collection equipment, and to provide maintenance to correct equipment failures.

8.3.1 Patron Assistance

In general, Metro Rail procedures will incorporate a philosophy on patron claims that will require acceptance of a patron's statement of loss of money in all cases that cannot be immediately verified, unless the patron is a known and repeated fare abuser. Metro Rail personnel will ensure that patrons experiencing a loss are not unnecessarily detained. If appropriate, a Patron Claim Form will be completed by Station Agents, Line Supervisors, or CCTV Operators in the event that money is claimed to be owed to the patron by SCRTD. One copy of the claim form will be sent to the Claims Department, and one copy to the patron. All settlements to patrons will be handled by mail.

If a loss is claimed by a patron who is known to be a repeated fare abuser, or if it is determined that a patron is attempting to use a ticket or pass that has been illegally altered, the Station Agent, Line Supervisor, or CCTV Operator will (1) ask the patron to present identification, (2) request the patron to wait while assistance is summoned, and (3) request that Transit Police be dispatched to handle the problem.

Patrons may experience a loss through a ticket, bill, or coin jam in a TVM or through a TVM's not printing necessary information on the face of the ticket. In such events, patrons will notify the Station Agent, if one is present, or will contact a CCTV Operator at the RCC via the PAI.

If a Station Agent is present, and the problem is a ticket, bill, or coin jam, he or she will open the equipment and attempt to locate and retrieve the ticket or money. If the ticket or money cannot be retrieved, or if the patron has received a ticket not printed with necessary information, the Station Agent will ask the

patron to purchase a replacement ticket and complete a Patron Claim Form to reimburse the patron for the loss.

At Metro Rail stations where no Station Agent is present, patrons will contact CCTV Operators for assistance. CCTV Operators will use the fare collection microcomputer to ascertain the operating status of the TVM and confirm the reported problem. If the patron has experienced a loss through a ticket or coin jam, the CCTV Operator will instruct the patron to purchase a replacement ticket, and will complete a Patron Claim Form.

In case of hardship, Station Agents and CCTV Operators can, at their discretion, advise the patron to board a train without purchasing a replacement ticket. In such a case, the patron will be given information to supply to Fare Inspectors, who will contact the CCTV Operator or Station Agent via radio for confirmation that the patron was authorized to enter the system.

8.3.2 Equipment Failure

The design of the TVMs will provide for the automatic reporting of certain conditions which require corrective response. Signals indicating these conditions will be sent to the RCC and to the Maintenance Control Center (see Chapter 10.0) via the SCADA subsystem. These conditions are:

- Out of Service
- Intrusion
- Door Opened
- Revenue Servicing Required.

The SCADA subsystem will identify individual TVMs that are out of service; for each of the remaining three conditions, only one indication per mezzanine will be reported. Identification of the problem TVM(s) will be done via the fare collection microcomputer, which will also supply diagnostic data. The SCADA subsystem will enable individual TVMs to be remotely switched off, allowing problem TVMs to be serviced without disrupting patron use of functioning TVMs.

8.4 FARE COLLECTION SYSTEM SECURITY

Fare collection equipment will include intrusion alarms that will annunciate at the RCC; in addition, CCTV Operators will visually monitor fare collection equipment. When an intrusion alarm goes off and/or a security incident is observed on a CCTV monitor, the Transit Police Radio Dispatcher will be notified and will direct Transit Police Officers to respond to the incident.

Fare Inspectors will be deployed throughout the ~~light~~ Rail and Metro Rail system to monitor and enforce fare compliance. The Transit Police Captain-Rail Operations will be responsible for directing the assignment of Fare Inspectors and will have the flexibility to assign Inspectors to cover all times of the operating day and all parts of the line, or to focus forces at a particular location or time of day.

The Fare Inspectors will conduct random checks of patrons' fare media and will issue citations to those lacking valid media. Fare Inspectors will, however, exercise discretion when deciding whether to cite patrons for fare evasion. A cited patron may pay the citation fine by mail or may dispute the citation in municipal court.

