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Southern California Rapid Transit District

METRO RAIL PROJECT

SYSTEM OPERATING PLAN for MOS-1

PRE-BASELINE DRAFT

MARCH 1987

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L I S T O F E X H I B I T S

1.0 INTRODUCTION

1.0 INTRODUCTION

The Southern California Rapid Transit District (SCRTD) is developing an 18-mile rail rapid transit system planned to run from downtown Los Angeles via the Wilshire District and Hollywood to 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 will result in the Metro Rail system's being 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. 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
- 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. (Details on maintenance functions are contained in the System Maintenance Plan.)

2.0 SYSTEM DESCRIPTION

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MOS-1, the initial segment of the 18-mile Metro Rail system, will be a 4-mile segment comprising approximately 3 miles of double-track main line and a yard and shops area.

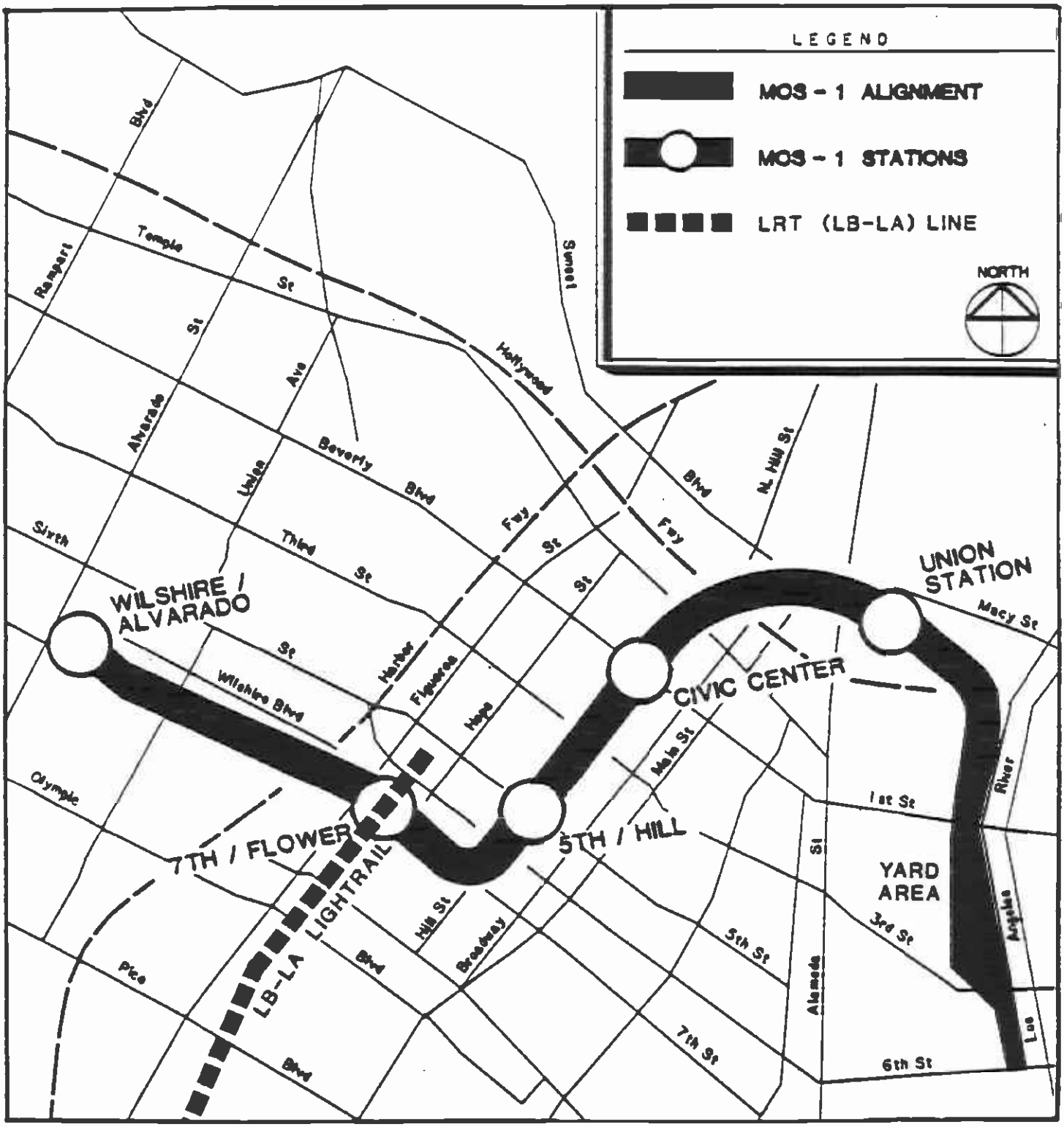
As shown in Exhibit 2-1, the MOS-1 main line route will begin at Union Station, where it will turn northwest and run through the central business district along Hill Street. Turning on 7th Street, the route will head toward the west side of downtown, pass the Harbor Freeway, and continue to the Wilshire/Alvarado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

Additional subway and surface track will connect the main line with the yard, southeast of Union Station. MOS-1 will include all yard and shop facilities planned for the full 18-mile 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 the single-center-mezzanine design characteristic of the majority of the stations planned for the 18-mile line. The station at 7th/Flower will be the transfer point between the Long Beach-Los Angeles light rail system and the Metro Rail 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 Metro Rail system

EXHIBIT 2-1
MOS-1 System Alignment



expansion. Escalators, stairs, and elevators will provide normal vertical circulation between surface, mezzanine, and platform levels of Metro Rail stations. 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 main line. 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.

