

SCRIPD
1988
.T665



Southern California Rapid Transit District

METRO RAIL PROJECT

TEST PROGRAM PLAN APPENDIX C PRELIMINARY LIST OF SYSTEMS INTEGRATION AND PRE-REVENUE TESTS

SEPTEMBER 1988

REVISION 0



Southern California Rapid Transit District

METRO RAIL PROJECT

**TEST PROGRAM PLAN
APPENDIX C
PRELIMINARY LIST OF
SYSTEMS INTEGRATION
AND PRE-REVENUE TESTS**

SEPTEMBER 1988

REVISION 0

APPENDIX C - TEST PROGRAM PLAN

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

<u>SECTION</u>	<u>PAGE NUMBER</u>
I. INTRODUCTION	C-1
II. SYSTEM INTEGRATION TESTS	C-3
S101 - Passenger and Auxiliary Vehicles/Special Trackwork Interface Test	C-3
S102 - Passenger Vehicle/Communications Interface Tests	C-3
S103 - Passenger Vehicle/Communications Integration Test	C-5
S104 - Passenger Vehicle/ATC Interface Test	C-5
S105 - Passenger Vehicle Control Interlock Tests	C-7
S106 - Passenger Vehicle On-Site Maintainability Test	C-10
S107 - Main Shop Facilities/Communications Interface Tests	C-10
S108 - Maintenance-of-Way Facilities/Communications Interface Test	C-10
S109 - Union Station and Yard Lead Facilities/Communications Interface Cabinet #5 Interface Tests	C-10
S110 - Union Station Facilities/Communications Interface Cabinet #3 East Interface Tests	C-11
S111 - Union Station Facilities/Communications Interface Cabinet #2 West Interface Tests	C-12
S112 - Union Station Facilities/Communications Interface Cabinet #4 Interface Tests	C-13
S113 - Union Station to 5th/Hill Line Section Facilities/ Communications Interface Tests	C-13
S114 - Yard Traction Power/Communications Interface Tests	C-14
S115 - Shop Traction Power/Communications Interface Tests	C-15
S116 - Traction Power/Communications Interface Tests at Union Station	C-15
S117 - ATC/Communications Interface Tests at Union Station	C-16
S118 - Fare Collection/Communications Interface Tests at Union Station	C-17
S119 - Uninterruptible Power Supply/SCADA Interface Test	C-18
S120 - Traction Power Corrosion Control Test	C-18
S121 - ATC Equipment Room and Power Substation Ground Fault Detector Test	C-18

APPENDIX C - TEST PROGRAM PLAN

T A B L E O F C O N T E N T S (Continued)

<u>SECTION</u>	<u>PAGE NUMBER</u>
III. SYSTEM PRE-REVENUE TESTS	C-20
1.0 Normal System Operation	C-20
P101 - System Opening and Closing for Normal Train Operations	C-20
P102 - Station Opening and Closing	C-20
P103 - Peak-Period Revenue Service Simulation	C-21
P104 - Off-Peak-Period Revenue Service Simulation	C-21
P105 - Metro Rail/Light Rail/Bus Integration	C-22
P106 - Work Train Operation	C-22
P107 - Revenue Handling	C-23
P108 - Station Operations	C-24
P109 - Rail Control Center Operations	C-24
P110 - Yard Operations	C-25
P111 - Normal Main-Line Maintenance	C-26
P112 - Normal Station Maintenance	C-26
P113 - Normal Yard Maintenance	C-27
P114 - Normal Main Shop Maintenance Activities	C-28
P115 - Normal RCC Maintenance	C-29
P116 - MIS Operation	C-30
2.0 Abnormal System Operations	C-31
P201 - Reverse Running Operations	C-31
P202 - Replacement of a Failed Train	C-31
P203 - Unscheduled Midline Turnback	C-31
P204 - Passenger Vehicle Equipment Failure	C-32
P205 - Train Breakup/Makeup	C-33
P206 - Pushout/Pullout by Train	C-33
P207 - Pullout by Locomotive	C-34
P208 - Platform Undershoot/Overshoot Correction	C-34

APPENDIX C - TEST PROGRAM PLAN

TABLE OF CONTENTS (Continued)

<u>SECTION</u>	<u>PAGE NUMBER</u>
III. SYSTEM PRE-REVENUE TESTS (Continued)	
2.0 Abnormal System Operations (Continued)	
P209 - Operation of Local Train Control and Traction Power Panels	C-34
P210 - Substitute Bus Service	C-35
P211 - Main-Line Power Failure	C-35
P212 - Schedule Adherence and Correction	C-36
P213 - Middle Cab Operation	C-36
P214 - Manual Block Operations	C-37
P215 - Special Events	C-37
P216 - Passenger on Train in Yard	C-38
P217 - Yard Equipment Failure	C-38
P218 - Station Equipment Failure	C-38
P219 - RCC Equipment Failure	C-39
P220 - Intrusion Alarm	C-40
3.0 Emergency System Operations	C-41
P301 - Fire or Smoke on Train	C-41
P302 - Fire or Smoke in Station	C-42
P303 - Fire or Smoke in RCC	C-43
P304 - Fire or Smoke in the Yard or Maintenance Facility	C-44
P305 - Train Collision	C-44
P306 - Train Derailment	C-45
P307 - Serious Criminal Act on Train	C-46
P308 - Serious Criminal Act in Station	C-47
P309 - Earthquake or Seismic Event	C-48
P310 - Gas Explosion	C-49

APPENDIX C - TEST PROGRAM PLAN

TABLE OF CONTENTS (Continued)

<u>SECTION</u>	<u>PAGE NUMBER</u>
III. SYSTEM PRE-REVENUE TESTS (Continued)	
3.0 Emergency System Operations (Continued)	
P311 - Major Traction Power Failure	C-50
P312 - Major Station Power Failure	C-51
P313 - Injured/Ill Passenger on Train	C-51
P314 - Injured/Ill Person in Station	C-52
P315 - Ill Train Operator	C-52
P316 - Person in Train Right-of-Way	C-53
P317 - Person under Train/Suicide	C-54
P318 - Bomb Threat	C-55
P319 - Flood	C-56
P320 - Train-to-Safety Walk Evacuation	C-57
IV. NONCONTRACTUAL SYSTEM INTEGRATION AND PRE-REVENUE TEST SEQUENCE	C-58
1.0 Introduction	C-58
2.0 Noncontractual System Integration Tests	C-61
3.0 Pre-Revenue Tests	C-67

METRO RAIL TEST PROGRAM PLAN
PRELIMINARY LIST OF NONCONTRACTUAL SYSTEM INTEGRATION AND PRE-REVENUE TESTS

I. INTRODUCTION

The objective of system integration and pre-revenue tests is to demonstrate the ability of Metro Rail personnel, facilities, and equipment to interact properly to provide the required levels of service, maintenance, safety, and security.

System Integration Tests are conducted at the system level to ensure that Metro Rail elements function properly together. Metro Rail contract specification books specify an extensive set of tests that are the responsibility of individual contractors. These tests are listed in Appendix B. The noncontractual system integration tests identified in this appendix are either not specified in a contract specification book, or are specified as being the responsibility of the SCRTD. For those tests specified as being the responsibility of the SCRTD, this appendix identifies the relevant contract and section number in the test description.

System Pre-Revenue Tests are conducted at the Metro Rail system level during the pre-revenue phase to verify proper training of SCRTD personnel by simulating revenue service operations during normal, abnormal, and emergency conditions. These tests involve all elements of the Metro Rail system.

- Normal system operation tests demonstrate that procedures and training, when integrated with equipment and facilities, permit safe and efficient operation and maintenance of the Metro Rail system under normal conditions.
- Abnormal system operation tests demonstrate that procedures and training, when integrated with equipment and facilities, permit safe operation and maintenance of the Metro Rail system under abnormal conditions, minimize the disruption to revenue service, and ensure that the system is returned to normal operation as quickly as possible.

- Emergency system operation tests demonstrate that procedures and training, when integrated with equipment and facilities, minimize the impact of emergency situations on patrons, employees, and the system; ensure that the appropriate emergency services are provided in a timely manner; and ensure that the system is returned to normal operation as quickly as possible.

Certain tests may require the execution of more than one scenario to demonstrate the adequacy of preparations.

The tests included in each of the above categories are described in the following pages, and the objectives for each test are identified. System integration test numbers are preceded by the letter S; pre-revenue test numbers are preceded by the letter P. As discussed in Chapter 6.0 (Section 6.3) of the Metro Rail Test Program Plan, each test will be assigned a complete test number after its individual test plan is approved by the SCRTD. The tests may be modified, or more tests may be added, as design progresses.

The Test Sequence, found in Section IV of this Appendix, establishes the sequence for the performance of noncontractual system integration and pre-revenue tests. The purpose of the test sequence is to:

- Provide a planning document to ensure that tests and prerequisite activities such as construction and installation are performed in an orderly and logical sequence
- Identify important milestones and activities that must be monitored closely for schedule conformance
- Provide a baseline schedule for test performance.

II. SYSTEM INTEGRATION TESTS

S101 - Passenger and Auxiliary Vehicles/Special Trackwork Interface Test

The objective of this test is to demonstrate that passenger vehicles and auxiliary vehicles operate adequately over special trackwork. Aspects to be demonstrated include the operation of vehicles over each switch in each switch position and in both directions.

S102 - Passenger Vehicle/Communications Interface Tests

The objective of these tests is to demonstrate that the interface between the passenger vehicle and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. The vehicles under test must be on the main line and may be stationary.

- Control functions to be tested include:
 - Destination sign control
 - Performance level control
 - Dwell-expired indicator control

- Train equipment status indications to be tested include:
 - Operating mode indications
 - Automatic Train Operation (ATO)
 - Manual Train Operation (MTO)

 - MTO submode indications
 - Emergency Manual Operation (EMO)
 - Restricted manual
 - Wash/couple

- Side door open indication
- Side door closed indication
- EMO enable switch indication
- Performance level indication
- Propulsion failure indication
- Service brake failure indication
- Auxiliary power failure indication
- Propulsion cutout indication
- Electric brake cutout indication
- Friction brake cutout indication
- Compressor cutout indication
- Emergency brake indication
- Parking brake indication
- Door bypass indication
- Movement bypass indication
- Zero speed bypass indication
- Berthing bypass indication
- Deadman indication
- Door cutout indication

- Radio interface aspects to be tested include:
 - Radio volume control input
 - Radio channel selector input
 - Radio push-to-talk input
 - Radio input from the Rail Control Center (RCC) to the vehicle public address (PA) system.

S103 - Passenger Vehicle/Communications Integration Test

The objective of this test is to demonstrate that passenger vehicle communications are adequate in all Metro Rail locations under normal operating conditions. This test is specified in contract specification A650, section 21.4.6.C, as the responsibility of SCRTD. It may be performed in conjunction with the passenger vehicle/communications interface tests. Aspects to be demonstrated include:

- Communications are continuous as a train is moved slowly through the system with or without traction power.
- Communications are continuous as a train operates at speed under a variety of conditions, including acceleration; low, nominal, and high contact rail voltages; and with and without vehicle subsystems operating, including compressors, heating, ventilating and air conditioning equipment, power converters, and battery chargers.

