

YARD AND SHOPS FUNCTIONAL PLAN

Metro Rail Transit Consultants

DMJM/PBQD/KE/HWA

Revised November 1986

The preparation of this document has been financed in part through a grant from the U.S. Department of Transportation, Urban Mass Transportation Administration, under the Urban Mass Transportation Act of 1964, as amended, the State of California, and the Los Angeles County Transportation Commission.

**MTA LIBRARY**

**S.C.R.T.D. LIBRARY**

FUNCTIONAL PLAN - YARD AND SHOPS

TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
EXECUTIVE SUMMARY		i
1.0	INTRODUCTION	1
1.1	DESCRIPTION	1
1.2	OBJECTIVE	3
1.3	SCOPE	4
2.0	YARD	5
2.1	YARD OPERATING PHILOSOPHY	5
2.1.1	Objectives	5
2.1.2	Basic Operating Parameters	5
2.1.3	Facility and Equipment Requirements	7
2.2	YARD FUNCTIONAL DESCRIPTION	9
2.2.1	General	9
2.2.2	Transit Vehicle Storage yard	10
2.2.3	Transfer Point	12
2.2.4	Transit Vehicle Interior Cleaning and Exterior Washing Facilities	13
2.2.5	yard Control Tower	16
2.2.6	Line Operations Administrative Facilities	19
2.2.7	Outdoor Material Storage Area	20
2.2.8	Plant Support Facilities	24
2.2.9	Relationship of yard Activities to Main Shop	27
2.2.10	Rail Control Center	28
3.0	SHOPS	29
3.1	MAINTENANCE PHILOSOPHY	29
3.1.1	Objectives	29
3.1.2	Basic Maintenance Parameters	29
3.2	FUNCTIONAL DESCRIPTION OF SHOPS	33
3.2.1	General	33
3.2.2	Service and Inspection Shop	38
3.2.3	Heavy Repair Shop	40
3.2.4	Component Repair Shops	42
3.2.5	Support Shops	49
3.2.6	Systemwide Stores	58
3.2.7	Blow-down Facility	61
3.2.8	Maintenance-of-Way Shop	62

FUNCTIONAL PLAN  
EXECUTIVE SUMMARY

The Southern California Rapid Transit District Metro Rail Project, an 18-mile rail rapid transit system starter line in Los Angeles, will require a comprehensive Yard and Shops support system to provide for the storage of transit vehicles and for the proper and cost-effective maintenance of the system's equipment and plant. The layout of the Yard and Shops will allow for the expeditious movement of trains between the yard and the main line without congestion or delay, and the safe and economical movement of trains and cars between the Yard and Shops.

The Yard and Shops comprise 10 storage tracks, six shop tracks, a car wash, heavy-cleaning platform, a blow-down facility and support shops. Their functions, location within the site, and the design of the track layouts that integrate the facilities are addressed.

The existing Santa Fe Trails building is being adapted with stores and workshops to support the maintenance of fixed facilities e.g., track, power supply, buildings fans, etc.

## CHAPTER 1.0

### INTRODUCTION

#### 1.1 DESCRIPTION

The Metro Rail System is an 18-mile rail rapid transit system planned by the Southern California Rapid Transit District (SCRTD) to serve downtown Los Angeles, the Wilshire District, Hollywood, and the North Hollywood area in the San Fernando Valley. This line is planned to be the core element of a regional rail rapid transit system.

The first four miles of the line, designated Minimum Operating Segment-1 (MOS-1), have received the necessary federal, state, and local funding for construction. This segment extends from Union Station to the Wilshire/Alvarado Station as a double-track main line subway. Included in MOS-1 is additional subway and surface track to connect the main line to the yard southeast of Union Station. It also includes all yard and shop facilities planned for the 18-mile system with the exception of some yard storage tracks and shop equipment, which will be installed as warranted by system extension and fleet expansion. Engineering work is proceeding on additional segments of the Metro Rail System. A Congressionally-ordered study is examining new alignments that will avoid tunneling through areas with pockets of hazardous natural gas.