LA1171020R

9.0 REVENUE PROCESSING AND MEDIA DISTRIBUTION

9.0 REVENUE PROCESSING AND MEDIA DISTRIBUTION

Chapter 9.0 describes the equipment, organization, and procedures planned for Metro Rail's revenue processing (cash collection and counting) and fare media distribution activities. The chapter is divided into four sections:

- Facilities and equipment
- Organization and personnel
- Media distribution and revenue servicing
- Revenue accounting and reporting.

Revenue processing and fare media distribution for the Metro Rail and light rail system will be integrated, and will be accomplished by expanding the SCRTD units now responsible for processing bus revenues and distributing bus passes.

9.1 FACILITIES AND EQUIPMENT

The facilities, vehicles, and equipment to be used for counting cash, storing fare media, and transporting both are outlined in this section.

9.1.1 Central Cash-Counting Facility

A central cash-counting facility located at Division 2 currently is used for processing SCRTD bus revenues. This facility includes coin- and bill-counting rooms and equipment; a vault room with loading bay; loading docks; revenue cart storage area; administrative rooms; and ancillary facilities for personnel. The rail system's cash-counting work will also be handled at this location. Ticket stock and coin supplies for use in ticket vending machines will be distributed from the central cash-counting facility to rail stations.

Bus revenues are presently processed at the central cash-counting facility during a single work shift. Because new bus fare collection equipment will simplify revenue processing operations, it is anticipated that a single shift will remain adequate for processing revenues from both the bus and rail systems.

9.1.2 Ticket Stockroom

Stocks of rail passes will be stored at and distributed from a ticket stockroom located at SCRTD headquarters. This stockroom currently handles the storage and distribution of SCRTD bus passes and tokens. Orders from service centers and sales outlets for stocks of passes will be received at and filled from this stockroom. In addition, the stockroom will handle the provision of fare eligibility permits--printed photo permits--to elderly and disabled citizens and students.

9.1.3 Vault Trucks and Media Delivery Vans

Vault trucks will be used to transport coins, bills, and tickets between the central cash-counting facility and rail stations. The same type of truck will service Metro Rail and light rail stations. Equipment Servicers on the trucks will provide daily revenue servicing of fare collection equipment at each rail station. Security Guards will accompany the Equipment Servicers on the trucks.

SCRTD's existing media delivery vans will be used to transport stocks of passes from the ticket stockroom to SCRTD service centers and sales outlets.

9.1.4 Revenue Carts

Revenue carts will be used to transport empty bill containers, empty coin containers, filled change replen-ishment containers, and blank ticket stock from the central cash-counting facility to rail stations. Carts will be prepared at the central cash-counting facility, loaded on the vault trucks, and taken to stations. At Metro Rail stations, carts will be moved via escalator or elevator to the areas where TVMs will be serviced. The carts will then hold full bill containers, full coin containers, and empty change replenishment containers for return to the central cash-counting facility.

The need to move revenue carts on escalators at some Metro Rail stations may result in the use of two types of carts; one designed to be moved by elevator, and one of lesser capacity especially designed to negotiate escala-tors. Design of revenue carts is left to the contractor.

9.1.5 Other Equipment

SCRTD currently has three coin sorting/counting machines in use at the central cash-counting facility. To handle the processing of rail TVM revenues, new cash

sorting/counting machines will be purchased and installed within the central cash-counting facility. These machines, which will be somewhat smaller than the SCRTD's existing equipment, will count coins/currency from and post total revenues for each TVM coin or bill container. The machines, by separately processing each TVM's revenues, will provide the SCRTD with greater accountability.

9.2   ORGANIZATION AND PERSONNEL

Revenue processing and fare media distribution activities for the rail system will be integrated into the existing SCRTD infrastructure under two basic functions-- finance and security. In addition, personnel at the ticket stockroom will coordinate with the SCRTD marketing organization to ensure that needs for passes are met in a timely and efficient manner.

The personnel required for fare media and revenue processing include:

- Equipment Servicers
- Cash Clerks and Supervisors
- Security Guards.

Equipment Servicers will be responsible for distributing revenue and fare media to, and retrieving them from, rail station fare collection equipment and SCRTD service centers. Equipment Servicers will be accompanied by Security Guards during revenue and media pick-up/delivery trips.

At the central cash-counting facility, Cash Clerks will process the cash collected from the rail system. Their activities will be overseen by Supervisors. The facility will be protected by Security Guards.