S104 - Passenger Vehicle/ATC Interface Test

The objective of this test is to demonstrate that the passenger vehicle/Automatic Train Control (ATC) interface was correctly designed. This test is specified in contract specification A650, section 21.4.6.B, as being the responsibility of the

SCRTD. This test verifies the vehicle/ATC interface by demonstrating proper train control for all consist sizes. Aspects to be demonstrated include:

- Overspeed protection, including:
 - Speed indication from tachometer is correct.
 - Brake trainline from Automatic Train Operation (ATO) to propulsion/brake controllers can be forced to the brake state by the Automatic Train Protection (ATP) equipment.
 - P-signal trainline from ATO to propulsion/brake controllers can be forced to the service brake state by the ATP.
- Door interlocks, including:
 - Zero speed is correctly indicated by the ATP and can be bypassed
 - Door-open/closed indication to the ATP is correct.
- Unintentional movement indication to the ATP is correct.
- Deadman indication to the ATP is correct.
- Overspeed indication is provided and properly annunciated.
- Brake assurance, including the emergency brake trainline to brake controllers, is correct.
- ATC circuit breaker is functioning properly.
- ATP speed limit indications from the ATP to the ATO and cab are correct and properly displayed.
- Mode indications from the mode selection switch to the ATP are correct.
- Confirmation that both left and right ATP receiver coils are functioning properly.

- Confirmation that EMO interlocks with ATP are functioning properly.
- Confirmation that the following interlocks with ATP are correct:
 - Master controller
 - Key switch
 - Mode selection switch
 - RMO.
- Confirmation that power connections to ATP are correctly phased.

S105 - Passenger Vehicle Control Interlock Tests

The objective of these tests is to demonstrate that the misapplication of train control commands by the Train Operator will not result in an unsafe condition. Interlocks to be tested include:

- Doors
- Mode change
- Couplers
- Emergency braking reset.

S105.1 - Door Interlock Test

The objective of this test is to demonstrate that passenger vehicle doors can be opened by activating the right or left side door-open button in the operator's cab only if:

- Zero speed is indicated from the ATP or zero-speed bypass.
- Friction brakes are applied on the vehicle.
- Berthing verification signal is being received for either right or left side platform, or berthing verification bypass is activated, or vehicle is in restricted manual submode.
- The cab is the active cab.

S105.2 - Mode Change Interlock Test

This test is designed to demonstrate that the interlocks for changing modes operate as intended and that changing from one mode to another mode cannot result in an unsafe condition. The operating modes/submodes are:

- Automatic Train Operation (ATO)
- Manual Train Operation (MTO)
- MTO Emergency Manual Operation (EMO) submode
- MTO Restricted Manual Operation (RMO) submode
- MTO Wash/Couple Manual Operation (WMO) submode.

Mode change interlock aspects to be demonstrated include the following:

- ATO cannot be entered from MTO or any of its submodes unless the train is at zero speed or the zero-speed bypass is activated, and the manual controller is locked in the full service brake position.
- Upon entering ATO from any of the MTO submodes after the doors have been opened in that submode, the train will not proceed until the doors have been closed.
- The EMO submode cannot be entered from any other mode unless the doors are closed, the selector switch is in the manual position, the manual controller is in the full service brake position, the EMO pushbutton is pressed, and EMO enable from the RCC or the bypass is present.
- While in the EMO submode, train speed is limited to 24±2 mph on all grades.
- If the door-open button is pressed while in the EMO submode, the submode will be cancelled, MTO will be entered, and the doors will not open unless the train is berthed in a station at zero speed and the brakes are applied.
- The RMO submode cannot be entered unless the selector switch is in the manual position, the manual controller is in the full service brake position, zero speed is indicated, and no ATP speed limit is present.

- While in the RMO submode, an overspeed condition occurs between 10 and 11 mph on all grades.
- If ATP speed limits are received while in the RMO submode, the RMO submode will be cancelled and MTO will be entered.
- The WMO submode cannot be entered unless the selector switch is in the manual position, the manual controller is in the full service brake position, side doors are closed, and the wash/couple pushbutton is depressed.
- While in the WMO submode, the train cannot be operated at over 3 mph on all grades.

S105.3 - Coupler Interlock Test

The objective of this test is to demonstrate that the activation of the automatic uncouple button in the operator's cab will not uncouple passenger vehicles unless the cab is activated, MTO mode is selected, the manual controller is in the full service brake position, and side doors are closed. The test is also designed to demonstrate that only the passenger vehicle facing the activated cab is uncoupled. This test will be conducted from each cab of two-pair and three-pair trains.

S105.4 - Emergency Braking Reset Interlock Test

The objective of this test is to demonstrate that emergency braking can be initiated by any of the following:

- Service braking rate failure
- Deadman
- Unintentional movement protection
- Door interlocks
- Emergency stop buttons
- Trip assembly.

The test is also designed to demonstrate that pressing the emergency stop reset button in the operator's cab will not cancel an emergency stop until the train has come to a complete stop.

S106 - Passenger Vehicle On-Site Maintainability Test

The objective of this test is to demonstrate passenger vehicle maintainability both on the main line for maintenance that can be provided in the field, and at the Main Shop. Maintainability aspects to be demonstrated include:

- Diagnosis of injected faults
- Removal and replacement of each Lowest Level Replaceable Unit (LLRU)
- Time required to perform maintenance and return the train to service.

S107 - Main Shop Facilities/Communications Interface Tests

The objective of these tests is to demonstrate that the interface between the Main Shop facilities and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Aspects to be demonstrated include:

- RCC communication equipment vital power.
- Yard control tower power
- Main Shop fire valve position detection.

S108 - Maintenance-of-Way Facilities/Communications Interface Test

The objective of this test is to demonstrate that the maintenance-of-way fire valve position detection interface is adequate and operates correctly.

S109 - Union Station and Yard Lead Facilities/Communications Interface Cabinet #5 Interface Tests*

The objective of these tests is to demonstrate that the interface between Union Station, Yard Lead facilities, and CIC #5 is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation

* Union Station is listed as an example; Exhibit C-1 on page C-19 lists similar corresponding interfaces to be tested at other stations.

will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- Emergency fans and fan dampers
- Emergency fans #1 and #2 auxiliary circuits
- Emergency fans #1, #2, and #3
- Emergency fan #3 auxiliary circuits
- Emergency fan bypass dampers
- Duplex sump pumps
- Traction power room supply fans
- Traction power room supply fan alarms
- TC&C battery room supply and exhaust fans
- Emergency fan room exhaust fans
- Incoming electrical service room supply fan
- Incoming electrical service battery room exhaust fans
- Electrical room supply and exhaust fans
- Corridor supply and exhaust fans.

S110 - Union Station Facilities/Communications Interface Cabinet #3 East Interface Tests*

The objective of these tests is to demonstrate that the interface between Union Station facilities and CIC #3 East is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- Station ventilation system
- Under-platform exhaust fan
- Roll-up doors at station entrance
- 480V main breakers in auxiliary power room
- Smoke, heat, and exhaust fans
- TC&C room air conditioning
- Elevator controls and indications
- Escalator controls and indications

* Union Station is listed as an example; Exhibit C-1 lists similar corresponding interfaces to be tested at other stations.

- Auxiliary power room supply and exhaust fans
- Auxiliary power battery room supply and exhaust fan
- TC&C room exhaust fans
- Fire pump
- Elevator equipment room exhaust fan
- Elevator shaft exhaust fan
- Ancillary room supply and exhaust fans
- Air supply room supply and exhaust fans
- UPE room supply and exhaust fans
- Chiller room supply and exhaust fans.

S111 - Union Station Facilities/Communications Interface Cabinet #2 West Interface Tests*

The objective of these tests is to demonstrate that the interface between Union Station facilities and CIC #2 West is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- Station ventilation system
- Under-platform exhaust fan
- Roll-up doors at station entrance
- Duplex sump pumps
- 480V main breaker in auxiliary power room
- Smoke, heat, and exhaust fans
- Escalator controls and indications
- Auxiliary power room supply and exhaust fans
- Auxiliary power battery room supply and exhaust fan
- Fire pump
- Utility shaft exhaust fan
- Ancillary room supply and exhaust fans
- Air supply room supply and exhaust fans.

* Union Station is listed as an example; Exhibit C-1 lists similar corresponding interfaces to be tested at other stations.

S112 - Union Station Facilities/Communications Interface Cabinet #4 Interface Tests*

The objective of these tests is to demonstrate that the interface between Union Station facilities and CIC #4 is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- Emergency fan track dampers
- Emergency fan dampers
- Emergency fans #1 and #2 auxiliary circuits
- Emergency fans #1, #2, and #3
- Emergency fan #3 auxiliary circuits
- Emergency fan bypass dampers
- Emergency fan room exhaust fans.

S113 - Union Station to 5th/Hill Line Section Facilities/Communications Interface Tests*

The objective of these tests is to demonstrate that the interface between Union Station to 5th/Hill Line section facilities and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- Fire pumps/Supervisory Control and Data Acquisition (SCADA) subsystem interface
 - SCADA inputs:
 - Local control indication
 - Trouble alarm indication
 - Water flowing indication
 - Motor overload alarm indication
 - Loss of control power alarm indication

* Union Station is listed as an example; Exhibit C-1 lists similar corresponding interfaces to be tested at other stations.

- SCADA outputs:
 - Deluge systems start control
 - Remote on EMP control
- Cross-passage ventilation/SCADA interface
 - SCADA inputs:
 - CS/local control indication
 - Trouble alarm indication
 - SCADA outputs:
 - Fire shutdown control
 - On control.

S114 - Yard Traction Power/Communications Interface Tests

The objective of these tests is to demonstrate that the interface between yard traction power and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- 34.5 KV disconnect switch
- 34.5 KV service circuit breaker
- DC circuit breaker
- Rectifier transformer
- Rectifier
- Auxiliary power transformer
- 480V switchgear
- DC switchboard
- Yard control disconnect and switch
- Miscellaneous.

S115 - Shop Traction Power/Communications Interface Tests

The objective of these tests is to demonstrate that the interface between shop traction power and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- DC circuit breaker
- Rectifier transformer
- Rectifier
- Auxiliary power transformer
- 480V switchgear
- DC switchboard
- Miscellaneous.

S116 - Traction Power/Communications Interface Tests at Union Station*

The objective of these tests is to demonstrate that the interface between Union Station traction power and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- 34.5 KV service circuit breaker
- Bus #1 auxiliary power disconnect switch
- Bus #2 trainway for SW breaker
- Bus #2 auxiliary power breaker
- Auxiliary power transformer
- 480V switchgear
- Rectifier transformer
- DC switchboard
- Disconnect switch metering and control
- Miscellaneous.

* Union Station is listed as an example; Exhibit C-1 lists similar corresponding interfaces to be tested at other stations.

S117 - ATC/Communications Interface Tests at Union Station*

The objective of these tests is to demonstrate that the interface between ATC and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified.

- Clear indication for each signal
- Call-on indication for some signals
- Signal overrun - AR track indications
- Signal overrun - AL track indications
- Traffic normal - AR track indications
- Traffic reverse - AR track indications
- Traffic normal - AL track indications
- Traffic reverse - AL track indications
- Switch normal correspondence indication for each switch
- Switch reverse correspondence indication for each switch
- Switch lock indication for each switch
- Route locking east - AR track indication for each route
- Route locking east - AL track indication for each route
- Route locking west - AR track indication for each route
- Route locking west - AL track indication for each route
- Automatic terminal mode #1 indication for each terminal
- Automatic terminal mode #2 indication for each terminal
- Automatic terminal mode #3 indication for each terminal
- Local control panel - local control request indication
- Local control panel - local control indication
- Local control panel - emergency local control indication
- AC power failure indication
- DC power failure indication
- Blown fuse indication
- Ground fault indication

* Union Station is listed as an example; Exhibit C-1 lists similar corresponding interfaces to be tested at other stations.