The vehicles for the system will be stainless steel, standard gauge, 75-foot long rail cars, which will be configured in 65 dependent pairs. They will be capable of operating at speeds up to 70 mph and will operate on 750 V dc

power supplied via third rail. Metro Rail trains may consist of two, four, or six vehicles, although two-car trains will not be run in passenger service. The capacity of each single vehicle will be 59 seated passengers plus space for one wheelchair, or up to 110 standing passengers at normal loads, and over 200 standing passengers at peak loads. The vehicle fleet for MOS-1 will consist of 15 dependent pairs.

MOS-1 trains will have Automatic Train Protection equipment to ensure safe speed and separation of trains. Automatic Train Operation (ATO) also will be included to regulate train speed and provide precision station stopping and train berthing verification for trains operating on the main line in the ATO mode. System operation will be centrally controlled from the Rail Control Center, located in the yard, using communication links with facilities and trains involving telephones, radios, P.A., CCTV, SCADA (Supervisory Control and Data Acquisition), and other sensors.

The Yard and Shops complex consists of the following major elements:

- A. Transit vehicle storage yard
- B. Transfer tracks
- C. Transit vehicle interior and heavy-cleaning platform
- D. Yard Control and line operating administrative facilities
- E. Outdoor materials storage area

- F. Plant support facilities
- G. Transit vehicle shop
- H. Maintenance-of-Way shop including plant maintenance shops
- I. Rail Control Center
- J. Car wash.

## 1.2 OBJECTIVE

This report documents the functional basis for design of the Yard and Shops of the Metro Rail System. To do this, the report:

- A. Identifies the elements of the Yard and Shops
- B. Describes the functions of each of the elements and their interrelationships
- C. Presents the planned configurations of the various elements and the associated facilities and equipment
- D. Presents the layouts and the design of the facilities.

Staffing is not addressed in the Functional Plan. It is discussed in two Operating and Maintenance Cost Estimate Reports produced by Booz-Allen & Hamilton Inc., one in June 1983 for the 18-mile system and one in March 1985 for the MOS-1 system. Staffing requirements for maintenance are currently under review.

### 1.3 SCOPE

The Yard and Shops are discussed individually. Chapter 2 presents a functional description of the various activities and facilities of the yard, while Chapter 3 presents the functional description of the activities and facilities of the shops within the complex.

## CHAPTER 2.0

### YARD

#### 2.1 YARD OPERATING PHILOSOPHY

##### 2.1.1 Objectives

The yard shall operate in a manner that maximizes the following:

- A. Safety of personnel, equipment, and facilities
- B. Efficient operation with economy of motion
- C. Flexibility in allowing simultaneous vehicle storage, yard switching and access, moves within the yard including shop and wash-track access, and movement to and from the main line.

A diagram of the yard is shown in Figure 1.

##### 2.1.2 Basic Operating Parameters

- A. Car and Train Operations: Trains will be operated within the yard in the Restricted Manual Submode, with speeds limited by on-board apparatus to ten mph. Trains coming out of service will be operated in either Manual Train Operation (MTO) or Automatic Train Operation with speeds restricted by speed code track circuit. Speed limit transmission signals will ensure a safe braking distance from the Transfer Point automatically bringing the train to a stop. From here, the operator will change to the



Restricted Manual submode, and speed will be limited to 10 mph. When trains enter service, they will be operated in Restricted Manual to the Transfer Point, where they will automatically enter MTO mode with the receipt of track circuit signals and will proceed to the main line without stopping.

B. Supervision: "Yard Limits" will include all trackage up to the transfer point with the exception of the shop leads and holding tracks, which will be defined as within "Shop Limits."

1. Yard limit trackage will be under the jurisdiction of a dispatcher located in the yard Control Tower. The dispatcher will initiate, control, and monitor all yard movements. The yard Control Tower will have capability for remote control of interlockings, including route selection, auxiliary switch control, and control of traction power; two-way communications with yard operating employees will also be possible from the Control Tower.

2. The shop supervisor or his delegate will oversee shop limit trackage by local liaison with the operator. Points of transition from yard to shop control will be designated in the operating rules and by appropriate signs. Movement to and from shop limits will be coordinated with Yard Control.