At the ticket stockroom, Cash Clerks will sort and package fare media for distribution to service centers and sales outlets. Supervisors will oversee the efforts of the clerks. The facility will be protected by Security Guards.

Equipment Servicers and Cash Clerks will be employed within the finance and accounting organization and will be fully integrated with existing activities and personnel.

9.3 MEDIA DISTRIBUTION AND REVENUE SERVICING

This section describes the procedures whereby fare media will be distributed, rail revenues will be collected, and cash will be counted.

9.3.1 Revenue Collection Process

Revenue servicing of station TVMs will be a closed system with coin recirculation, in which monies deposited by one patron are subsequently issued as change to another patron. Under a closed system, revenue and ticket stock are kept in secured containers during handling. A revenue crew, composed of two Equipment Servicers and one Security Guard, will be sent to each rail station during off-peak periods. The driver of the vault truck will remain with the truck, while the Security Guard will accompany the Equipment Servicers to service the station.

The vault truck will contain revenue carts which, prior to the crew's departure from the central cash-counting facility, will have been loaded by Cash Clerks with:

- Empty bill containers

- Empty coin containers

- Full change replenishment containers (nickels, dimes, and quarters)

- Blank ticket stock.

At the stations, the Equipment Servicers will be responsible for the following functions:

- Removing full secured bill and coin containers from TVMs and replacing them with empty containers

- Replenishing supplies of change by removing empty or near-empty change replenishment containers and replacing them with full ones

- Replenishing TVMs with blank ticket stock.

After servicing of rail stations is completed, the vault trucks will return to the central cash-counting facility, delivering the revenues to the Cash Clerks.

Media distribution and revenue servicing at SCRTD service centers and sales outlets will involve the same procedures as are currently followed. At 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 the SCRTD Accounting Department on a regular basis in the form of a check, at which time a report of sales will also be submitted.

9.3.2 Cash-Counting Process

Upon receipt at the central cash-counting facility, coins/currency from full coin and bill containers will be processed by new cash sorting and counting machines, which will count and post total revenue amounts for each TVM container. Empty change replenishment containers will be refilled and secured. A supply of coins will be retained from rail revenues for the refilling of empty change replenishment containers. (This retaining of a coin supply and refilling of containers will be new functions at the central cash-counting facility imposed by rail requirements.) Cash Clerks will prepare the revenues received from the stations for deposit in the bank.

9.3.3 Servicing Schedule

Projected revenue levels will warrant the servicing of each rail station ~~(light rail and Metro Rail)~~ once a day. One vault truck will service the five MOS-1 stations and may also possibly service some light rail stations. Each vault truck in the SCRTD fleet will make several round trips between the central cash-counting facility and specified station locations, servicing an average of three stations per trip. These trips will be scheduled to meet such objectives as:

- Equalizing the servicing workload

- Geographically organizing stations assigned to each route to minimize total travel time

- Limiting in-station revenue servicing to off-peak hours.

9.4 REVENUE ACCOUNTING AND REPORTING

A fare collection microcomputer at the central cash-counting facility will provide data on the revenue status of station TVMs for accounting and auditing use.

The revenue processed for each TVM will be recorded at the central cash-counting facility. These records will then be compared with those of the fare collection microcomputer to complete the balancing process.

LA1171021R

10.0 OPERATIONS/MAINTENANCE COORDINATION

10.0 OPERATIONS/MAINTENANCE COORDINATION

Chapter 10.0 identifies the activities that will require coordination between the operations and maintenance organizations in supporting MOS-1 operations, and the procedures that will be used to facilitate such coordination.[1]

Responsibility for maintaining the Metro Rail system will be shared by the SCRTD Equipment Maintenance Department and Facilities Maintenance Department. The Equipment Maintenance Department will be responsible for passenger vehicle maintenance; the Facilities Maintenance Department will be responsible for maintenance of way and structures and for electrical/electronic component repairs. The maintenance departments will essentially have "ownership" of Metro Rail equipment and will be responsible for the availability and readiness of equipment and facilities so that service levels and standards may be met.