- Contact rail de-energized - AR track westbound indication
- Contact rail de-energized - AL track westbound indication
- Contact rail de-energized - YR track eastbound indication
- Contact rail de-energized - YL track eastbound indication
- Alarm acknowledge indication
- Track occupied indications for each track circuit
- Manual terminal mode indication for each terminal
- Clear request for each signal
- Cancel request for each signal
- Call-on request for some signals
- Switch normal request for each switch
- Switch reverse request for each switch
- Automatic terminal mode #1 request for each terminal
- Automatic terminal mode #2 request for each terminal
- Automatic terminal mode #3 request for each terminal
- Local control panel - local control enable
- Local control panel - RCC control enable
- Alarm acknowledge
- Manual terminal mode request for each terminal.

S118 - Fare Collection/Communications Interface Tests at Union Station*

The objective of these tests is to demonstrate that the interface between Union Station fare collection and communications equipment is adequate and operates correctly. Each system interface input will be activated, and the proper indication of that activation will be verified. Each system interface output will be activated, and the correct response of the controlled system will be verified. Interfaces to be tested include:

- Intrusion indication
- Revenue service required indication
- Ticket vending machine door open indication
- Maintenance service required indication.

* Union Station is listed as an example; Exhibit C-1 lists similar corresponding interfaces to be tested at other stations.

S119 - Uninterruptible Power Supply/SCADA Interface Test

The objective of this test is to demonstrate that the interface between the uninterruptible power supply (UPS) and communications equipment is adequate and correctly indicates faults, and that those indications are handled by the SCADA subsystem as required for prompt attention to fault conditions. Aspects to be demonstrated include:

- Essential summary alarm indication
- Non-essential summary alarm indication.

S120 - Traction Power Corrosion Control Test

The objective of this test is to demonstrate that the corrosion control equipment supplied with the substation power equipment is adequate. This test is specified in contract specification A631, section 16950.3.5.B, as being the responsibility of the SCRTD. Aspects of this test include:

- Monitoring the voltage difference between the running rails and ground in several locations during normal operations on the main line to determine the effectiveness of the corrosion control equipment
- Introducing a current imbalance in the running rails at several locations while monitoring the effectiveness of the corrosion control equipment.

S121 - ATC Equipment Room and Power Substation Ground Fault Detector Test

The objective of this test is to demonstrate that each ground fault detector operates correctly in the operating environment. Aspects of this test include introduction of ground faults with various impedances and verification of ground fault detection and annunciation to SCADA and the local indicators.

EXHIBIT C-1
COMMUNICATIONS INTERFACES TO BE TESTED

<u>LOCATION</u>	<u>FACILITIES ELECTRICAL</u>	<u>A620 AUTO- MATIC TRAIN CONTROL</u>	<u>A631 TRACTION POWER</u>	<u>A795 UPS</u>	<u>H840 FARE COLLECTION</u>
Union Station/Yard Leads	CIC #5	-	CIC #1A	-	-
Union Station	CIC #3 East CIC #2 West CIC #4 West	TC&C CIR	CIC #1 TPSS CIC #4	CIC #3 East CIC #2 West	CIC #3 East CIC #2 West
Civic Center Station	CIC #2 North CIC #2 South	TC&C CIR	CIC #1 TPSS	CIC #2 North CIC #2 South	CIC #2 North CIC #2 South
5th/Hill Station	CIC #2 North CIC #2 South	TC&C CIR	CIC #1 TPSS CIC #2 North CIC #2 South	CIC #2 North CIC #2 South	CIC #2 North CIC #2 South
7th/Flower Station	CIC #3 East CIC #2 West CIC #4L CIC #5L CIC #6L CIC #7L	TC&C CIR	CIC #1 TPSS	CIC #3 East CIC #2 West	CIC #3 East CIC #2 West
Wilshire/Alvarado Station	CIC #2 East CIC #3 West CIC #4 West CIC #5 East	TC&C CIR	CIC #1 TPSS CIC #5	CIC #2 East CIC #3 West	CIC #2 East CIC #3 West
5th/Hill to 7th/ Flower Line Section	2 CICs per Cross-passage	-	-	-	-
Wilshire/Alvarado Line Section	2 CICs per Cross-passage	-	-	-	-

LA1065R

09/88
 Rev. 0

III. SYSTEM PRE-REVENUE TESTS

1.0 NORMAL SYSTEM OPERATION

Pl01 - System Opening and Closing for Normal Train Operations

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, promote on-schedule opening and closing of the Metro Rail system for normal revenue train operations, including:

- Scheduling train operations personnel
- Preparing trains
- Clearing the main line
- Preparing and energizing power equipment, including traction power, safely and as required
- Coordinating opening of stations with the Transit Police
- Dispatching trains to the main line from the yard
- Informing and clearing passengers for system closing
- Coordinating closing of stations with the Transit Police
- Removing and storing trains
- Configuring the system for non-revenue activities.

Pl02 - Station Opening and Closing

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, permit secure, timely, and efficient opening and closing of stations by the Transit Police, coordinated through the RCC. Aspects to be demonstrated include:

- Walking through the station
- Starting-up/shutting-down escalators

- Reducing or increasing lighting
- Locking and unlocking stations
- Coordinating and communicating with the RCC staff.

Pl03 - Peak-Period Revenue Service Simulation

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, permit safe and efficient train operations at the planned peak-period schedule. This test will consist of a simulation of peak-period revenue service, including:

- Running trains to a representative peak-period schedule, with:
 - Runs in both ATO and MTO modes in accordance with the Operating Rule Book
 - Correct station stopping, including door opening, dwell control, door closing, recycling as necessary, and station departure
 - Terminal turnback, terminal dropback, and terminal platform alternation
 - Communications as required between Train Operator and RCC, Train Operator and Line Supervisor, and others.
- Introducing trains into and removing them from revenue service to meet schedule requirements, for building to the peak, and for the post-peak reduction. Tests will be made of all planned train change moves, including:
 - Night reduction and train length cut
 - Trains lengthened and shortened at Union Station
 - Trains lengthened and shortened in the yard.

Pl04 - Off-Peak-Period Revenue Service Simulation

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, permit safe and efficient train operations at the planned off-peak-period schedule. This test will consist of a simulation of off-peak-period revenue service.

Pl05 - Metro Rail/Light Rail/Bus Integration

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, ensure suitable coordination between Metro Rail, light rail, and bus operations, including scheduled bus and light rail interchanges at the 7th/Flower Station. Capabilities to be tested include:

- Communications between Metro Rail transportation staff and bus and light rail transportation staff
- Integrated responses to normal passenger service level variations expected during peak periods.

Pl06 - Work Train Operation

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, permit safe and efficient use of the work train during non-revenue service periods. Aspects to be demonstrated include:

- Forming and preparing the work train with the required equipment
- Coordinating the work train schedule with the Yard and Train Dispatchers (Operations Supervisor during non-revenue hours)
- Staffing and dispatching the work train as planned
- Operating the work train on the main line as required by the Standard Operating Procedures
- Clearing the work site and coordinating with the Train Dispatcher (Operations Supervisor during non-revenue hours)
- Returning the work train to storage at the Maintenance-of-Way facility.

P107 - Revenue Handling

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, permit secure and efficient revenue processing operations. Aspects to be demonstrated include:

- Revenue Preparation:
 - Stocking tickets, including monthly passes and stamps
 - Stocking revenue carts
 - Preparing coins, bills, and tickets for the ticket vending machines (TVMs) and filling containers
 - Stocking sales outlets.
- Revenue Collection:
 - Unloading revenue carts from the vault truck and delivering them to the central cash-counting facility
 - Using the revenue cart to load and unload station fare collection equipment
 - Removing revenue from the station by escalators and elevators
 - Loading the revenue carts onto the vault truck.
- Revenue Processing:
 - Counting revenue
 - Transit Police security.

P108 - Station Operations

The objective of this test is to demonstrate that procedures and training of Station Agents, Fare Inspectors, Transit Police, RCC personnel, and Line Supervisors, when integrated with equipment and facilities, permit efficient operation of stations. Aspects to be demonstrated include:

- Assisting patrons with fare collection procedures or equipment, including:
 - Instructions or information
 - Patron Claim Forms
- Performing the required fingertip maintenance on the fare collection equipment, including retrieval of stuck money or fare media, and clearing or turning off a jammed machine
- Communicating equipment failures to the Operations Supervisor in the RCC
- Enforcing fare policies
- Responding to and reporting passenger incidents, in conformance with the guidelines for dealing with SCRTD patrons
- Managing passenger flow at stations, reversal of escalators, and issuing announcements and instructions.

P109 - Rail Control Center Operations

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, permit the monitoring and control of normal train operations in accordance with Standard Operating Procedures under the direction of the RCC staff. Aspects to be demonstrated include:

- Console use by the staff, including keyboards, VDUs, CCTV monitors, video recorders, telephones, and speakers, for the:
 - Train Dispatcher console
 - System Communications console
 - Operations Supervisor console
 - CCTV Operator console

- CCTV surveillance by CCTV Operators, including:
 - Patron assistance:
 - Providing information or instructions
 - Preparing Patron Claim Forms
 - Communication of equipment failures to the Operations Supervisor at the RCC
 - Reporting of observed abnormal and serious incidents to the appropriate parties and recording of the incident
- RCC response to equipment alarms and failure indications, especially as handled between the Operations Supervisor and the Maintenance Control Center
- Communications among RCC staff, and between RCC staff and light rail staff and Transit Police at the Willowbrook facility
- Daily, weekly, monthly and other specified reports for Transportation, Maintenance, Finance, Management, and other departments which reflect actual train operations and provide the needed information for planning, coordinating, evaluating, and conducting revenue service.

P110 - Yard Operations

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, permit efficient operation of the Metro Rail yard under the direction of the Yard Dispatcher. Aspects to be demonstrated include:

- Train makeup, breakup, and storage
- Coordination and movement of passenger and work vehicles for maintenance, including:
 - Movement to and from the shop
 - Movement to, through, and from the wash and cleaning track
 - Maintenance or inspection of passenger vehicles in the yard

- Dispatching trains and receiving trains from the main line
- Yard traction power control
- Yard control console operation, including the keyboard, VDU, telephone, and speaker.

P111 - Normal Main-Line Maintenance

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, safely meet the requirements of normal main-line maintenance. Aspects to be demonstrated include:

- Coordination of access, entry, and movement of trackside maintenance workers and equipment, including flagging and protection at the beginning of and during the maintenance task, and coordination of movements and communications with the Train Dispatcher (or Operations Supervisor at night)
- Maintenance of main-line equipment and facilities, including:
 - Track and roadbed
 - Tunnels, including cleaning, inspection, and maintenance
 - ATC, including track circuits, switch machines, and signals
 - Communications equipment, including gas and seismic detectors
 - Traction power equipment
 - Tunnel and substation ventilation equipment
- Removal and replacement of equipment and components for off-site repairs at the Central Maintenance Facility (CMF) or the Maintenance-of-Way (M-O-W) facility
- Removal of all maintenance equipment at the completion of the task, restoration of all main-line systems and facilities, and coordination with RCC staff.