C. Movement: Train movement will be performed by a single operator who may utilize remote route selection or auxiliary switch control. Inyard routes will be established by the yard dispatcher, who may

utilize either remote route selection or individual switch control, or if necessary, direct the operator to utilize hand throwing of switches. All controls necessary for train movement, coupling, uncoupling, and communication with Yard Control will be located within the operator cab of each car. However, the operator may on occasion be required to leave the vehicle to align coupler for coupling, or to hand-throw switches when remote control is inoperative, or to take other actions, as needed. All reverse direction movements of the train will require the operator to "change ends" of the car or train.

### 2.1.3 Facility and Equipment Requirements

- A. Signaling: Movements through the interlockings up to the "Yard Limits" will be governed by home signal indications. Signaling will consist of conventional wayside signals indicating interlocking condition. Other signals may be provided where deemed necessary; e.g., to govern movement through the car washer or in areas where a safe view of the track is obstructed.
  
- B. Graphics: Each storage track will be uniquely identified at each end and at intermediate locations. Fixed standards or other markings will be applied between the legs of each turnout to locate the "Fouling Point," beyond which movement in the direction of travel toward the turnout will result in conflict between the clearance profiles of the two legs of the turnout. Each switch will be identified. Signs will be posted at appropriate locations displaying any special operating instructions

required and will also identify PABX phone and emergency trip station locations.

- C. Roadways: The storage yard and transfer zone will be accessible to motor vehicles. At the periphery of the storage yard, paved roads will be capable of carrying maintenance-of-way and emergency response vehicles. The wide-spaced aisles within the storage yard shall be paved and capable of carrying small support and emergency response vehicles.
- D. Fire and Life Safety: Standpipes, hoses, and chemical fire extinguishers will be strategically placed within the storage yard under the direction of the L.A. Fire Department. Cars or trucks will be utilized inside the storage yard. Firefighting techniques within the storage yard will rely upon facilities and equipment in place augmented by additional items carried on road vehicles, and by L.A. Fire Department vehicles.
- E. Communications: Basic communications requirements are for contact between the yard operating personnel (train operators) and the Yard Control dispatcher, which will be accomplished by use of vehicle radios. In addition, public address loudspeakers and PABX telephones will be located throughout the yard. Selected personnel will carry portable radios.
- F. Illumination: Lighting levels will be sufficient to provide glare-free illumination to permit 24-hour operation in a safe and efficient manner.

## 2.2 YARD FUNCTIONAL DESCRIPTION

### 2.2.1 General

The site of the main yard is located east of the Central Business District of Los Angeles. It is situated between the Santa Fe Railway to the east, which is immediately west of the Los Angeles River, and Santa Fe Avenue on the west. The yard site extends south from the Santa Ana Freeway to a point about 1,100 feet south of the Sixth Street Bridge.

In the north-south dimension, the site is approximately 6,000 feet long. The east-west dimension varies, with the widest point being just north of the Fourth Street Bridge; at this point, the yard will be 800 feet wide. North of the First Street Bridge and south of the Fourth Street Bridge, the yard narrows appreciably. This site provides for a yard area of approximately 45 acres.

Rail access to the main yard is based on the following: Leaving Union Station, the two leads will ascend from Union Station, pass over the future eastbound main track and under the Santa Ana Freeway and a relocated freight spur to a portal at the north end of the yard. This portal will provide for four tracks. Two will be the yard leads from the Union Station. Space is left for two tracks from the yard leads to the Metro Rail eastward extension.

Function and description of the various elements of the complex are as follows:

### 2.2.2 Transit Vehicle Storage Yard

Function: The purpose of the storage yard is to provide a location where cars and trains may be kept, in a secure and accessible condition, when not in service. Each storage track will have direct access to each of the three transfer tracks so as to minimize the potential for movement conflicts between trains entering and leaving the yard or switching within the yard.

It will be necessary to move trains to the wash track or to the transit vehicle shops. These moves can be made from either end of the storage yard, with the tail track arrangement. However, car washing will be made more expeditiously as trains return from revenue service.