A Maintenance Control Center (MCC), which will be located in the Maintenance-of-Way (M-O-W) building, will plan and coordinate the maintenance activities of both the Facilities Maintenance and Equipment Maintenance Departments, and will serve as the central point of contact for operations personnel.[2] The MCC will be staffed by a Supervisor and several clerks. The Supervisor on duty in the MCC will be drawn in rotation from the Facilities Maintenance Department and the Equipment Maintenance Department.

The Yard Dispatcher, Train Dispatcher, and Operations Supervisor will have principal responsibilities for liaison with the MCC. The Yard Dispatcher will be in charge of all yard movements and will notify the MCC of any condition in the yard requiring maintenance. The Train Dispatcher will be responsible for notifying the MCC

---

1 Further details on maintenance functions are contained in SCRTD Metro Rail Project, System Maintenance Plan, Draft, April 1987.

2 As the Metro Rail and light rail systems expand, it is expected that the Facilities Maintenance and Equipment Maintenance Departments will have separate MCCs.

of any failures to vehicles or mainline power or ATC
equipment. The Operations Supervisor will serve as the
principal liaison with the MCC for maintenance activities
on all other system elements.

Three types of activities will require coordination
between the maintenance and operations organizations:

- Scheduled introduction and removal of vehicles
  from revenue service

- Failure reporting and corrective action

- Preventive maintenance.

The capabilities provided by the SCRTD's maintenance
management information systems and the SCADA subsystem
will help to accomplish the above activities in a timely
and efficient manner. The maintenance management
information systems include the Vehicle Management System
(VMS) and a new Facilities Maintenance System (FMS), which
will be used by maintenance personnel for scheduling and
documenting maintenance activities.

10.1 SCHEDULED INTRODUCTION AND REMOVAL OF VEHICLES FROM REVENUE SERVICE

Prior to the start of each day, the MCC will prepare
a vehicle plan that will identify the vehicles available
for revenue service, and any pertinent maintenance
information on the vehicles (e.g., information that would
affect the placement of a vehicle within a consist); the
vehicles scheduled to be in the shop for maintenance; and
the vehicles that will remain in the yard as maintenance
spares. This vehicle plan will be entered into SCADA by
the MCC clerk.

The Yard Dispatcher will use this information to
direct train make-up. The Yard Dispatcher will assign the
initial work run number for each train and will have Yard
Operators position trains in the yard in the order of
priority for departure. The Yard Dispatcher will enter
the vehicle numbers, run number, and location of each
train into SCADA. The Division Dispatcher will use the
information to direct Train Operators to their assigned
trains.

If there are occasions when there are insufficient
trains or vehicles available to satisfy the operating
schedule, the Operations Supervisor and the MCC will
develop a contingency plan which may include temporarily
deferring maintenance on some vehicles, using fewer

vehicles in some trains, or increasing headways to reduce the total required number of trains. The contingency plan will not compromise the safety of passengers or Train Operators, but may affect either service standards or vehicle load standards.

Before trains are dispatched into revenue service, a Yard Operator will board the rear cab of a consist and walk through the train to inspect for cleanliness, vandalism, or vagrants. The Yard Operator will place unused Defect Cards in the cab of each vehicle, and will also perform various predeparture tests, including those prescribed in the Operator's Rulebook and/or in operating procedures.

If an equipment failure is identified during the predeparture tests, the Yard Operator will notify the Yard Dispatcher of the problem. If the problem will not affect safety or service levels, the Yard Dispatcher may instruct the Yard Operator to fill out a Defect Card and continue to prepare the train for departure. If the problem is more severe, the Yard Dispatcher will enter the information into SCADA and notify the MCC. The Yard Dispatcher will then coordinate with the Equipment Maintenance Department's Main Shop Supervisor to arrange for the failed vehicle(s) to be moved to the shop or to a storage track to await maintenance, and will have replacement vehicles moved into place for train make-up, inspection, and positioning for departure. Yard Operators will report to the Yard Dispatcher at the completion of each move to inform the Dispatcher of the current location of all car sets.

After trains are prepared and positioned for departure, they will be boarded by revenue service Train Operators, who will move them onto the mainline in accordance with the procedures outlined in Chapter 6.0.