P112 - Normal Station Maintenance

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, meet the requirements for normal station

maintenance during both revenue and non-revenue periods. Aspects to be demonstrated include:

- Coordination of access for each station maintenance task
- Posting of appropriate signs to indicate that equipment is out of order
- Maintenance of station equipment and facilities, including:
 - Station cleaning, inspection, and repair
 - Fare collection equipment
 - Elevators and escalators
 - ATC, including equipment rooms and control panels
 - Communications equipment, such as telephones, public address, passenger assistance intercom (PAI), Emergency Management Panel (EMP), and Command Post (CP)
 - Traction power equipment
 - Auxiliary power equipment, lights and ventilation
- Removal and replacement of equipment and components for off-site maintenance at the CMF or M-O-W facility
- Removal of all maintenance equipment at the completion of the task, restoration of all station systems and facilities, and coordination with RCC staff.

P113 - Normal Yard Maintenance

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, meet the requirements for normal yard

maintenance during both revenue and non-revenue periods. Aspects to be demonstrated include:

- Coordination of access for each yard maintenance task
- Maintenance of yard equipment and facilities, including:
 - Yard tower cleaning, inspection, and maintenance
 - ATC, including track circuits, equipment rooms, switch machines and signals
 - Communications equipment, such as telephones, radio, PA, intercom, SCADA terminals, and maintenance information system terminals
 - Traction power equipment
 - Auxiliary power equipment, lights, heating, and ventilation
- Removal and replacement of equipment and components for off-site maintenance at the CMF or M-O-W facility
- Removal of all maintenance equipment at the completion of the task, restoration of all yard systems and facilities, and coordination with Yard Dispatcher.

P114 - Normal Main Shop Maintenance Activities

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, meet the requirements for normal shop maintenance activities during both revenue and non-revenue periods. Aspects to be demonstrated include:

- Coordination and prioritization of resources for maintenance tasks
- Vehicle maintenance, including:
 - Car wash
 - Blowdown

- Scheduled service and inspection
 - Corrective maintenance
 - Daily interior cleaning and periodic major cleaning
 - Trucking, detucking, and transportation of wheel sets
 - Movement using the stinger
- Maintenance of shop equipment, lights, heating, and ventilation
 - Removal and replacement of equipment and components for off-site maintenance at the CMF or M-O-W facility
 - Timely return of passenger vehicles to the yard for revenue service.

P115 - Normal RCC Maintenance

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, meet the requirements for normal maintenance of the RCC during both revenue and non-revenue periods. Aspects to be demonstrated include:

- Coordination and prioritization of resources for maintenance tasks
- Periodic maintenance and response to failures of RCC equipment, including:
 - Consoles for the Train Dispatcher, Operations Supervisor, and CCTV Operators
 - SCADA computer
- Removal and replacement of equipment and components for off-site maintenance at the CMF.

P116 - MIS Operation

The objective of this test is to demonstrate that the procedures and training for use of the management information system meet the requirements for normal operations, such as:

- Scheduling and tracking employees
- Scheduling preventive maintenance and inspections
- Tracking equipment
- Reporting and analyzing failures
- Enforcing warranties
- Reporting performance
- Reporting and recording incidents/accidents.

2.0 ABNORMAL SYSTEM OPERATIONS

P201 - Reverse Running Operations

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Train Dispatcher, Operations Supervisor, and Line Supervisors to correctly set up single-track operations for reverse running around a blocked track, and that the procedures and equipment promote safe and effective recovery operations.

For the MOS-1 system, the test also demonstrates reverse operations on both the outbound and inbound tracks.

P202 - Replacement of a Failed Train

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the Train Dispatcher, Division Dispatcher, Train Operators, Operations Supervisor, and Line Supervisor to correctly coordinate actions in response to a failure of a main-line train, by:

- Informing patrons of delays and skip-stops, etc.
- Removing the failed train from the line
- Bringing a replacement train onto the line at a time and place suitable for the required service
- Instructing the replacement Train Operator and Train Operators of nearby trains to modify station and terminal dwells and performance to minimize the disturbance to scheduled service.

P203 - Unscheduled Midline Turnback

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the Train Dispatcher, Train Operators,

Operations Supervisor, and Line Supervisor to correctly coordinate actions in preparing for and executing an unscheduled midline turnback, including:

- Discharging passengers at the first opportunity
- Holding opposing traffic
- Removing the failed train with the least additional disruption.

For MOS-1, there are no crossover locations where an unscheduled midline turnback can be made.

P204 - Passenger Vehicle Equipment Failure

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Train Dispatcher, Operations Supervisor, and Line Supervisor to correctly respond to passenger vehicle equipment failures. Aspects to be demonstrated include:

- Correct operation and notification/documentation of equipment cutout switches and cocks in case of failures, for:
 - Doors
 - Friction and electric brakes
 - Propulsion
 - Automatic train control
 - Auxiliaries
- Correct operation of a train with one or more passenger vehicles not operable
- Correct reporting of conditions by the Train Operator, correct advice by the Train Dispatcher to the Train Operator, and correct coordination with the Line Supervisor and Operations Supervisor of actions related to cutouts and bypasses
- Adequate responses to equipment failures that reduce the operating modes available for a train, including cases where the train:
 - Can move in EMO mode only
 - Can move in ATO mode only
 - Can move in MTO mode only
 - Can move in one direction only

- Can move only at reduced speed
- Remains in station for an extended station dwell
- Correct action by the Train Dispatcher to inform the Maintenance Control Center
- Correct action by RCC staff in informing passengers, adjusting service, and controlling crowds.

P205 - Train Breakup/Makeup

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the Train Dispatcher to correctly authorize and route a train breakup, when equipment failures warrant and train positions permit. Aspects to be demonstrated include:

- Correct handling by the Train Operator of:
 - Routing
 - Uncoupling
 - Making up a new train
 - Return to service of the shortened train
- Correct coordination of train actions by the Line Supervisor, if present.

P206 - Pushout/Pullout by Train

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, support safe pushout or pullout of a train unable to move under its own power, but able to be pushed or pulled by another revenue train of equal length, including:

- Routing a rescue train to the disabled train
- Coupling the failed train and the pushout train
- Unloading passengers in a safe manner at the earliest possible moment
- Routing and operating the coupled trains.

For MOS-1, an example of this test would be removing a train stalled outbound between the 5th/Hill and 7th/Flower Stations, requiring both pushing and pulling of the stalled train.

P207 - Pullout by Locomotive

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, support the pullout of a failed train by the locomotive, including:

- Dispatching and routing the locomotive from the M-O-W facility to a disabled train
- Coupling and preparing the train and locomotive for movement
- Removing passengers at the earliest possible moment
- Routing and operating the coupled train and locomotive.

For MOS-1, example tests would be removing a train stalled outbound at the 5th/Hill Station, and a train stalled at the Wilshire/Alvarado Station.

P208 - Platform Undershoot/Overshoot Correction

The objective of this test is to demonstrate that procedures and training, when integrated with equipment, enable the Train Operator to correctly respond to a platform undershoot or overshoot condition. Aspects to be demonstrated include whether:

- The Train Operator reports the undershoot or overshoot incident to the Train Dispatcher
- The Train Operator uses the appropriate operating modes, door controls, door cutouts, and announcements
- For station stopping equipment failures, the Train Operator reports lack of station stopping signals to the Train Dispatcher, for relay to the Maintenance Control Center.

P209 - Operation of Local Train Control and Traction Power Panels

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the system to be operated from the local train control and traction power control panels, when failure of SCADA,

the communications system, or the ATC or traction power system disrupts normal control, including:

- Dispatching of appropriate staff to the local control panel by the Operations Supervisor and the Maintenance Control Center, including:
 - Operations personnel for train control panels
 - Traction power technicians for traction power panels
- Appropriate coordination of panel operation and train movement by the RCC staff.

P210 - Substitute Bus Service

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, support the Metro Rail Operations Supervisor and bus division Transportation Supervisors in arranging for substitute bus service. Aspects to be demonstrated include:

- The Train Dispatcher or Operations Supervisor informs operating personnel of the new requirements.
- Suitable announcements are made on the Metro Rail system.
- Bus division staff sets up and operates a suitable bus bridge.
- The service disruption is corrected as quickly as possible, so that scheduled service can be restored.
- Service restoration and bus bridge termination are accomplished in an orderly and coordinated manner.

P211 - Main-Line Power Failure

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the Train Dispatcher, Train Operators, Operations Supervisor, and Maintenance Control Center staff to take the necessary

steps in case of a traction power failure or disturbance which does not cause a major disruption of train operations. Aspects to be demonstrated include:

- Checking the status of the tunnel, station, and main-line power and emergency lights
- Reconfiguration of gap and feeder breakers, dual feed switchovers, and other controls to minimize disruption and to enable quick restoration of power
- A prompt and effective response to a traction power emergency trip activation by a patron, other person, or the RCC staff, to ensure that no one is endangered.

P212 - Schedule Adherence and Correction

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, are adequate for the maintenance of scheduled service. Aspects to be demonstrated include:

- Station dwell time control
- Terminal turnback time modification
- Train performance level modification
- Train run addition or deletion
- Station skipping.

P213 - Middle Cab Operation

The objective of this test is to demonstrate that procedures and training, when integrated with equipment, enable the Train Dispatcher, Train Operators, and Line Supervisors to take the appropriate steps to maintain system safety when a train is being operated from a middle cab. Aspects to be demonstrated are:

- The Train Operator controlling train motion is guided by a Train Operator or Line Supervisor in the lead cab in the direction of travel.

- Communications between controlling and guiding staff member permit continuous contact:
 - Normally by intercom
 - By radio when failures require cutout of the intercom circuits in the electrical couplers.

P214 - Manual Block Operations

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators and Line Supervisors, under the direction of the Train Dispatcher, to set up and operate a Manual Block System for safe train separation, in case of major failure of the ATC system. Aspects to be demonstrated include:

- Suitable procedures are in place for:
 - Identifying and noting block occupancies
 - Issuing authority to occupy a block
 - Indicating clearance of a block by a train
- Communications enable a timely relay of status and instructions between Train Operators, Line Supervisors, and the Train Dispatcher.

P215 - Special Events

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable RCC staff, Train Operators, Line Supervisors, Station Agents, Fare Inspectors, and Transit Police to handle large crowds generated by special events. Aspects to be demonstrated include:

- Platform overcrowding and passenger vehicle overcrowding are controlled to avoid hazardous situations.
- Stations are adequately staffed for the expected crowd size.

- The RCC schedules and dispatches enough trains to meet the event demand.
- The yard supplies enough trains.

P216 - Passenger on Train in Yard

The objective of this test is to demonstrate that procedures and training enable the Train Operator, Line Supervisor, Yard Dispatcher, and Transit Police to organize a prompt, safe, and effective response to a passenger found on a passenger vehicle in the yard. Aspects to be demonstrated include:

- Bringing the train to a location where the passenger can safely leave the passenger vehicle
- Filling out an incident report, if required.

P217 - Yard Equipment Failure

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the Yard Dispatcher to promptly diagnose and report failed equipment which can disrupt operations, and for the Maintenance Control Center to respond in a timely manner. Aspects to be demonstrated include:

- Response to failure of the Yard Dispatcher console
- Response to failure of yard traction power distribution or control equipment
- Response to failure of yard ATC equipment, including switches and signals needed to move trains in, out, and around the yard
- Ability of the Yard Dispatcher to report to and coordinate with the Maintenance Control Center.

P218 - Station Equipment Failure

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the Operations Supervisor, Line Supervisors, Station Agents, and RCC staff to promptly diagnose and report failed

equipment in a station which can disrupt operations, and for the appropriate Maintenance Control Center to respond in a timely manner. Aspects to be demonstrated include:

- Response to a failure of an escalator or elevator
- Response to a failure in the lighting system
- Response to a failure in the PA system
- Response to a failure in the communications/ATC systems
- Response to a failure in the fare collection system
- Response to a failure of other station equipment.