As a result of problems previously reported, discovered by inspection in the storage yard, or created by scheduled maintenance activities, individual dependent pairs will be switched out of trains and routed to the transit vehicle shops. These switching activities will normally be executed at the south end of the storage yard to avoid conflict with trains entering or returning from service.

During the course of the operating day, train headways and consist lengths will be adjusted at Union Station or in the yard to meet the demands of patronage and operating economy. These activities will require the yard to receive trains, reduce or increase consist lengths, and release trains of the desired length and spacing. Such changes will take place during periods when the majority of the fleet is in revenue service, thus enabling the yard supervisor to set aside some tracks for this purpose.

The main storage yard will be a double-ended layout (Figure 1) with leads and turnouts arranged at each end to provide storage capacity for 18 dependent pairs for MOS-1, and 90 dependent pairs for the full system. Storage tracks 1-8 are deferred for MOS-1; tracks 9-10 only are provided.

The yard is arranged to provide:

- A. Individual tracks to accommodate three six-car trains.
- B. Grouping of storage tracks, with each grouping having sufficient lead tracks to permit switching operations without blocking the leads to either grouping.
- C. The lead tracks to the groupings will be connected to multiple ladder tracks arranged to enable simultaneous, bidirectional, nonconflicting movement to and from each grouping.
- D. The storage tracks shall be straight and as near level as possible. Alternate track spacings of 14 and 19 feet will allow for movement of personnel along the narrower aisles for purposes of train inspection. Movement of small vehicles and personnel, such as car cleaners, will take place along the alternate wider aisles. The contact rails will be placed in the 14-foot track spacing.

At the south end of the yard, all tracks within the main body of the yard shall connect into one of two tail tracks. This allows a train leaving a shop track to enter

either of the tail tracks in a southward movement and then reverse direction and proceed northward into the storage yard.

### 2.2.3 Transfer Point

- A.     Function:   Between the storage tracks and the line to Union Station, Transfer Tracks TT1, TT2, and TT3 provide for the handoff of trains to/from the main-line between Yard Control and Rail Control Center. The transfer tracks are also used for reversing moves between the storage yard and shop tracks.
  
- B.     Facility:   The transfer point for the main yard is south of the portal. From the portal, the two yard leads proceed through an interlocking that allows each lead to have access to any one of the three transfer tracks which are marked by a signal and a sign. The most westerly track (TT3) at the south end of the interlocking has the car wash and provides the lead to the maintenance-of-way shop and its storage tracks, the main shop, the blow-down pit track, and the storage yard. The two easterly transfer tracks (TT1 and TT2) connect to the storage yard, the car cleaning platform, and blow-down shop. The layout described above allows access of any of the three leads from the main line: trains moving from TT3 to the main shop, blow-down shop or MOW shop and any part of the yard, and from TT1 and TT2 to the blow-down shop or any part of the yard.
  
- C.     Procedure:   Between the storage tracks and the line to Union Station, departing train movements will be governed by a yard signal, which, when cleared, will indicate an aligned and locked route to exit the yard. Upon exiting the yard limits, the train

will receive speed limit transmissions, and will change automatically from "Restricted Manual" to MTO. The train will be operated manually, with speed limits enforced by the Automatic Train Protection system, to Union Station and then stop.

Trains going out of service to the yard will operate from the Union Station platform to the Transfer Point in either ATO or MTO. In ATO, the train will automatically come to a full stop at the Transfer Point. In MTO, the train operator will stop the train. There the train operator will switch to Restricted Manual and hold the train at a yard entrance signal on Transfer Tracks TT1, TT2, or the Car Wash Track TT3 to await disposal instructions from the yard Control.

#### 2.2.4 Transit Vehicle Interior Cleaning and Exterior Washing Facilities

A. Function: Although these activities are a maintenance responsibility, they will both take place in the yard. For the purposes of this report, they are therefore considered as yard functions.

1. Daily interior car cleaning will be performed in the storage yard to minimize space facility and train handling costs.