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

3.0 METRO RAIL 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: one for the initial years of system operation; and one for follow-on years, which represents a full-service plan for the MOS-1 system. The somewhat lower levels of service to be provided in the initial operating period reflect the potential for increased maintenance and testing following system start-up, as well as the lower levels of passenger demand expected in early years. 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 maintenance 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 have occurred by that time. Exhibit 3-1, shows the average daily volumes of passengers boarding and alighting in the year 2000 at the five MOS-1 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 the maximum load point in the outbound[1]

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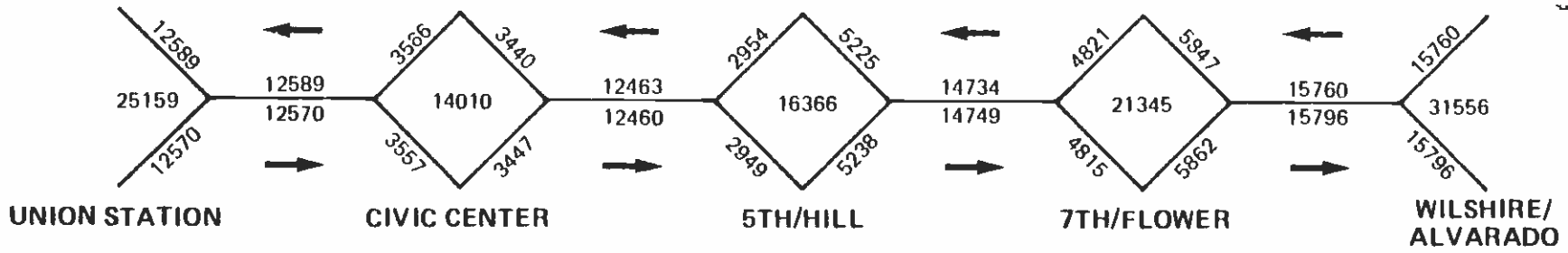
1 In this context, outbound traffic is defined as that traffic proceeding toward Wilshire/Alvarado, and inbound traffic is defined as that traffic proceeding toward Union Station.

EXHIBIT 3-1
MOS-1 System
Boarding, Alighting & Link Volumes by Direction:
Average Daily Volumes, Year 2000



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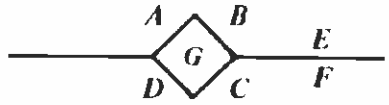
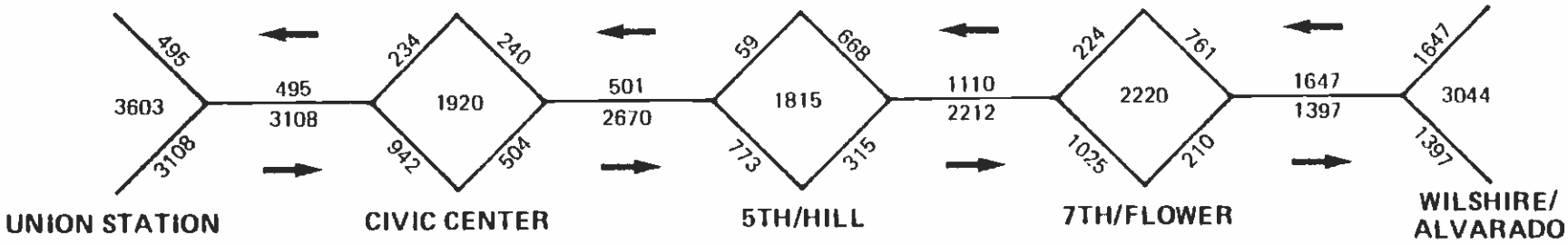


A: BOARD INBOUND
B: ALIGHT INBOUND
C: BOARD OUTBOUND
D: ALIGHT OUTBOUND
E: LINK INBOUND
F: LINK OUTBOUND
G: TOTAL STATION VOLUME