P219 - RCC Equipment Failure

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable the Operations Supervisor, Train Dispatcher, and other RCC staff to promptly diagnose and report failed equipment in the RCC which can disrupt operations, for the Maintenance Control Center to respond in a timely manner, and for uninterrupted operation of the RCC during failures and failure correction. Aspects to be demonstrated include:

- Response to failure of an active RCC console
- Response to failure of the SCADA computer
- Response to failure of voice communication equipment. Alternative communications are quickly put in place for critical functions:
 - Telephone
 - Radio
 - Public Address
- Response to failure of RCC power supply equipment, including the uninterruptible power supplies for SCADA and communications equipment
- Ability of the Operations Supervisor to report to and coordinate with the Maintenance Control Center.

P220 - Intrusion Alarm

The objective of this test is to demonstrate that procedures and training enable the Operations Supervisor, Line Supervisor, Train Dispatcher, and Transit Police to organize a prompt and effective response to an intrusion alarm signalling an unauthorized intrusion into the tunnel, an equipment room, or other off-limits station area.

3.0 EMERGENCY SYSTEM OPERATIONS

P301 - Fire or Smoke on Train

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, Fire Department staff, paramedics, and other staff to respond safely and effectively to fire or smoke on a revenue-service train. Aspects to be demonstrated include:

- Operator of the affected train correctly informs the RCC of the problem and provides all relevant information.
- RCC staff immediately notifies the appropriate agencies and authorities.
- The RCC mounts a coordinated response, including control of fans, trains, and elevators and escalators. RCC staff act under the direction of the liaison from the Fire Department, when present, located at the System Communications console.
- Train Operators halt the affected train and nearby trains, or bring them to the next station, and evacuate the passengers from the trains.
- Station Agents, firefighters, and Line Supervisors direct the evacuation of stations directly affected by smoke or flame from the passenger vehicle.
- Firefighting equipment, tunnel and station fans and dampers, the undercar deluge system, traction power emergency trip stations, fire telephones (FTEL), EMP, and CP are used, as appropriate, by firefighters.
- Traction power in the vicinity is immediately shut down as soon as trains are secured.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Suitable announcements are made to patrons and the news media.

- Maintenance staff mounts a damage control and correction effort to restore full revenue service as quickly as possible. Train Operators in the yard bring the locomotive and other rescue equipment onto the line as needed.
- Tunnels are inspected before revenue service is restored.

P302 - Fire or Smoke in Station

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, Fire Department staff, paramedics, and other staff to respond to fire or smoke in a passenger station. Aspects to be demonstrated include:

- RCC staff correctly identifies the problem and location.
- RCC staff immediately notifies the appropriate agencies and authorities.
- The RCC mounts a coordinated response, including control of fans, trains, elevators, and escalators. RCC staff act under the direction of the liaison from the Fire Department, when present, located at the System Communications console.
- Train Operators halt the trains, or bring them to safe stations, as required and directed, and evacuate the passengers from the train.
- Station Agents, firefighters, and Line Supervisors direct the evacuation of the affected station.
- Firefighting equipment, tunnel and station fans and dampers, FTEL, EMP, and CP are used, as appropriate, by firefighters.
- Traction power is shut down when and where appropriate.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Suitable announcements are made to patrons and the news media.

- Maintenance staff mounts a damage control and correction effort to restore full revenue service as quickly as possible.

P303 - Fire or Smoke in RCC

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, Fire Department staff, paramedics, and other staff to respond to fire or smoke in the RCC. Aspects to be demonstrated include:

- RCC staff immediately notifies the appropriate agencies and authorities.
- RCC staff determines the nature and severity of the fire and initiates the appropriate response.
- RCC staff, firefighters, and Transit Police direct the evacuation of the RCC, when necessary.
- An alternate central site is established, if required.
- Emergency actions normally mounted from the RCC are mounted from the alternative site if the RCC is unusable.
- Train Operators bring their trains to the next stations and hold them, until directed to continue by RCC staff, and train operation then proceeds in an orderly manner.
- Firefighting equipment and the FTEs are used, as appropriate, by firefighters.
- The RCC staff mounts a coordinated response to minimize the damage and stabilize the status of the Metro Rail system. RCC staff will act under the direction of the liaison from the Fire Department, when present.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Suitable announcements are made to patrons and the news media.

P304 - Fire or Smoke in the Yard or Maintenance Facility

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, Fire Department staff, paramedics, and other staff to respond to fire or smoke in the Main Shop or other maintenance facility. Aspects to be demonstrated include:

- Staff immediately notifies the appropriate agencies and authorities.
- Appropriate personnel determine the nature and severity of the fire and initiate the appropriate response.
- The staff mounts a coordinated response, under the direction of the liaison from the Fire Department, when present, to minimize the damage to the facility.
- Train Operators in the yard move trains as necessary.
- RCC staff, firefighters, and Transit Police direct the evacuation of the maintenance facility and, if necessary, the RCC.
- Firefighting equipment and communications equipment are used, as appropriate, by firefighters.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Traction power is controlled as required for the incident.

P305 - Train Collision

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Line Supervisors, RCC staff, Fire Department staff, paramedics, and other staff to respond to a train collision. Aspects to be demonstrated include:

- Train Operators of the affected trains immediately halt their trains, determine the severity of the situation, and notify the RCC.

- RCC staff immediately notifies the appropriate agencies and authorities.
- The RCC mounts a coordinated response, including immediately shutting down traction power in the vicinity of the collision. RCC staff act under the direction of the liaison from the Fire Department, when present, located at the System Communications console.
- Other Train Operators halt their trains, or bring them to the next station, as directed by the RCC.
- Train Operators, firefighters, paramedics, and Line Supervisors direct the evacuation of the passengers from the affected trains.
- Firefighting and emergency rescue equipment and emergency traction power trip stations are used, as appropriate, by firefighters.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Tunnels are inspected before revenue service is restored.
- Service is restored and maintained to the extent safely possible.
- Maintenance staff mounts a damage control and correction effort, to restore full revenue service as quickly as possible. Train Operators in the yard bring the locomotive and other rescue equipment onto the line as needed.
- Suitable announcements are made to patrons and the news media.

P306 - Train Derailment

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Line Supervisors, RCC staff, Fire Department staff, paramedics, and other staff to respond to a train derailment. Aspects to be demonstrated include:

- The affected Train Operator halts the train, reports the derailment, assesses the damage, and reports the extent of the damage to the RCC. Other Train Operators respond to RCC directions to halt their trains or bring them to the next station.

- RCC staff immediately notifies the appropriate agencies and authorities.
- The RCC mounts a coordinated response, including immediately shutting down traction power in the vicinity of the derailment. RCC staff act under the direction of the liaison from the Fire Department, when present, located at the System Communications console.
- The Train Operator, firefighters, paramedics, and Line Supervisors direct the evacuation of the passengers from the affected train.
- Firefighting and emergency rescue equipment and emergency traction power trip stations are used, as appropriate, by firefighters.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Service is maintained to the extent safely possible.
- Maintenance staff mounts a damage control and correction effort, to restore full revenue service as quickly as possible. Train Operators in the yard bring the locomotive and other rescue equipment onto the line as needed.
- Rerailing equipment is brought to the site.
- Tunnels are inspected before full revenue service is restored.
- Suitable announcements are made to patrons and the news media.

P307 - Serious Criminal Act on Train

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Line Supervisors, RCC staff, Transit Police and other authorities, paramedics, and other staff to respond to a serious criminal act on a train. Such acts include murder, kidnapping, terrorist attack, rape, or other violent crime. Aspects to be demonstrated include:

- The affected Train Operator reports the crime to the RCC.

- RCC staff immediately notifies the Transit Police. The Transit Police notify the City and County Police, FBI, Fire Department, paramedics, and other authorities, as appropriate.
- Actions dictated by the responsible law enforcement agency are immediately implemented.
- The affected Train Operator moves the train as directed. Alternatives are:
 - Halt the train
 - Hold the train in the next station with the doors closed
 - Bring the train to the next station, and open the doors.
- Other Train Operators halt their trains, or bring them to the next station, as directed.
- All possible patrons and staff are evacuated from the crime scene.
- The RCC mounts a coordinated response in terms of traction power control, signals, and all other train movements.
- Suitable announcements are made to patrons and the news media.
- Service is maintained to the extent safely practical.

P308 - Serious Criminal Act in Station

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Line Supervisors, Station Agents, RCC staff, Transit Police and other authorities, paramedics, and other staff to respond to a serious criminal act in a station. Such acts include murder, kidnapping, terrorist attack, rape, or other violent crime. Aspects to be demonstrated include:

- Handling of crimes reported by patrons and employees is appropriate.
- CCTV Operators identify and correctly report crimes that can be observed over the CCTV subsystem.

- The appropriate parties determine the severity of the situation and initiate the appropriate response.
- RCC staff immediately notifies the Transit Police. The Transit Police notify the City and County Police, FBI, Fire Department, paramedics, and other authorities, as appropriate.
- Actions dictated by the responsible law enforcement agency are immediately implemented. All possible patrons and staff are evacuated from the crime scene.
- Trains are moved as directed by the Transit Police Watch Commander, or other legal authority.
- The RCC mounts a coordinated response in terms of traction power control, signals, and all other train movements.
- Suitable announcements are made to patrons and the news media.

P309 - Earthquake or Seismic Event

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Line Supervisors, RCC staff, Fire Department staff, Transit Police and other authorities, paramedics, and other staff to respond to an earthquake or seismic alarm. Aspects to be demonstrated include:

- The appropriate parties respond to the annunciation of the event, determine the severity of the situation, and take appropriate actions.
- RCC staff immediately notifies the appropriate agencies and authorities.
- The RCC mounts a coordinated response. RCC staff act under the direction of the liaison from the Fire Department, when present, located at the System Communications console.
- Train Operators halt the trains or bring them to the next station, as directed, and evacuate the passengers from the trains as directed.

- Traction power is immediately shut down when trains are in secure locations.
- Station Agents, firefighters, Transit Police, and Line Supervisors direct the evacuation of stations.
- Firefighting equipment, rescue equipment, traction power emergency trip stations, FTEL, EMP, and CP are used, as appropriate, by firefighters.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Suitable announcements are made to patrons and the news media.
- Inspections are conducted before the system is restarted.

P310 - Gas Explosion

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, Fire Department staff, paramedics, and other staff to respond to a gas explosion. Aspects to be demonstrated include:

- The appropriate parties respond to the annunciation of the event, determine the severity of the situation, and take appropriate actions.
- RCC staff immediately notifies the appropriate agencies and authorities.
- The RCC mounts a coordinated response. RCC staff act under the direction of the liaison from the Fire Department, when present, located at the System Communications console.
- Train Operators halt the trains or bring them to the next station, as directed, and evacuate the passengers from the trains as directed.
- Station Agents, firefighters, Transit Police, and Line Supervisors direct the evacuation of stations affected by smoke or flame from the explosion.

- Firefighting equipment, tunnel and main-line fans and dampers, traction power emergency trip stations, FTEL, EMP, and CP are used, as appropriate, by firefighters.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.
- Suitable announcements are made to patrons and the news media.
- Tunnels are inspected before revenue service is restored.