Car cleaning crews will report to a central reporting location, with toilets, showers, lockers, and lunchroom facilities in the main shop. Using utility vehicles, the crews will then proceed with their materials to the storage yard. Crews will place an indicating



device on each end of the train to prohibit car and train movement. They will enter the cars via the side doors, with their cleaning equipment and supplies. Trash will be collected into disposable bags and placed in the adjacent roadways for pickup and disposal. Floor coverings will be either swept, vacuumed, or scrubbed, the seats cleaned, other surfaces dusted and otherwise cleaned, insides of windows cleaned, and spots, stains, and graffiti will be removed. Minor damage such as torn or slashed seats, as well as noted car equipment problems, will be reported to the shop supervisor for correction by shop personnel. This may involve movement of the car to the main shop, or repair in place on the storage track.

2. Exterior of cars will be washed using an automatic car wash facility under control of the yard tower. The tower may isolate the car wash for shunting moves through the facility. Trains coming out of service will go via Transfer Track TT3, where train operated limit switches will automatically start up the machine. When an illuminated sign is given to the operator, the train is driven through in the two mph "wash/couple" mode. The machine will prewet, apply acid or detergent, and rinse the car. Track switches will stop the machine.

Vehicles will be washed twice a week or as required. In addition, some carbody materials and finishes may require periodic acid brightening. This will be done at the wash facility.

The car wash facility has been arranged so that trains may proceed through the washer en route from the transfer zone to the storage yard. It is possible that when trains are entering the yard at close headway, it may be necessary for some trains to either bypass the washer on a different track or run through the car wash with the wash deactivated and be held in the storage yard until they can be routed through the washer.

3. A car cleaning platform will be provided to facilitate manual washing of areas, such as ends, that may not be adequately cleaned by the automated equipment, and scheduled heavy interior cleaning.

B. Facilities and Equipment:

1. Interior Car Cleaning: Paved access is provided in the wide-spaced aisles located on one side of each track to support and accommodate movement of personnel, equipment, and small utility vehicles. Materials storage, portable stairs, service connections, and small utility vehicles will be provided.
2. Exterior Car Wash Facility: This will consist of an automated car washer located on Transfer Track TT3, which will include prewetting acid, detergent and rinse nozzles, rotating brushes, platforms, water reclamation facilities, and other equipment as required.

The wash facility area will include a screen, paved track area, roadways, lighting, tanks for bulk supplies, and other facilities as required.

3. Heavy interior cleaning is to be carried out at a short platform with secure storage for washing and cleaning equipment and materials. It will also have water and electrical power connections, as required by the equipment to be used.

#### 2.2.5 Yard Control Tower

##### A. Function:

The yard Control Tower will provide safe, effective, and timely control of yard activities, supervising train movements within the yard. The yard dispatcher in the tower will have visibility of the storage yard, the various yard leads, ladder tracks, and run around tracks, and, to the extent possible, the shop leads, car wash facility, and the transfer point.

The yard dispatcher will have radio and telephone communications and public address in the yard, and will be able to:

1. Select various routes for train movements inside the yard, subject to track occupation.
2. Control individual switches or crossovers within the yard.

S.C.R.T.D. LIBRARY

3. Control traction power to the individual section of the yard. Each pair of storage tracks can be isolated, and separate sections for tail tracks, common tracks, and each end of shop are provided.
4. Monitor track occupancy and work activity in the yard tracks, such as car cleaning and minor repairs in the storage yard, and avoid conflicting moves.

The yard dispatcher will authorize or initiate all train movements within the yard. Train operators will receive all movement instructions from Yard Control by means of vehicle radio. Yard Control will maintain knowledge of trains arriving from the transfer point, of consist lengths required by central control, and of cars or trains to be routed to and from the shops and washing track. Yard Control will ensure that:

1. Incoming trains are brought from the transfer point into the yard without delay.
2. Trains are assembled into proper consists as required by the train schedule and assignment sheets prepared by equipment maintenance, and moved to the transfer point in the required sequence and timing for service.
3. Vehicles and trains are moved to and from the shops and wash track efficiently.