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



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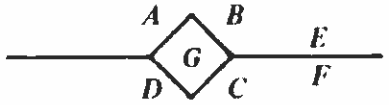
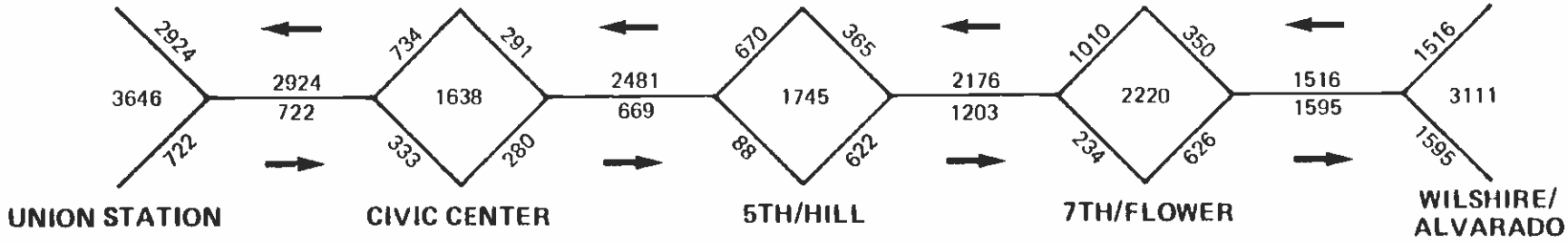


A: BOARD INBOUND
B: ALIGHT INBOUND
C: BOARD OUTBOUND
D: ALIGHT OUTBOUND
E: LINK INBOUND
F: LINK OUTBOUND
G: TOTAL STATION VOLUME

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



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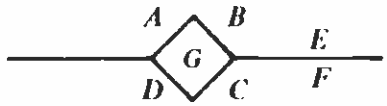

A: BOARD INBOUND
B: ALIGHT INBOUND
C: BOARD OUTBOUND)
D: ALIGHT OUTBOUND
E: LINK INBOUND
F: LINK OUTBOUND)
G: TOTAL STATION VOLUME

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 thelink 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.

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 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 start-up 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 efficient, uninterrupted right-of-way maintenance. However, the design of the Metro Rail system will not preclude 24-hour operation if such service becomes appropriate.

3.2.3 Policy Headways

Policy headways define the maximum amount of time that passengers will spend awaiting Metro Rail trains during various periods of the day. Headways shorter than policy will be used as required to satisfy vehicle load standards or to move trains to points where they are needed.

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.

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.) Metro Rail off-peak 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 volume of passengers may not warrant a four-car consist, the SCRTD's 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:

- 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)
- A performance level of 85 percent
- Speed codes of 0, 8, 9, 25, 40, 45, 55, and 70 mph.

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

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

STATION	RUN TIMES (SECONDS) OUTBOUND	RUN TIMES (SECONDS) INBOUND	DWELL TIMES (SECONDS) OUTBOUND	DWELL TIMES (SECONDS) 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 (Sec)	359	360		
Total Dwell Time (Sec)			60	60
One-Way Total (including dwells) (minutes:seconds)			6:59	7:00

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 projected 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 headways. 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 in each direction 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. 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.

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

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 passengers per car, or 360 passengers per four-car train, six train trips per hour in each direction 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 be provided only in the year 2000. 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 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 train trips will be operated as revenue service. No deadheading will occur under normal conditions.

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

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.

LA1261023R

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.

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3.6 FLEET REQUIREMENTS

A total fleet size of 30 cars will be required for both initial operating period service and year 2000 service. This fleet size will provide 16 cars for revenue service and 14 cars for maintenance spares.

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 personnel within the SCRTD Transportation Department and of security personnel within the Transit Police Department. The following categories of personnel are considered:

- Operations Management: SCRTD Superintendent of Rail Operations, Manager of Metro Rail Operations, and supporting staff (Rail Support Staff and Instructors)
- Metro Rail 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 and Auxiliary Dispatcher, Transit Police Officers, and Fare Inspectors.

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 located in the Main Shop building within the yard.[1] The Transit Police Dispatch Center, which will be staffed by the Police Watch Commander, Radio Dispatcher, and

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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, July 1985.

Auxiliary 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 operations staff will be at widely dispersed locations throughout the system.

A preliminary functional organization chart for operations staff on the MOS-1 system is shown in Exhibit 4-1.[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'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 Transportation has the responsibility for all transit modes 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 Manager of Metro Rail Operations will be assisted by the Rail 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 train and operator assignment sheets.