At the end of their revenue service runs, all trains will be brought back to the yard. On the basis of the information contained in the daily vehicle plan, the Yard Dispatcher will route the trains to appropriate yard storage locations or to the shop for maintenance. Trains scheduled for washing will be routed through the car wash and washed before being stored.

10.2 FAILURE REPORTING AND CORRECTIVE ACTION

Equipment failures and problems requiring corrective action may be identified by the annunciation of alarms or displays at the RCC or Yard Tower, or may be reported to RCC personnel or the Yard Dispatcher via radio, telephone,

or intercom. Once identified, all failures will be reported to the MCC, which will manage all corrective actions.

As noted previously, the Operations Supervisor, Train Dispatcher, and Yard Dispatcher will have primary responsibilities for liaison with the MCC. In addition, they will maintain communications with maintenance crews as necessary to support safety and service requirements.

During revenue service hours, maintenance crews required to work in tunnels, mainline substations, or station TC&C rooms must receive authorization from the Train Dispatcher before beginning work. The maintenance crews will report by radio to the Train Dispatcher before entering the work area, and will report clear of the area at the conclusion of the maintenance activity. When possible, maintenance in these work areas will be scheduled in advance and advance notification will be sent to the RCC. Maintenance crews required to work on certain facility equipment (e.g., escalators and elevators) during revenue service hours will similarly report to the Operations Supervisor. During non-revenue service hours, all maintenance crews working on mainline equipment will report to the Operations Supervisor.

While maintenance work is proceeding, the crew will remain in communication with the Train Dispatcher or Operations Supervisor as necessary to ensure crew safety; to coordinate the removal and restoration of traction power; and, during revenue service hours, to provide sufficient information on which to base decisions *Red Line* concerning adjustments to Metro Rail service. During revenue service hours, appropriate speed restrictions will be imposed in tunnel areas occupied by maintenance personnel, and the Train Dispatcher will notify Train Operators by radio of the speed restrictions. When operating restrictions are expected to be long term due to the time required for maintenance, special bulletins will be issued to Train Operators as they report to duty at the Division Dispatcher's desk. Equipment repairs will be made as expeditiously as possible, and the maintenance crew will inform the RCC when the crew is clear of the area.

The coordination of maintenance activity in the yard, including vehicle rerailing, ATC equipment repairs, etc., will be the responsibility of the Yard Dispatcher. The maintenance crews will report by radio to the Yard Dispatcher before beginning maintenance activities, and will remain in communication with the Yard Dispatcher regarding the removal and restoration of traction power,

11/87
Revision 0   10-4

necessary operational restrictions in the yard, the estimated duration and extent of the problem, and so on. At the conclusion of maintenance activities, the maintenance crew will notify the Yard Dispatcher when the crew is clear of the area.

The following sections describe the process for failure reporting and corrective action on the various elements of the Metro ~~Rail system.~~ Red Line

10.2.1 Passenger Vehicles

Vehicle problems identified during revenue service operations will be noted by the Train Operator on a Defect Card. If the defect may affect safety or service, the Train Operator will also notify the Train Dispatcher in the RCC. The Train Dispatcher will generate an incident report on SCADA and transmit it to the MCC. The MCC clerk will acknowledge the incident report and will enter the failure data into the VMS.

The Train Operator, with the assistance of the Train Dispatcher and/or a Line Supervisor, will attempt to resolve the problem. If the problem cannot be resolved and impairs safety standards or significantly impairs service levels, the Train Dispatcher will remove the train from revenue service.

If the train is immobile and cannot be removed from the mainline, the Train Dispatcher will contact the MCC and request that a maintenance crew be dispatched to the scene. The MCC will contact the Main Shop and arrange for a crew to be dispatched to the vehicle.

Minor equipment problems will be brought to the attention of the MCC by the Defect Cards filled out by Train Operators, rather than through a SCADA incident report. After storing a train in the yard at the end of its revenue service runs, the Train Operator will walk through the train to pick up all Defect Cards and to inspect for vandalism or vagrants. The Train Operator will deliver the Defect Cards to the Division Dispatcher and inform him of any problems on the train. The Division Dispatcher will notify the MCC of these problems and will provide the MCC with the Defect Cards. The MCC clerk will promptly enter the defect data into the VMS.