4. Yard operations are conducted in accordance with all rules and procedures, in a safe and efficient manner.

5. Trains are washed and cleaned when required.

B. Facility:

The yard Control Tower will be adjacent to the main shop and elevated to a height that provides an unobstructed view of as much of the yard complex as possible, with priority given to the following:

1. The storage yard
2. The various yard leads and ladder tracks

Limited visibility will be provided of the following:

1. The transfer point area and car wash
2. The shops and shop leads
3. The main gate
4. The outdoor material storage area

The yard Control Tower will contain apparatus, consoles, and displays to provide:

1. Radio, telephone, public address, and intercom communications
2. Indication of track occupancy

3. Controls for route alignment and interlocking
4. Traction power controls
5. Fire and intrusion alarms/detectors.

It will be arranged so that seated personnel will have an unobstructed view of the high-priority areas of the yard and simultaneous easy access to the relevant displays and controls. Windows will not be blocked or obscured. It will be possible for personnel to freely move about, along all windows.

Equipment rooms and a restroom will also be provided.

#### 2.2.6 Line Operations Administrative Facilities:

##### A. Function:

Administrative support of the transportation organization line operations activities will be housed in the transportation facility where train operators will report to work. These facilities will consist of:

1. Reporting area for operating personnel
2. Office accommodations for supervision and clerical staff
3. Crew dispatching and timekeeping office

4. Employee facilities including toilet, shower, locker, lunch, meeting, and training rooms
5. Storage and issue facilities for radios, batteries, uniforms, and publications.

All train operators will report for duty at the transportation facility in the main shop building. These operators will walk to their assigned train in the yard or, in some cases, be transported to their on-duty point at Union Station. The transportation facility will not only be used as a reporting location, but as a point for breaks and for relief for transportation employees.

B. Facility:

The line operations administrative facility will be located in the main shop building. Parking will be provided for both employee and district vehicles. An employee lobby, adjacent to a crew dispatchers window, will be provided. Train operators will report to the crew dispatcher for assignment.

2.2.7 Outdoor Materials Storage Area

- A. Function: The purpose of this facility is to provide accessible, controlled, and secure storage of materials that cannot be handled in the stores facility within the shop and would not suffer from outside storage. Typical materials to be stored include:

1. Track ballast, in bulk

2. Running rail, contact rail, insulators and coverboard
3. Various rail fasteners, joint bars, and base plates
4. Special trackwork components
5. Crossties
6. Building and station maintenance and repair supplies
7. Spare tunnel linings and other structural components
8. Bulk solvents, cleaners, lubricants, and other chemicals, in drums
9. Combustible, corrosive, and toxic material, which require secure storage.

Materials in outdoor storage will be subject to inventory control, and receipt and issue procedures as developed and managed by the stores organization. The outdoor storage area will be provided with appropriate security measures.

- B. Facility: The outdoor storage area will be level, paved in appropriate areas, and have drainage sufficient to preclude standing water. Wooden bearers will raise material above ground. A secure area will be fenced and illuminated for such high value items as cable on drums. Locked entry gates will



be provided in compliance with the security requirements.

The area will be accessible for deliveries and re-loading by truck or rail vehicles. Materials may arrive in highway trucks or railroad freight cars for storage before being reloaded onto district trucks or rail work-train cars for movement to work locations along the route, or to various shops. An "interchange" area on the tail tracks will be designated, into which the rail carrier will place loaded freight cars, and from which it will pick up empty cars. District forces will place the cars in the yard area for unloading and then return them to the "interchange" area, using a work-train locomotive or other form of prime mover.

1. An open and paved area will be provided. Within this area will be a cribbed site for ballast. There will also be an area for storage of various lengths of running and power rail. Fixtures for stacking the rail above ground in a straight condition will be provided. Similar fixtures will be provided for storing special trackwork components.
2. An open, paved area capable of supporting cranes and loaded highway trucks will be provided with:
  - a. Storage racks, for stacking and storing materials on pallets.
  - b. Fixtures for storing materials in drums.