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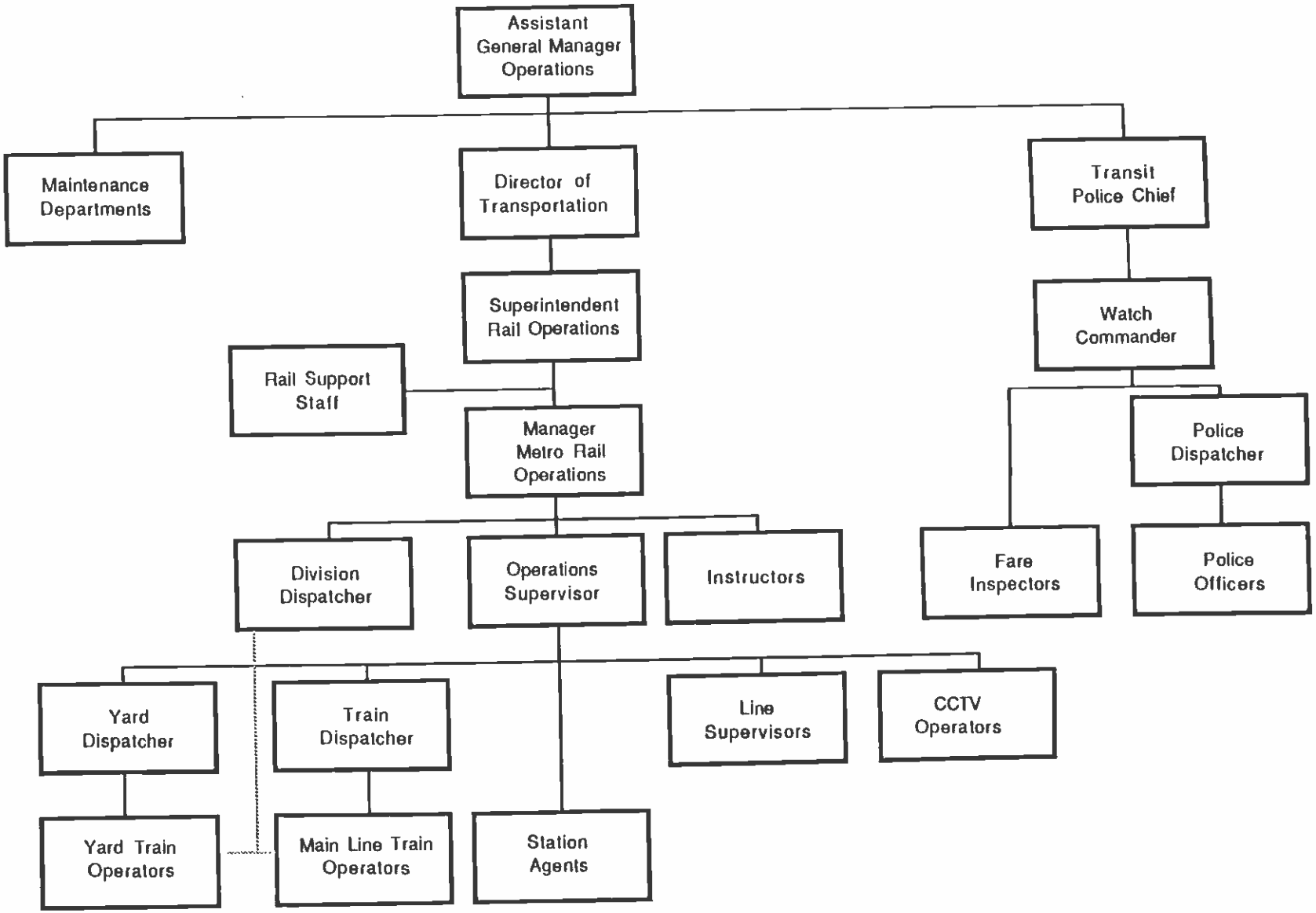
2 The design of the full 18-mile Metro Rail system provides for a Communications Controller, who will report to the Operations Supervisor and be responsible for supervising Station Agents and managing patron activity and plant facilities in support of safe and timely train operations. The staffing of 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 Communications Controller for MOS-1.

EXHIBIT 4-1
MOS-1 Operations Functional Organization



Note: Dashed line(.....) denotes administrative relationship.

4.1.1 Superintendent of Rail Operations

The Superintendent of Rail Operations will have overall responsibility for the conduct and coordination of operations on both the Metro Rail and light rail transit systems. In conjunction with the Director of Transportation, 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
- Directing the activities of the managers of the light rail and Metro Rail systems
- Supervising the activities of the Rail Support Staff.

The Superintendent will be on duty at SCRTD headquarters during normal working hours and will be on call at all times for emergencies.

4.1.2 Manager of Metro Rail Operations

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

- Establishing procedures and guidelines to achieve Metro Rail safety and performance goals
- 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
- 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.

The Manager will be on duty during normal working hours at the transportation divisional 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 Staff

The Rail Support Staff will report to the Superintendent of Rail Operations and will be responsible for the preparation of the plans, procedures, reports, etc., that will be required by SCRTD management. Major duties of staff personnel will be:

- Preparing staffing plans under the direction of division supervisory personnel
- Analyzing operating statistics and reports to identify problems and/or opportunities for service improvements
- Developing and maintaining operating manuals and rulebooks
- Preparing rail operations budgets.

4.1.4 Instructors

Instructors, under the direction of the Manager of Metro Rail Operations, will train operations personnel in the safe and efficient performance of their duties. The training function will not require a dedicated staff of Instructors; rather, Line Supervisors will be assigned, on rotation, to serve as Instructors.