P311 - Major Traction Power Failure

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, and other staff to respond to a major traction power failure of one or more substations, a failure of one of the redundant feeders, or a power failure affecting a major portion of the line. Aspects to be demonstrated include:

- The Train Dispatcher correctly detects and responds to the annunciation of a power failure.
- RCC staff immediately notifies maintenance staff, power utility personnel, and other agencies and authorities.
- The RCC mounts a coordinated response, under the direction of the Operations Supervisor.
- Train Operators evacuate the passengers from the trains as directed.
- Station Agents, Line Supervisors, and Transit Police direct the evacuation and closing of stations.
- Traction power is controlled so that it does not come on while the evacuation is taking place. RCC staff reconfigures gap and feeder breakers, dual feed switchovers, and emergency lights to enable quick restoration of power.
- Suitable announcements are made to patrons and the news media.

- The locomotive is dispatched from the yard to move trains as necessary.

P312 - Major Station Power Failure

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Station Agents, Transit Police, and other staff to respond to a major station power failure. Aspects to be demonstrated include:

- Operations Supervisor correctly detects and responds to the annunciation of a power failure.
- RCC staff immediately notifies the maintenance staff, power utility personnel, and other agencies and authorities.
- The RCC mounts a coordinated response under the direction of the Operations Supervisor.
- RCC staff direct Train Operators to skip the affected stations, if revenue service is to continue.
- Station Agents, Line Supervisors, and Transit Police direct the evacuation and closing of the affected station. A report on the status of emergency lighting is made to RCC staff.
- Suitable announcements are made to patrons and the news media.

P313 - Injured/Ill Passenger on Train

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, paramedics, and other staff to respond to a seriously injured or ill passenger on a revenue train. Aspects to be demonstrated include:

- The Train Operator determines the nature of the injury/illness and reports to the RCC.
- RCC staff immediately notifies the appropriate agencies and authorities.

- The Train Operator brings the affected train to the next station, as directed.
- Station Agents, paramedics, and Line Supervisors direct the removal of the injured or ill passenger from the passenger vehicle.
- Suitable announcements are made, as required.

P314 - Injured/Ill Person in Station

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, paramedics, and other staff to respond to a seriously injured or ill person in a station. Aspects to be demonstrated include:

- Appropriate parties determine the nature of the injury/illness and report to the RCC.
- RCC staff immediately notifies the appropriate agencies and authorities.
- Station Agents, paramedics, and Line Supervisors direct the removal of the injured or ill person from the station.
- Suitable announcements are made, as required.

P315 - Ill Train Operator

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, paramedics, and other staff to respond to an ill Train Operator on a revenue train. Aspects to be demonstrated include:

- Illness is detected, the severity of the illness is determined, and appropriate actions are taken by all parties involved to initiate resolution of the problem.
- RCC staff immediately notifies the appropriate agencies and authorities.

- Using ATO mode, the Train Operator brings the affected train to the next station, if possible. If not, the nearest qualified person is dispatched to the train by the fastest possible means, to take control over the train and bring it to the nearest station.
- Station Agents, paramedics, or Line Supervisors remove the ill Train Operator from the passenger vehicle.
- The RCC mounts a coordinated response, under the direction of the Operations Supervisor, to enable the train to continue on its scheduled run as quickly as possible.
- Ambulances and medical authorities are notified and dispatched, if needed.
- Suitable announcements are made to affected patrons.

P316 - Person in Train Right-of-Way

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, and other staff to respond to a report of a person on the train right-of-way. Aspects to be demonstrated include:

- The affected Train Operator brings his train to a halt, assesses the situation, and reports to the RCC.
- RCC staff immediately turns off traction power in an area large enough to ensure that the person cannot be electrocuted. Other staff on the site may use an emergency traction power trip station to remove power.
- Operations Supervisor informs the Transit Police.
- Train Operators of trains in the area are notified and bring trains to a halt.
- Train Operators notify passengers of the delay.

- Station Agents, Transit Police, or Line Supervisors immediately help remove the person from the right-of-way.
- The RCC mounts a coordinated response, under the direction of the Operations Supervisor, to enable trains to continue on their scheduled runs as quickly as possible.
- The person is detained for questioning by the Transit Police.

P317 - Person under Train/Suicide

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, RCC staff, Transit Police, Coroner's Office staff, paramedics, and other staff to respond to a report of a person under a train, or person falling from the train, dragged in the doors, or hit by a train. Aspects to be demonstrated include:

- The affected Train Operator brings his train to a halt, assesses the situation, and reports to the RCC.
- RCC staff immediately turns off traction power in an area large enough to ensure that the person or rescuers cannot be electrocuted. Other staff on the site may use an emergency traction power trip station to remove power.
- The RCC mounts a coordinated response, under the direction of the Operations Supervisor.
- Train Operators are notified, bring affected trains to a halt, and notify passengers of the delay.
- The Operations Supervisor notifies the Transit Police.
- Transit Police notify the appropriate authorities.
- Station Agents, Transit Police, or Line Supervisors immediately judge the severity of the situation.

- Ambulances, medical authorities, and the Coroner's Office are notified and dispatched, if needed.
- Statements are taken from the necessary people by the Transit Police.
- Suitable announcements are made to patrons and the news media.

P318 - Bomb Threat

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Line Supervisors, Station Agents, RCC staff, Transit Police, paramedics, and other staff to respond to a bomb threat. Aspects to be demonstrated include:

- Appropriate staff handle the report and response to the report of the bomb threat.
- RCC staff immediately notifies the Transit Police. The Transit Police notify the City and County Police, FBI, Fire Department, paramedics, and other authorities.
- Actions dictated by the responsible law enforcement agency are immediately implemented.
- The RCC mounts a coordinated response in terms of traction power control, control of RF energy in the affected area, signals, and all train movements.
- Train Operators bring their trains to the nearest stations and evacuate the passengers from the trains.
- Station Agents, Line Supervisors, and Transit Police direct the immediate evacuation and closing of stations.
- Suitable announcements are made to patrons and the news media.

P319 - Flood

The objective of this test is to demonstrate that procedures and training, when integrated with equipment and facilities, enable Train Operators, Line Supervisors, RCC staff, Transit Police, paramedics, and other staff to respond to a flood. Aspects to be demonstrated include:

- The Operations Supervisor detects the annunciation of the flood and takes appropriate action.
- RCC staff immediately notifies the Transit Police. The Transit Police notify the Fire Department and other authorities.
- The RCC mounts a coordinated response in terms of traction power control, sump pumps, signals, and all other train movements. RCC staff act under the direction of the liaison from the Fire Department, when present, located at the System Communications console.
- Train Operators bring their trains to the nearest stations, if possible, and evacuate the passengers from the trains.
- Traction power is shut down as soon as trains are secured.
- Station Agents, Line Supervisors, and Transit Police direct the immediate evacuation and closing of stations.
- Rescue equipment, traction power emergency trip stations, FTEL, EMP, and CP are used, as appropriate, by firefighters and rescue staff.
- Ambulances and medical authorities are notified and dispatched, if needed, under the Fire Department's direction.

P320 - Train-to-Safety Walk Evacuation

The objective of this test is to demonstrate that procedures and training enable the Operations Supervisor, Line Supervisor, Train Operators, Train Dispatcher, and Transit Police to organize and implement the appropriate steps when it is necessary to evacuate a train by guiding the passengers down the safety walk into a nearby station or a train in the opposite tunnel. Aspects to be demonstrated include:

- Determination of the need for evacuation
- Authorization for evacuation
- Controlling other trains as required
- Announcements
- Shutting off traction power in the area
- Guiding passengers safely along the safety walk to the nearest station or through the cross passage to a train waiting in the opposite tunnel.

IV. NONCONTRACTUAL SYSTEM INTEGRATION AND PRE-REVENUE TEST SEQUENCE

1.0 INTRODUCTION

This section of the Appendix establishes the sequence for the performance of noncontractual system integration and pre-revenue tests. The actual calendar dates for performing noncontractual tests will be determined by the SCRTD Test Engineer during the preparation of monthly test schedules.

1.1 Scope

This section establishes the planned sequence for all Metro Rail noncontractual tests identified in this Appendix. The SCRTD is responsible for the performance of noncontractual tests.

The planned sequence for performing the tests reflects equipment availability and the completion of prerequisite tests, where such are a factor. Where prerequisite tests are not a factor, similar tests are grouped together.

1.2 Changes in the Planned Test Sequence

Several factors can require the actual test sequence to differ from the planned test sequence. These include:

- Availability of test program manpower
- Availability of non-test program personnel that are required to perform tests, such as:
 - Transportation personnel
 - Equipment Maintenance personnel
 - Facilities Maintenance personnel
 - Transit Police personnel
 - Personnel from outside agencies
 - Consultants and contractors

- Availability of equipment, such as:
 - Traction power
 - Passenger vehicles
 - Maintenance equipment

- Availability of system operations time for the performance of tests.

These factors will affect the test sequence in ways which cannot be completely anticipated. Flexibility exists in the planned sequence of pre-revenue tests, since few dependencies exist between tests. This flexibility can be exploited to limit the impact of changes to the sequence on the timely completion of the test program. In the following sections, constraints and options for alternate sequences are noted.

Any change to the approved test sequence that affects Level II milestones is subject to the SCRTD's formal change control process.

1.3 Overall Sequence

The overall sequence for noncontractual system integration and pre-revenue tests is as follows:

1. Noncontractual system integration tests will be performed prior to pre-revenue tests to verify adequate system design.

2. Normal operations pre-revenue tests will be performed following noncontractual system integration tests. These tests will cover normal operating procedures. Should an actual abnormal or emergency condition arise during the performance of these tests, personnel will follow emergency response procedures which will be established before testing begins.

3. Abnormal operations pre-revenue tests will be performed following normal operations tests to verify abnormal operating procedures. Abnormal operations pre-revenue tests follow normal operations pre-revenue tests so that operating and maintenance staff are familiar with normal conditions when responding to abnormal conditions.

4. Emergency operations pre-revenue tests will be performed following abnormal operations tests to verify emergency operating procedures. Emergency operations pre-revenue tests are performed last, so that operating and maintenance staff are familiar with normal and abnormal conditions when responding to emergency conditions.

This sequence is intended to group tests into logical categories. However, some tests may be conducted at times other than indicated.

1.4 Level III Schedule

The Revision 6 Level III Construction Schedule, dated January 14, 1988, indicates the following:

- Traction power is planned to be available on April 10, 1991. Once traction power is available, new safety rules for tunnel access become effective to ensure the safety of all employees and contractor personnel.
- Noncontractual system integration tests are scheduled to begin between April 16, 1992, and July 10, 1992, and continue for a duration of 59 working days.
- Pre-revenue tests are scheduled to begin on July 13, 1992, following the completion of noncontractual system integration tests, and end on December 31, 1992. The scheduled start of revenue operations is the following Monday, January 4, 1993. The scheduled duration of these tests is 119 working days.

2.0 NONCONTRACTUAL SYSTEM INTEGRATION TESTS

Noncontractual system integration tests will be performed as soon as the subsystems involved in each test become available, prerequisite tests by the manufacturers are complete, and the equipment and/or subsystems have been accepted by SCRTD. Noncontractual system integration tests may be performed while contractual system integration tests are still being performed. Careful coordination will be required to interweave the tests.

The sequence for performing noncontractual system integration tests is shown in Exhibit C-2. The simplest tests are performed first. Alternate test sequences are also feasible. The Test Engineer may need to modify the test sequence depending on the progress of construction, equipment delivery, and contractual tests. The following paragraphs describe the sequence and dependencies of noncontractual system integration tests.