- c. A shelter with open racks, for storing materials loose or in cartons. All such fixtures will have provisions for displaying a location identification number as well as part or catalog numbers.
- d. Roadways and service aisles shall be provided to enable highway and utility trucks to enter the facility, and for fork-lift trucks to access all materials. A location identification scheme shall also be provided.
- e. A rail spur from TT3 track just north of the car wash runs via a loop to a neck from which it is necessary to shunt to a track alongside the loading platform on the east side of the MOW building. Two additional tracks, MW1 and MW2 serve an outdoor storage area.
- f. Illumination shall be provided to permit 24-hour use.
- g. A secure fence will surround the complete yard facility. Locking gates shall be included for security as required.
- h. Security devices such as CCTV, alarms, etc.
- i. Fire fighting equipment, extinguishers, and hydrants in shop, and hydrants throughout the yard.

## 2.2.8 Plant Support Facilities

These elements and activities include:

### A. Traction Power Substation:

1. Function: To supply power for train yard and shop electrification.
2. Facilities Required: Switch gear and control equipment will be housed in a structure provided for that purpose. Concrete foundations for substation equipment such as transformers and rectifiers will be provided in accordance with equipment supplier recommendations. Circuit breakers will protect sections of the yard.

### B. Yard Security System:

1. Function: To control access into the facility thereby providing for the protection of District property and personnel, preventing the public from obtaining access to a traction power contact rail in accordance with the General Orders of the California Public Utilities Commission (PUC).

#### 2. Facility:

Primary access control will be exercised at a manned guardhouse at the main entrance to the facility complex, which shall be entirely fenced.

The guardhouse will be placed in the center of the main entrance roadway, to enable observation and control of persons and vehicles leaving and entering the facility.

The guardhouse will contain 360 degree glass walls, climate control, a portable radio, P.A., and telephone communications, and necessary signs or other graphics describing entry procedures and requirements.

The perimeter fencing will, at a minimum, consist of 8-foot-high chain link fencing with double barbed-wire aprons. All gates and appurtenances will be appropriate to security requirements.

Illumination will ensure visibility of all exterior gates, roadways, and other approach routes, as well as security-sensitive areas within the complex.

The guard house personnel may be supplemented by additional roving guards. All security personnel will be equipped with hand-held portable radios, on two dedicated security channels.

C. Fire and Life Safety:

1. Function: To ensure the safety of personnel and security of property.

Rescue requirements throughout the yard complex may arise as a result of transit car or other

vehicle-related incidents, industrial accidents in the yard or shops, or electrical shock.

2. Facilities:

- a. Roadways will be provided throughout the complex, providing access for fire and other emergency vehicles. Firefighting equipment and small vehicles will be provided for early response and fire lanes will be provided adjacent to all buildings and storage locations for access by Fire Department vehicles.
- b. Standpipes, hoses, and chemical fire extinguishers will be deployed at the storage yard, the transfer zone, points of restricted access by standard emergency response vehicles, and at other locations as deemed necessary by systemwide requirements.
- c. To the extent possible, contact rails will be placed on sides of tracks away from areas of personnel activity. Contact rail coverboard will be used throughout the yard in accordance with the General Orders of the California PUC. Emergency trip stations will be provided at strategic points in the yard to cut power to sections of the yard in emergencies.

### 2.2.9 Relationship of Yard Activities to Main Shop

Shop facilities provide for maintenance and repair of transit vehicles and components, and a systemwide equipment and dispatching area for plant maintenance activities and crews. Road vehicles and selected electronic equipment will go to other RTD shops for maintenance and repair.

The shops are a functional element of the yard complex. The following train movements are provided for:

- A. Movement of complete trains out of service from the transfer point or from the storage yard to the shops for inspection or repair. Occasionally it will be necessary to inspect the entire fleet, over a short period of time, in response to real or suspected equipment problems. The yard track layout permits this activity.
- B. Movement of work trains from the MOW shop or main shop to the storage yard or transfer point.
- C. Movement of inspected or repaired vehicles or trains from the shop to the washing facility, storage yard, or transfer zone.

The shop tracks will be under the supervision of the shop forces rather than Yard Control. The point of transition from yard to shop control is the roll-up door. Maintenance personnel will be allowed to move vehicles between the leads and the shops, or between shop tracks, so as to avoid delays resulting from waiting for train operators to come and make such moves.