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 main line 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 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 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 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 bus bridges

- Recommending changes to operating procedures to improve Metro Rail service and response to emergency conditions.

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
- 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
- Making public address announcements to inform patrons of service disruptions and schedule changes
- Informing appropriate maintenance personnel of conditions requiring maintenance on Metro Rail equipment and emergency systems
- Coordinating and supporting field maintenance work.

4.2.2 Division Dispatcher

The Division Dispatcher will be responsible for ensuring the availability of Train Operators and Station Agents 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 the following responsibilities:

- Checking that personnel report for work and leave as scheduled
- Making provisions for adequate "extra board" Train Operators and additional Station Agents to ensure no shift or location is left unstaffed
- Supervising unassigned Train Operators and Station Agents
- Informing main line 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 main line 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 Shop Superintendent for the transfer of vehicles between storage and shop
- Monitoring and controlling the traction power system in the yard
- Preparing routes between the main line transfer point and storage or shop locations
- Coordinating with the Train Dispatcher for unscheduled train movements to and from the main line 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 appropriate maintenance personnel 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 main line 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 main line Train Operators. The Train Dispatcher's responsibilities will include:

- Monitoring train movement on the main line and at the transfer point to the yard
- 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 appropriate maintenance personnel of all in-service failures to rail vehicles, train control equipment, and power distribution equipment.

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

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

- Logging reports on operations and incidents on the main line

- Monitoring and controlling traction power and auxiliary power systems.

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 the 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 overcrowding 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 trains and stations are discussed in this section. They are the Line Supervisors, Train Operators, and Station Agents.

4.4.1 Line Supervisors

Line Supervisors will rove the Metro Rail system, providing on-site supervision of station and train operations and field response to abnormal events affecting operations. Line Supervisors will be qualified to operate 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 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 passenger levels. As noted previously, Line Supervisors may also be assigned to serve as Instructors.

4.4.2 Train Operators

Train Operators will be responsible for the safe operation of trains, on the main line 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 main line 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
- Diagnosing and correcting minor equipment faults, with assistance from RCC staff
- During yard assignments, assisting in train consist make-up 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
- 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 will report to the Division Dispatcher in the Main Shop for main line or yard duty according to their bid assignments. Extra-board Train Operators will report to the Division Dispatcher and will await an assignment. No distinction will be made in the qualifications or responsibilities of Train Operators assigned to the main line or the yard. Train Operators must be prepared to undertake any train operating assignment necessary to provide Metro Rail service.

4.4.3 Station Agents

Station Agents will be responsible for assisting patrons and monitoring conditions within their assigned stations. Station Agents will report to the Operations Supervisor. Their duties will include:

- 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 their stations to inform, assist, direct, or warn patrons
- Responding to the directions of the Operations Supervisor or Line Supervisors
- Advising the Operations Supervisor of overcrowding or other situations that might affect safety or train operations
- Advising the Operations Supervisor of failures in fare collection or other station equipment
- Assisting Transit Police in opening and closing stations
- 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 stations assigned to them by bid, and will notify the Operations Supervisor by telephone of their arrival and departure at the start and end of a shift. Not all stations will have a Station Agent assigned to them; the decision on whether a station will be attended or unattended will depend on passenger levels and security considerations.

4.5 SECURITY PERSONNEL

To ensure a secure environment for Metro Rail patrons, the SCRTD Transit Police will have an expanded responsibility for 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.

4.5.1 Police Watch Commander

The Police Watch Commander will provide direction to all Fare Inspectors and Transit Police on duty in the SCRTD bus/rail system. The principal duties of the Watch Commander for the Metro Rail system will include:

- Managing the Transit Police Dispatch Center
- 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.

4.5.2 Police Radio Dispatcher

The Police Radio Dispatcher will be responsible for communications with all Transit Police forces. The Radio Dispatcher's main duties for the Metro Rail system will include:

- Receiving and transmitting direction and/or information concerning Metro Rail security incidents

- Dispatching Transit Police officers to the location of security incidents
- Providing advice to Train Operators and other Metro Rail staff who are involved in security incidents
- Coordinating with the Operations Supervisor and CCTV Operators in responding to security incidents.

4.5.3 Police Auxiliary Dispatcher

The Police Auxiliary Dispatcher will be responsible for answering all telephone calls made to the Transit Police from outside the Metro Rail system. In addition, he will assist the Police Radio Dispatcher and will provide relief for the Radio Dispatcher, as required.

4.5.4 Transit Police Officers

Transit Police Officers will rove the Metro Rail system to monitor operations and quickly respond to security incidents. Their principal responsibilities will be:

- Patrolling the Metro Rail system to deter crime
- Arresting suspects for violation of laws
- Responding to directions received from the Police Radio Dispatcher.

4.5.5 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 commissioned officers, they will be members of the Transit Police organization and will be given some police powers. The principal duties of Fare Inspectors will include:

- 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 Transit Police Officers when habitual fare evaders for whom warrants have been issued are encountered.