In the yard, the Yard Dispatcher and Main Shop Supervisor will coordinate to move the failed vehicle(s) to the shop or a storage location. The Shop Supervisor will review the vehicle failure data entered into VMS by the MCC, and will schedule maintenance activities and

assign maintenance tasks. The status of all failed vehicles will be monitored through VMS, and the information will be reflected in the daily vehicle plan prepared by the MCC.

After the failure has been repaired, the Shop Supervisor will coordinate the transfer of the vehicle/pair from the shop to the yard with the Yard Dispatcher. The MCC will be notified that the vehicle is repaired and available for service. The MCC clerk will update the daily vehicle plan.

10.2.2 Fare Collection Equipment

Failures of station TVMs will be annunciated in the RCC and the MCC through the SCADA subsystem, or they may be reported by radio, telephones, or intercom by an employee or patron. If the problem is reported to the RCC by a patron or employee, the Operations Supervisor will generate a SCADA incident report and notify the MCC. If the failure is annunciated via the SCADA subsystem, the MCC will directly respond to the problem. MCC personnel will use the fare collection microcomputer to ascertain the operational status of the defective TVM and will remotely take it out of service. A clerk at the MCC will enter the failure data into the Facilities Maintenance System (FMS) and will dispatch a fare collection technician to restore the equipment to a fully functional state.

Using vans, fare collection technicians will travel around the Metro Rail system during operating hours and will receive assignments via radio or telephone from the MCC. High-usage parts will be carried in the vans. The technicians will be responsive to the priorities relayed by the MCC clerk.

If it is necessary for a technician to work in the revenue-secure area of the TVMs, the repair will be made in the presence of the Transit Police. In those instances, the fare collection technician will contact the Operations Supervisor to notify the Watch Commander of the need to arrange for a Transit Police Officer to be present. If the repair requires that revenue-containing equipment be changed, the Transit Police Officer and technician will transport the defective unit to the central cash-counting facility in the technician's van.

After the repair has been completed, the fare collection technician will notify the MCC. The MCC clerk will contact the Operations Supervisor to confirm that the problem has been resolved, and will enter appropriate

repair data into the FMS. The MCC clerk will send the fare collection technician to his next assignment. Defective parts will be tagged and loaded on the van and will be returned to the M-O-W building for failure analysis and disposition.

10.2.3 Automatic Train Control Equipment

ATC equipment failure alarms will be annunciated at the RCC or the Yard Tower. The Train Dispatcher or the Yard Dispatcher will generate an incident report on SCADA and will notify the MCC. The MCC clerk will acknowledge the incident report; will enter the failure data into the FMS; and will dispatch ATC technicians, stationed at the M-O-W building, to the scene of the problem.

The technicians will carry high-usage parts in their vans. Defective parts will be tagged and returned to the M-O-W building for failure analysis and disposition.

After the repair has been completed, the ATC technicians will notify the MCC. The MCC clerk will contact the Train Dispatcher or Yard Dispatcher to confirm that the problem has been resolved, and will enter appropriate repair data into the FMS.

10.2.4 Communications Equipment

Failures to most communications equipment will be annunciated in the RCC, or may be reported by Metro Rail employees to the Operations Supervisor via radio, telephone, or intercom. The Operations Supervisor will generate a SCADA incident report and will notify the MCC. The MCC clerk will acknowledge the incident report and will enter failure data into the FMS. The MCC clerk will then dispatch communications technicians, stationed at the Central Maintenance Facility (CMF), to the scene of the problem.

The communications technicians will carry high-usage parts in their vans. Defective parts will be tagged and returned by van to the CMF for failure analysis and disposition.

After the repair has been completed, the communications technicians will notify the MCC. The MCC clerk will contact the Operations Supervisor to confirm that the problem has been resolved, and will enter appropriate repair data into the FMS.

10.2.5 Traction Power Equipment

Failures to traction power equipment will be annunciated in the RCC or the Yard Tower via the SCADA subsystem. The Train Dispatcher or Yard Dispatcher will generate an incident report on SCADA, and will notify the MCC. The MCC clerk will acknowledge the incident report; will enter the failure data into the FMS; and will dispatch power technicians, stationed at the M-O-W building, to the scene of the problem.