The Main Shop Facilities/Communications Interface Test (S107) should be performed after the Main Shop facilities are complete and after the necessary communications equipment is complete, which includes the communications equipment in the Main Shop and the central communications equipment. The purpose of the test is to demonstrate that the interfaces are adequate for all specified communications functions to operate correctly. This test will be performed in the Main Shop.

The Maintenance-of-Way Facility/Communications Interface Test (S108) should be performed after the maintenance-of-way facilities are complete and after the necessary communications equipment is complete. The purpose of the test is to demonstrate that the interfaces are adequate for all specified communications functions to operate correctly. This test will be performed in the M-O-W facility.

The Union Station and Yard Lead Facilities/Communications Interface Cabinet #5 Interface Test (S109) should be performed after the Union Station and yard leads facilities are complete and after the necessary communications equipment is complete. The purpose of the test is to demonstrate that the interfaces are adequate for all specified communications and facilities monitoring functions to operate correctly. This test will be performed on site at the Union Station and yard leads facilities.

EXHIBIT C-2
NONCONTRACTUAL SYSTEM INTEGRATION TEST SEQUENCE

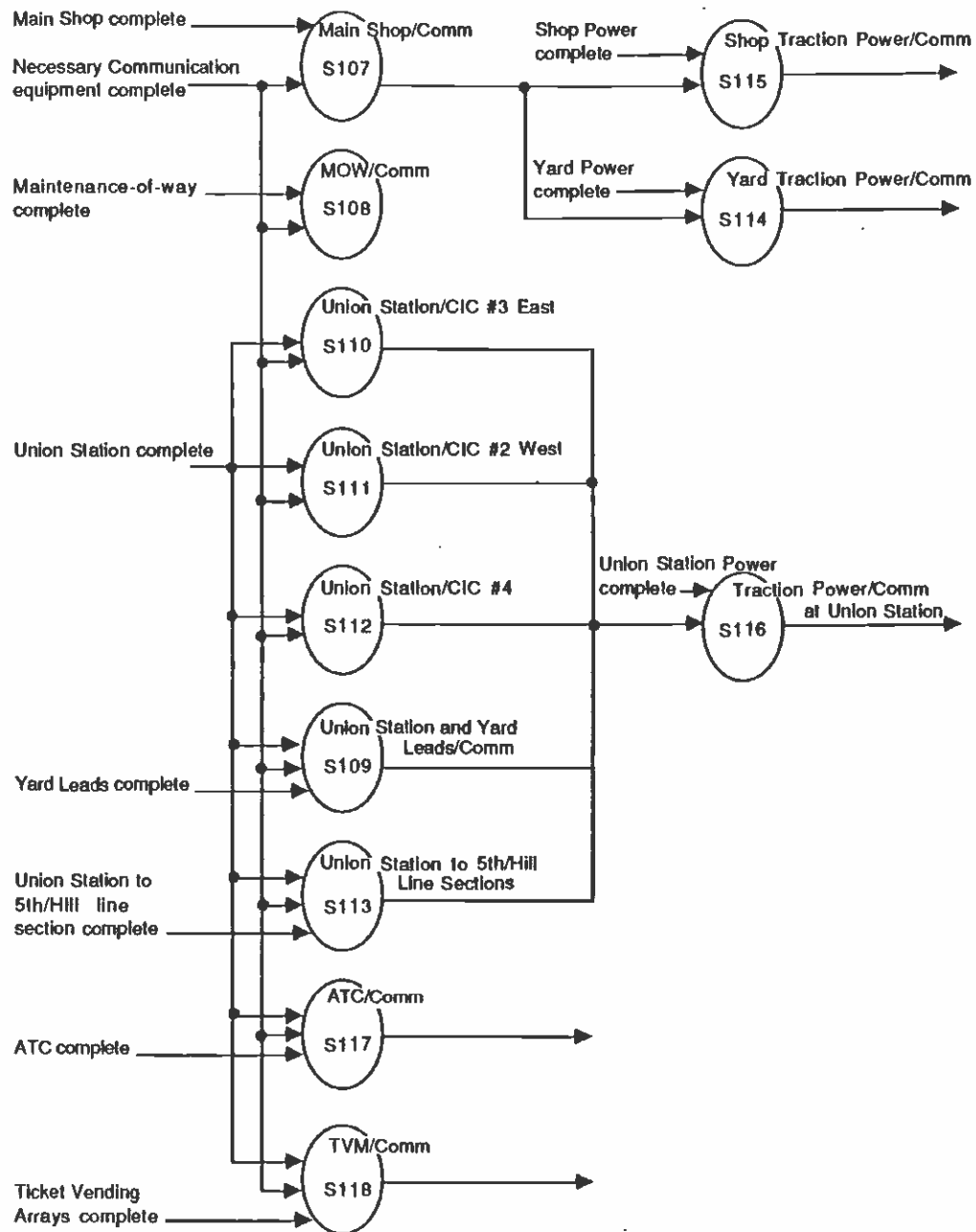
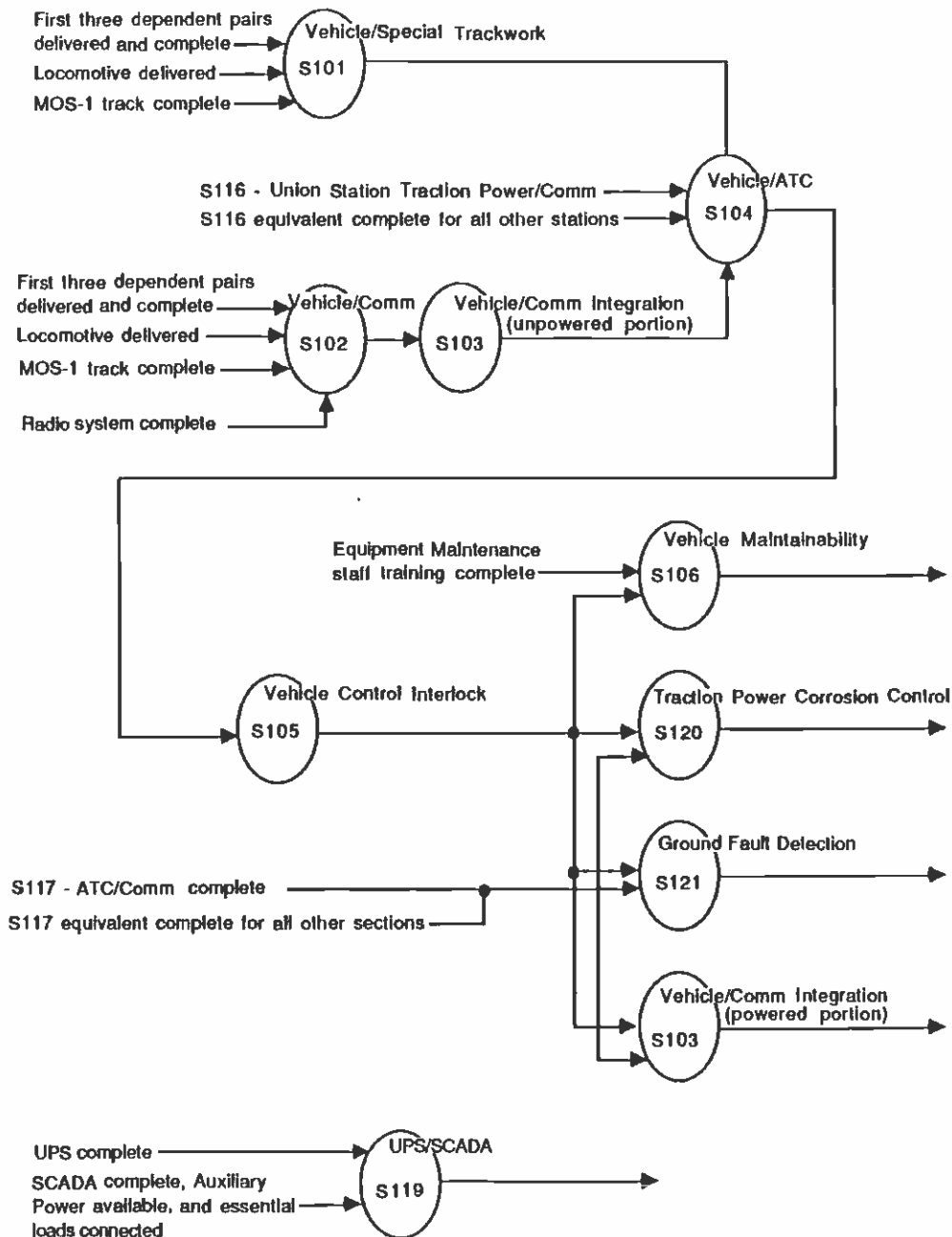


EXHIBIT C-2
NONCONTRACTUAL SYSTEM INTEGRATION TEST SEQUENCE
 (continued)



The Union Station Facilities/Communications Interface Cabinet #3 East Interface Test (S110), the Union Station Facilities/Communications Interface Cabinet #2 West Interface Test (S111), and the Union Station Facilities/Communications Interface Cabinet #4 Interface Test (S112) should be performed after the Union Station facilities are complete and after the necessary communications equipment is complete. The purpose of these tests is to demonstrate that the interfaces are adequate for all specified communications and facilities monitoring functions to operate correctly. These tests will be performed at Union Station.

The Union Station to 5th/Hill Line Section Facilities/Communications Interface Test (S113) should be performed after the Union Station to 5th/Hill line section facilities are complete and after the necessary communications equipment is complete. The purpose of the test is to demonstrate that the interfaces are adequate for all specified communications and facilities monitoring functions to operate correctly. This test will be performed at equipment locations on the line section between Union Station and 5th/Hill.

The Yard Traction Power/Communications Interface Test (S114) should be performed after the Main Shop Facilities/Communications Interface Test and after the yard traction power equipment is complete. The purpose of the test is to demonstrate that the interfaces are adequate for all specified traction power control and monitoring functions to operate correctly. This test will be performed in the yard.

The Shop Traction Power/Communications Interface Test (S115) should be performed after the Main Shop Facilities/Communications Interface Test and after the main shop traction power equipment is complete. The purpose of the test is to demonstrate that the interfaces are adequate for all specified traction power control and monitoring functions to operate correctly. This test will be performed in the Main Shop.

The Union Station Traction Power/Communications Interface Test (S116) should be performed after the Union Station and Yard Leads Facilities/Communications Interface Test, the Union Station Facilities/Communications Interface Cabinet #3 East Interface Test, the Union Station Facilities/Communications Interface Cabinet #2 West Interface Test, the Union Station Facilities/Communications Interface Cabinet #4 Interface Test, and the Union Station to 5th/Hill Line Section Facilities/Communications Interface Test are complete, and after the Union Station traction power equipment is complete. The purpose of the test is to demonstrate that the interfaces are adequate for all specified traction power control and monitoring functions to operate correctly. This test will be performed in equipment rooms and on the main line around Union Station.

The Automatic Train Control/Communications Interface Test at Union Station (S117) should be performed after the Union Station and yard leads facilities and the Union Station to 5th/Hill line section are complete; after necessary communications equipment is complete; and after the ATC equipment is complete in Union Station, in the yard, and at Civic Center. The purpose of the test is to demonstrate that the interfaces are adequate for all specified ATC and communications functions to operate correctly. This test will be performed in Union Station equipment rooms and on the main line at and around Union Station.