The number of Fare Inspectors on duty within the rail system will vary depending on time of day and fare inspection strategies. 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.

5.0 EQUIPMENT FOR SYSTEM OPERATIONS

5.0 EQUIPMENT FOR SYSTEM OPERATIONS

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 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 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

Metro Rail trains will normally operate on the main line, in the terminal zones, and between the transfer point and the main line 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 main line. 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, at ATC equipment 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 main line and at the transfer point to the yard. Control signals from the RCC will be transmitted by the SCADA subsystem to remote terminals at station ATC equipment 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 ATC equipment 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 operations will include the following:

- Radio subsystem, including 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 subsystem, to provide Emergency (ETEL), Maintenance (MTEL), and Administrative (ATEL) telephone subsystems and the Passenger Assistance Intercom (PAI)

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

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

- 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 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

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 will be the normal mode for main line 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.

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 communicate with the RCC via the train radio, and will carry a portable radio as back-up equipment. 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 main line, 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 an ETEL handset and a pushbutton for de-energizing traction power in the local power zone. Additional ETEL units, MTEL jacks, ATEL units, and fire services telephone (FTEL) jacks[1] will be located in tunnels, cross passages, traction power substations, and other key locations.

5.4 STATION EQUIPMENT

Metro Rail stations will contain a variety of control and communications equipment, much of which will be centered at the Emergency Management Panel (EMP) and (at stations with two mezzanines) the Command Post.

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

The EMP will be located near the main entrance of each station. The EMP will contain a three-function Metro Rail telephone, providing ETEL, ATEL, and MTEL 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 intrusion alarms. All indications and alarms will be sent to the RCC; intrusion alarms will also be sent to the Transit Police Dispatch Center for security response.

At stations with two mezzanines, a Command Post will be located on the second mezzanine. It will include a PA microphone, a three-function 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. An MTEL jack will also be provided at the same location. In addition, the public areas of Metro Rail stations will contain CCTV cameras for surveillance, PA speakers, pay telephones, and ETEL sets. A patron seeking assistance will use a PAI, while a patron with an emergency may use either a PAI or ETEL. Emergency trip stations will be located at the platform ends of stations.

Intrusion alarms will be located on specific doors and fare collection equipment. Bypass switches will be provided at certain doors.

ATC-related equipment, including remote SCADA terminals, will be housed in the ATC equipment 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 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 Communications Controller 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 display board. The system status display will provide a dynamic representation of the status of the ATC system and the traction power contact rail for main line track and yard leads. The display 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 video display units at those consoles will fulfill the function of the system status display board.

5.5.1 Train Dispatcher Console

Equipment at the Train Dispatcher console will allow the Train Dispatcher to execute all ATC and traction power system control actions and to monitor operations on the main line 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 video display units (VDUs) 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 ATEL 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 VDUs 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 locking 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 VDUs.

5.5.2 Communications Controller Console

The Communications Controller 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 Communications Controller 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.

Each workstation will include the following equipment:

- Two SCADA VDUs 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 ATEL, ETEL, and MTEL lines, and will provide displays of ETEL 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.

- Audio recording equipment to record all radio channels and all active ETEL lines.

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

The VDUs 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, 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, elevators and escalators, ventilating equipment, fire suppression equipment, and AC power equipment.

In addition, the VDUs 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 Communications Controller 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. Each CCTV Operator workstation will also have the following equipment:

- A keyboard to control image display on CCTV monitors
- Electronic telephone set display. This equipment will provide the CCTV Operator with control of station PA equipment, the RCC intercom, and ETEL/ATEL lines. It will provide displays of PAI and ETEL calls and allow the CCTV Operator to handle the call or redirect it as necessary.
- Video recording equipment to permit the recording of the CCTV image on the call-up monitor.
- 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.

On weekdays during the period from the a.m. peak through the p.m. peak, all three CCTV Operator workstations will be staffed. At each workstation, a CCTV Operator will be responsible for monitoring two Metro Rail stations,[2] using six CCTV monitors per station. During other Metro Rail operating hours, the monitoring load for the 5-station line will be consolidated to permit monitoring by two CCTV Operators. In the non-revenue service period when stations are closed, one CCTV Operator will be sufficient.

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 and a telephone answering (Auxiliary Dispatcher) console.

The Police Radio Dispatcher console will be equipped with:

- Transit Police Incident Processing VDU to display incident data, and a keyboard to control the VDU and to enter incident data.
- A controlled-access VDU to display intrusion detection alarms, and a controlled-access system keyboard.
- Electronic telephone set with alphanumeric display. This equipment will function as the communications keyboard providing Police Radio Dispatcher control of radio, RCC intercom, and telephone. It will provide access to ATEL, ETEL, 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.

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2 The CCTV Operator responsible for the 7th/Flower Station will monitor the Metro Rail and light rail areas of the transfer station.