The power technicians will carry high-usage parts in their vans. Large parts will be stored in the M-O-W building. Defective parts will be tagged and returned to the M-O-W building for failure analysis and disposition.

After the repair has been completed, the power technicians will notify the MCC. The MCC clerk will contact the Train Dispatcher or Yard Dispatcher to confirm that the problem has been resolved, and will enter appropriate repair data into the FMS.

10.2.6 Way and Structures

Few failures are expected with the structural elements of stations, tunnels, and other facilities. However, many of the electrical, pneumatic, and mechanical systems within facilities will require corrective maintenance, such as elevators and escalators and ventilation equipment.

Failures of critical equipment, such as fans, dampers, escalators, elevators, fire detection and suppression systems, and sump pumps will be annunciated at the RCC. When a failure is annunciated, the Operations Supervisor will generate an incident report on SCADA, and will notify the MCC. The MCC clerk will acknowledge the incident report; will enter the failure data into the FMS; and will dispatch appropriate technicians (including contract maintenance personnel) from the M-O-W building to the scene of the problem.

Less critical failures, such as plumbing defects and minor electrical problems, will not be annunciated at the RCC. When such failures are identified by operations personnel, the failures will be reported to the Operations Supervisor (or, if appropriate, the Yard Dispatcher) via radio or telephone. The Operations Supervisor (or Yard Dispatcher) will in turn generate an incident report and transmit it via SCADA to the MCC. Many of these minor problems will be uncovered by maintenance personnel during the conduct of preventive maintenance activities. In such

a case, any repair requiring 1 hour or less will be conducted by the preventive maintenance crew. The maintenance foreperson will notify the MCC of the repair, and the MCC clerk will enter the information on the completed repair into the FMS. For problems requiring more than an hour to repair, the maintenance foreperson will notify the MCC, where the clerk will enter the failure data into the FMS and schedule the equipment for later repair.

Parts for way and structures maintenance will be stored at the M-O-W building and will be transported in vans to the station or facility needing repairs. Large or bulky items, such as replacement rails, will be transported to the system using the locomotive and flat car.

Where maintenance requires that emergency systems (fans, dampers, fire detection or suppression systems) be shut down during revenue operations, special procedures will be implemented to ensure that safety is not compromised.

Once the repair has been completed, the technicians will telephone or radio the MCC. The MCC clerk will contact the Operations Supervisor or the Yard Dispatcher to ensure the problem has been resolved, and will enter the appropriate data into the FMS.

10.3 PREVENTIVE MAINTENANCE

Preventive maintenance activities will occur on a regular cycle for each Metro Rail system element, although the cycle will vary from element to element. On the basis of these cycles, the MCC will schedule day-to-day preventive maintenance activities, taking into account equipment and manpower availability. To minimize potential disruptions to Metro Rail operations, preventive maintenance on most system elements will be scheduled for non-revenue service hours. Exceptions are passenger vehicles and fare collection and station equipment. Preventive maintenance on passenger vehicles may be scheduled for any time during the 24-hour day; preventive maintenance on fare collection and station equipment will be scheduled for off-peak service periods.

Summary information on scheduled preventive maintenance activities will be transmitted from the MCC to the RCC and, if appropriate, to the Yard Dispatcher. This summary information will identify all preventive maintenance activities scheduled for revenue service hours, as well as any preventive maintenance activities scheduled for non-service hours that will require maintenance

personnel to work along the wayside or in stations, substations, or TC&C rooms, or that may affect the operation of any equipment required for safety or operational needs.

Information on preventive maintenance scheduled for passenger vehicles will be transmitted to the RCC and Yard Dispatcher via the daily vehicle plan described earlier in this chapter.

Information on other preventive maintenance activities will be entered into VMS and FMS, which will include an identification of the location, nature, and expected duration of the planned maintenance. Such information will be distributed daily so that RCC personnel and the Yard Dispatcher can coordinate with and ensure the safety of maintenance personnel, and, if the maintenance activity is occurring during revenue hours, to preclude or minimize disruptions to Metro Rail service. As noted previously, whenever maintenance crews are working along the wayside or in stations, substations, or TC&C rooms, close radio communications will be maintained between the crews and RCC personnel or, if appropriate, the Yard Dispatcher.

LA1171022R