The Fare Collection/Communications Interface Test (S118) should be performed after the Union Station facilities, the fare collection equipment at Union Station, and the necessary communications equipment is complete. The purpose of the test is to demonstrate that the interfaces are adequate for the specified fare collection monitoring and control functions to operate correctly. This test will be performed at Union Station.

Tests S110 through S118 refer to equipment and facilities in and around Union Station. Comparable tests must also be performed for similar equipment at the other locations listed in Exhibit C-1, including the yard leads, Civic Center, 5th/Hill, 7th/Flower, and Wilshire/Alvarado, in the sequence shown in Exhibit C-2.

The Passenger and Auxiliary Vehicles/Special Trackwork Interface Test (S101) should be performed after three dependent pairs and the locomotive are delivered and should be performed before passenger or auxiliary vehicles are otherwise operated on the Metro Rail system. The purpose of this test is to verify the ability of the passenger vehicle and the locomotive to safely negotiate the track and special trackwork. This test will use the locomotive to pull and push a six-car train throughout the system.

The Passenger Vehicle/Communications Interface Test (S102) and the unpowered portion of the Passenger Vehicle/Communications Integration Test (S103) should be performed during the Passenger and Auxiliary Vehicle/Special Trackwork Interface Test and before further operation of passenger vehicles on the main line. The purpose of these tests is to verify passenger vehicle communication capabilities in all locations. These tests must be performed before trains are run on the main line so that the reception of instructions and status information can be assured. These tests may be conducted by using the locomotive to move a train through the system, while using the radio continuously, or after traction power is available, with the train moving under its own power.

The Passenger Vehicle/ATC Interface Test (S104) should be performed before the vehicle is operated regularly on the Metro Rail system, and following the Passenger and Auxiliary Vehicles/Special Trackwork Interface Test and the Passenger Vehicle/Communication Interface Test. The purpose of this test is to verify the design of the interfaces between equipment supplied by separate contractors for the passenger vehicle. This test need be performed only on the first dependent pair.

The Passenger Vehicle Control Interlock Test (S105) should be performed after the passenger vehicle/ATC interface tests. The purpose of this test is to verify that misapplication of train control commands cannot cause a hazard to persons or the system. This test will require operation of multipair trains on the main line or in the yard.

The Passenger Vehicle On-Site Maintainability Test (S106) should be performed after the Passenger Vehicle Control Interlock Test, and after adequate Equipment Maintenance staff training has occurred. The purpose of the test is to demonstrate that the vehicle design, documentation, and staff training are adequate to meet the contractual maintainability requirements.

Conduct of the Traction Power Corrosion Control Test (S120), ATC Equipment Room and Power Substation Ground Fault Detection Test (S121), and the powered portion of the Passenger Vehicle/Communications Integration Test (S103) all require an operable transit system, and should be performed after the Passenger Vehicle Control Interlock Test. The purpose of the tests is to ensure that the functions operate correctly. The tests are conducted on the main line with trains operating.

The Uninterruptible Power Supply (UPS)/SCADA Interface Test (S119) can be performed as soon as the two systems are installed and operational, and contractors have completed their tests. This test is not dependent on the completion of any other tests, nor are other system integration tests dependent on the completion of this test.

3.0 PRE-REVENUE TESTS

System pre-revenue tests are performed at the Metro Rail system level during the pre-revenue phase to simulate revenue service operations during normal, abnormal, and emergency conditions, to verify proper training of SCRTD personnel. These tests will involve all elements of the Metro Rail system.

Revenue service must be simulated for most pre-revenue tests, requiring the availability of facilities, equipment, and trained personnel, and the simultaneous performance of many functions associated with system operation.

In addition, revenue service must be simulated for training purposes prior to the actual start of revenue service. The performance of pre-revenue tests requires close coordination with other groups using the Metro Rail system for training and verification purposes, to minimize the impact of testing on other service preparation activities.

During each scheduled pre-revenue test, the test team's attention will be focused on the function and performance of the systems or equipment under test. However, the test team will also informally observe and review other operating and maintenance aspects while the particular test is being performed.

3.1 Normal System Operation Tests

The sequence for performing normal system operation tests is shown in Exhibit C-3. The tests have few interdependencies. This is because each test is designed to demonstrate a single aspect of normal Metro Rail system operations. The date and duration of each test shown in Exhibit C-3 indicate the time when the aspect will be tested. However, use of that aspect will also be required in support of other tests.

In order to indicate the allocation of test resources, Exhibit C-3 does not show any overlapping tests. However, if testing manpower and procedures permit, tests can be performed concurrently for greater efficiency or shorter overall duration.

For some tests a logical order is apparent, such as off-peak-period revenue service simulation preceding peak-period revenue service simulation. Station operations tests, for example, do not depend on the completion of any other pre-revenue tests.

EXHIBIT C-3
Pre-Revenue Operations Test Sequence
Normal Operations

	JULY 1992			AUGUST 1992					SEPTEMBER 1992		
	13	20	27	3	10	17	24	31	7	14	21
P114 Normal Main Shop Maintenance Activities	===										*
P113 Normal Yard Maintenance	==	=									*
P110 Yard Operations			====								*
SIMULATED REVENUE OPERATIONS											
P101 System Opening/Closing for Normal Train Operations			===								*
P115 Normal RCC Maintenance			==	=							*
P109 Rail Control Center Operations				====	==						*
P111 Normal Main Line Maintenance					===						*
P112 Normal Station Maintenance						==					*
P106 Work Train Operation						===					*
P108 Station Operations							===				*
P104 Off-Peak-Period Revenue Service Simulation							==	=			*
P103 Peak Period Revenue Service Simulation									====		*
P116 MIS Operation										==	*
P107 Revenue Handling											=*
P102 Station Opening/Closing											=* =
P105 Metro Rail/Light Rail/Bus Integration											* ====

Scale: Each character (=) equals one test day

*SCRTD HOLIDAY

04/12/88 LA0481124R(1)

Most tests require at least limited support from RCC Operations, MIS Operations, and Train Operations. In addition, maintenance of the equipment will be required at times not specifically indicated as maintenance test times, both for scheduled preventive maintenance and to correct failures.

Because the yard will be available before the main line, tests involving yard operations are scheduled first. Maintenance activities precede operating activities. Yard and maintenance tests do not heavily rely on simulated main-line service aspects, although they do require demonstration of interfaces with operations staff and main-line equipment.

Some tests can be performed later than presently scheduled. For example, Station Opening and Closing, Rail/Light Rail/Bus Integration, and Revenue Handling tests could be performed after Emergency Operations Tests.

3.2 Abnormal System Operation Tests

The sequence for abnormal system operations tests is shown in Exhibit C-4. The abnormal system operations tests have few interdependencies, because each test is designed to demonstrate a single aspect of Metro Rail system operations under abnormal conditions.

In order to indicate the allocation of test resources, Exhibit C-4 does not show any overlapping tests. However, if testing manpower and procedures permit, tests can be performed concurrently for greater efficiency or shorter overall duration.

For some tests a logical order is apparent, such as testing the adequacy of the response to small service perturbations before testing manual block operations. However, train breakup tests do not depend on the completion of any other tests.

Revenue service simulation will be required for all tests except the "Passenger on Train in Yard" and "Intrusion Alarms" tests. Simulated revenue service will be disrupted by most tests. For example, demonstrating the response to equipment failures will require:

- Reconfiguration of the system to minimize the impact of the failure
- Locating, removing, and replacing the failed systems, subsystems, or components
- Returning the system to the normal operational configuration.

EXHIBIT C-4
Pre-Revenue Operations Test Sequence
Abnormal Operations

	SEPTEMBER 1992		OCTOBER 1992				NOVEMBER 1992			
	21	28	5	12	19	26	2	9	16	20
SIMULATED REVENUE OPERATIONS (Continued)										
P212	Schedule Adherence and Correction	===								!
P208	Platform Undershoot/Overshoot Correction	==								!
P204	Passenger Vehicle Equipment Failure		====							!
P205	Train Breakup/Makeup		= =							!
P201	Reverse Running Operations			==						!
P203	Unscheduled Midline Turnback				==					!
P213	Middle Cab Operation				=					!
P202	Replacement of a Failed Train				==					!
P206	Pushout/Pullout By Train				==					!
P207	Pullout By Locomotive					=				!
P209	Operation of Local Train Control and Traction Power Panels					====				!
P214	Manual Block Operation						==			!
P210	Substitute Bus Service						===			!
P211	Main Line Power Failure							==		!
P217	Yard Equipment Failure							==		!
P218	Station Equipment Failure							= =		!
P219	RCC Equipment Failure							==		!
P215	Special Events								==	!
P220	Intrusion Alarms									== !
P216	Passenger On Train In Yard									== !

Scale: Each character (=) equals one test day

*SCRTD HOLIDAY

! Last Scheduled Day

04/12/88 LA0481124R(2)

3.3 Emergency System Operation Tests

The sequence for performing emergency system operation tests is shown in Exhibit C-5. The emergency system operation tests have few internal interdependencies. For example, testing the response to a serious criminal act does not depend on the completion of any other tests. However, emergency system operation tests must be performed in concert with Fire and Life Safety Tests which are part of the System Certification Program. Therefore, the test sequence and schedule for emergency system operation tests must be coordinated with the Safety Certification Review Team, the Los Angeles Fire Department, and the Los Angeles County Fire Department.

For some tests a logical order is apparent, such as testing all fire-related responses and procedures in a single test sequence. Grouping similar tests together reduces the setup costs of the tests and scheduling burden with outside agencies that will participate in the tests.

Revenue service simulation will be required for all tests. Simulated revenue service will be disrupted by most emergency system operation tests. For example, demonstrating the response to a fire will require:

- Reconfiguration of the system to minimize the impact of the emergency condition on personnel, patrons, and Metro Rail equipment
- Steps to eliminate the emergency condition
- Returning the system to the normal operational configuration.

In order to indicate the allocation of test resources, Exhibit C-5 does not show any overlapping tests. However, if testing manpower and procedures permit, tests can be performed concurrently for greater efficiency or shorter overall duration.

LA0481065R

09/88
Rev. 0

EXHIBIT C-5
Pre-Revenue Operations Test Sequence
Emergency Operations

	NOVEMBER 1992		DECEMBER 1992			
	23	30	7	14	21	28 31
SIMULATED REVENUE OPERATIONS (Continued)						
P301	Fire or Smoke on Train	=== **			*	!
P320	Train-to-Safety Walk Evacuation	** ==			*	!
P302	Fire or Smoke in a Station	** =			*	!
P303	Fire or Smoke in the RCC	** =			*	!
P304	Fire or Smoke in Yard Area or Maintenance Facility	** =			*	!
P305	Train Collision	** ==			*	!
P306	Train Derailment	** =			*	!
P307	Serious Criminal Act on a Train	** =			*	!
P308	Serious Criminal Act in Station	** =			*	!
P309	Earthquake or Seismic Event	** =			*	!
P310	Gas Explosion	** ==			*	!
P311	Major Traction Power Failure	** =			*	!
P312	Major Station Power Failure	** =			*	!
P313	Injured/III Passenger on Train	** =			*	!
P314	Injured/III Person In Station	** =			*	!
P315	III Train Operator	** =			*	!
P316	Person in Train Right-of-Way	** ==*			*	!
P317	Person Under Train/Suicide	** =			*	!
P318	Bomb Threat	** =			*	!
P319	Flood	** =!			*	!
Scale: Each character (=) equals one test day						
			*SCRTD HOLIDAY		! Last Scheduled Day	

04/12/88 LA0481124R(3)