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

- Video recording equipment to permit the recording of the CCTV image on the call-up monitor.

The telephone answering console, which will contain an electronic telephone with alphanumeric display, will be used to handle all calls to Transit Police made from SCRTD's field locations. The telephone set will also provide direct-line access to area emergency service agencies.

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 VDU 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, ATEL/MTEL/ETEL, intercom, and yard PA functions. A separate yard radio operating 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 ETEL handset and a pushbutton to de-energize traction power in the local power zone. In addition, MTEL jacks and PA speakers will be located in the yard.

6.0 NORMAL SYSTEM OPERATIONS

6.0 NORMAL SYSTEM OPERATIONS

Chapter 6.0 describes the activities necessary to provide passenger service according to the planned Metro Rail operating schedule. The operating schedule for the year 2000 provides for 20 hours of service each day, seven days each week. The detailed operating schedule is described in Chapter 3.0 of this plan.

Daily Metro Rail 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 to the Operations Supervisor at the RCC. Fare Inspectors and Transit Police will report to the Watch Commander at the Transit Police Dispatch Center.

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

Station Agents will report directly to their assigned 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 record the arrival times of personnel for payroll purposes, and will, as necessary, assign extra-board personnel to perform the duties of absentee staff. The Division Dispatcher will have access to crew schedules and vehicle availability and maintenance data.

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 main line Train Operators, who will move the trains to the main line 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 main line 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 turn on station equipment. 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.

6.1.5 Introduction of Trains into Revenue Service

Following their preparation for revenue service, trains will be dispatched on to the main line 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 main line Train Operator will enter his badge number, train run number, and trip destination into the key pad on his console, and will set up the train radio for communication with the Yard Dispatcher. Through the yard, the Train Operator will move the train in the Restricted Manual submode 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 main line 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 be expected to make an 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.

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 Union Station to provide Train Operators with a minimum layover of 6 minutes at that station. Dropback operator rotation, which will be conducted under the direction of an on-site Line Supervisor, 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 for meals or 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 stations will normally operate without the need for a Station Agent. In the event that a patron has a problem, a CCTV Operator will assist in resolving it. When a Station Agent is present at a station, he or she will provide assistance and directions to patrons and may conduct "finger tip" maintenance on fare collection equipment. Line Supervisors may also provide patron assistance and limited troubleshooting of fare collection equipment at Metro Rail stations. Fare collection system operations are discussed in detail in Chapter 8.0.

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.

6.2.3 Changes in Main Line 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 main line fleet size. Additions to the main

line fleet will be made using the same procedure used to start Metro Rail service.

Trains leaving main line service according to the operating schedule will have their departure routes established by the SCADA subsystem. Trains will depart from Union Station in either the ATO or 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 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, station equipment will be turned off and the public entrances will be closed by the Transit Police. Closing of each Metro Rail 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. 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 a carwash, in which case the Train Operator will need to use the Wash/Couple submode.

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

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 and Fare Inspectors will report to the Transit Police Dispatch Center. RCC staff will report to the Operations Supervisor.

6.3.5 Non-Service Hours

After the last train has completed its run, Metro Rail track and wayside maintenance activities may begin. 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 main line. In addition, a CCTV Operator will monitor the status of stations.

7.0 ABNORMAL SYSTEM OPERATIONS

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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 main line operations during abnormal conditions internal to the Metro Rail system. Abnormal conditions in the yard will primarily require a maintenance response and so are addressed in Chapter 10.0. Operations during emergency conditions, including DWP power outages, floods, fire, and seismic events, are addressed in detail in the Metro Rail 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 responses to abnormal main line 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:

- 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. Routing failures at the end-of-line terminals will have the greatest effect on operations, because the terminal interlockings must be repeatedly used for crossover moves. Loss-of-routing at other 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. 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 reason for 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 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 ATC equipment 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 main line track or both tracks if the derailment occurs at a crossover; it may foul an interlocking; 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 substitute bus 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 by a following train to the nearest station, where the passengers will be discharged. The failed train will then be pushed off the revenue service track by the following train.

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 to 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. 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.

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 complete the service run, after which the train will proceed to the yard.

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 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

The Train Dispatcher will monitor the status of Metro Rail main line 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 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 equipment, 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. During off-peak periods, 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 rapidly replace a failed train. The procedure for dispatching the replacement train will be initiated by the Train Dispatcher, who will notify 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.

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 and train-stop 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 operate 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 operate the Door Closed Bypass switch and will continue to the next station. All passengers will be offloaded, 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 passengers 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 maintenance 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 Dispatcher 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 train 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 obstruction. 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 create a major delay or create unsafe conditions, the Operations Supervisor may order alternative service around the point of disruption. This alternative service will generally entail the use of buses to move passengers between the appropriate stations. The Operations Supervisor will coordinate with the bus dispatch center and will initiate the necessary changes to Metro Rail operations to make the bus bridge effective.

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 of 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.

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--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 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 demarcated; 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

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. Elderly and disabled citizens purchasing discount-fare passes and students purchasing reduced-fare student passes will be required to show proof of eligibility both at the time of purchase and on the rail system when requested to do so by Fare Inspectors.

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 will need to carry proof of eligibility. Patrons will use buttons located on the face of the TVM to select their appropriate passenger category (regular fare or discount fare), destination 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:

- Number of zones purchased
- Origin station name
- Date (Day/month/year)
- Time
- A.M. or P.M.
- 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 proof of eligibility 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 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 will 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:

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

In each case, only one indication per mezzanine will be reported. Identification of the problem TVM(s) will be done via the fare collection microcomputer. 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 Transit Police Dispatch Center and 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 MOS-1 system to monitor and enforce fare compliance. The Transit Police Supervisor (lieutenant or sergeant) responsible for directing the assignment of Fare Inspectors 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.

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 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 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. Metro Rail's cash-counting work will also be handled at this location. Ticket stock and coin supplies for use in Metro Rail's automatic fare collection equipment will be distributed from the central cash-counting facility to Metro 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. Security forces will accompany revenue servicing agents on the trucks, and will provide daily servicing of fare collection equipment at each rail station.

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 replenishment 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 escalators. 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 Metro 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 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 media and revenue processing include:

- ~~Revenue collectors~~ Equipment Service
- ~~Revenue~~ clerks and supervisors
- ~~Media clerks and supervisors~~ Cash
- Security guards.

Revenue collectors will be responsible for distributing revenue and fare media to, and retrieving them from, rail station fare collection equipment and SCRTD service centers. Revenue collectors will be accompanied by security guards during revenue and media pick-up/delivery trips.

At the central cash-counting facility, ~~revenue~~ cash clerks will process the cash collected from the rail system. Their activities will be overseen by ~~revenue~~ cash supervisors. The facility will be protected by security guards.

~~Media~~ Cash clerks will also sort and package fare media for distribution to service centers and sales outlets. ~~Media supervisors will oversee the efforts of the media clerks.~~ Cash A security guard will be stationed at the ticket stockroom.

Security personnel used for these activities will be integrated with SCRTD's other security forces. Collectors and clerks will be employed within the finance and accounting organization and 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 revenue collectors and two security guards, will be sent to each rail station during off-peak periods. One security guard will serve as the driver of the vault truck and will remain with the truck, while the other guard will accompany the revenue collectors 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 revenue clerks with:

- Empty bill containers
- Empty coin containers
- Full change replenishment containers (nickels, dimes, and quarters)
- Blank ticket stock.

At the stations, the revenue collectors 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 revenue 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 Metro 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.) Revenue 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 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 or nonoperating 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.

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.

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. 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 on the second floor of 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.[1] 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 of any failures to vehicles or main line power or ATC equipment. The Operations Supervisor will serve as the principal liaison with the MCC for maintenance activities on all other system elements.

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

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 Transit Management Information System (TRANSMIS) and the SCADA subsystem will help to accomplish the above activities in a timely and efficient manner. TRANSMIS includes 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 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 on to the main line 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 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, main line substations, or station ATC equipment rooms must receive authorization from the Train Dispatcher before beginning work. The maintenance crews will report in to the Train Dispatcher before entering the work area, and will report clear of the area at the conclusion of the maintenance activity. 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 main line 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 other equipment; and, during revenue service hours, to provide sufficient information on which to base decisions 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. Maintenance crews working the yard will be supplied with yard-frequency radios to enable them to communicate with the Yard Dispatcher and to monitor yard activities. The 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 power or other equipment, 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.

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 main line, the Train Dispatcher will contact the MCC and request that a maintenance crew be dispatched to the scene. The MCC will contact the appropriate railcar 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 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 revenue service trains, fare collection technicians will rove the Metro Rail system during operating hours and will receive assignments via radio or telephone from the MCC. High-usage parts will be stored in knock-out panels or in the station ATC equipment rooms. Other parts will be delivered from the M-O-W building by parts runners. 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 will transport the defective unit to the central cash-counting facility in a Transit Police car.

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 left in the knock-out panel for pick-up by a parts runner. The defective parts 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 technician will carry high-usage parts in their vans. Additional spares will be maintained in ATC equipment rooms and at 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 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. Additional spares will be maintained in the station ATC rooms and at the CMF. 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 acknowlege the incident report; will enter the failure data into the FMS; and will dispatch appropriate technicians 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. Many of these minor problems will be uncovered by maintenance personnel during the conduct of preventive maintenance and/or periodic inspections. In such a case, the maintenance foreperson will report the problem to the MCC, where the clerk will enter the failure data into the FMS and schedule the equipment for 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 diesel 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 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 nonservice hours that will require maintenance personnel to work along the wayside or in stations, substations, or ATC equipment rooms.

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 ATC equipment rooms, close radio communications will be maintained between the crews and RCC personnel or, if appropriate, the Yard Dispatcher.