All train movements to the shop must be requested or approved by shop forces prior to the move. This is to avoid danger and congestion in the shop area, and to ensure that the proper authorities determine which vehicles are to be sent to the shop and when. Conversely, the yard dispatcher must be requested to remove such vehicles from the shop area when it is deemed necessary by the shop forces.

#### 2.2.10 Rail Control Center

The Rail Control Center (RCC) will be the nerve center that will monitor and control all activity on the main line of Metro Rail. The RCC will be located on the second floor of the main shop building adjacent to the transportation facility. The facilities, equipment, and functions of the RCC are described in detail in the Rail Control Center Functional Plan.

## CHAPTER 3.0

### SHOPS

#### 3.1 MAINTENANCE PHILOSOPHY

##### 3.1.1 Objectives

- A. Safety of passengers and employees
- B. Passenger comfort and service dependability
- C. Protection of District property
- D. Minimization of system down-time
- E. Minimization of system operating costs.

A diagram of the shops is shown in Figure 2.

##### 3.1.2 Basic Maintenance Parameters

- A. Preventive maintenance programs will seek to:
  - 1. Reduce service failures and corrective maintenance
  - 2. Prolong equipment life
  - 3. Provide for periodic inspection in order to ensure operational safety
  - 4. Minimize system maintenance costs
  - 5. Optimize shop loadings.
- B. Corrective maintenance actions will make use of component exchange (failed parts replacement), and



testing at the vehicle, subsystem, and component level, in order to:

1. Ensure the correctness of repairs performed
2. Reduce time-to-repair.

C. Component exchange will be practiced to the greatest extent practicable, and repairs and overhauls will be accomplished by:

1. Removal and replacement of lowest level replaceable parts
2. Performance of actual repair or overhaul operations in a component repair shop, possibly at the CMF under conditions of efficient shop layout and facilities, cleanliness, supervision, testing, and quality control.

D. In-house Versus Contract Maintenance: As a general rule, work which is similar to existing bus maintenance will be performed by the District. Component repair and elements not similar to the existing operating system (e.g., motor rewinding, elevators, and escalators) will be considered as candidates for contract maintenance. The shop has been sized to perform all other work.

Contract maintenance will be evaluated and considered for those cases in which it is desirable for the District to perform this. Factors to be evaluated will include:

1. Availability of suitable contractors

2. Logistics, inventory, and materials handling implications
3. Labor agreements
4. Costs of special shop equipment
5. Liabilities
6. Equipment procurement, contractual warranty, and reliability verification considerations
7. Relative costs to perform the work
8. Availability and requirements of special skills.

E. Testing: Various electronic and other test apparatus will be provided, configured to perform static and dynamic testing at the vehicle level, and static testing at lower levels of the vehicles, train control, communications, and other appropriate systems in order to:

1. Ensure the proper function of the various systems and subsystems
2. Provide for timely and accurate failure diagnosis
3. Reduce time-to-repair and costs by identifying the lowest level failed replaceable component.

F. Shop Functions:

1. Service and inspection requires access to the undercar equipment, and movement through the shop. Generally, only minor items of equipment will be removed. Accordingly, most service and inspection workstations will be equipped with underfloor pits.
2. Heavy repair activities will normally be of longer duration than those of service and inspection, and will include the removal and replacement of major components, using underfloor vehicle lifts. Shop floor space is provided for occasional loading and unloading of highway and rail freight vehicles.
3. Component repair areas reflect the characteristics and requirements of the components to be repaired, the specialized skills and equipment required, and the work and material flow between the various shop functional areas.

G. Plant Maintenance: Maintenance-of-Way functions and other facility-related maintenance require a separate maintenance facility, reflecting the requirements of these activities, yet avoiding duplication of facilities with the transit vehicle shops. Consequently, where practicable, tasks such as electronic equipment repair and other applicable activities will be performed at a specialist shop.

In addition to maintenance-of-way shop activities, provisions must be made for supporting the work that will be performed along the system and within the various buildings and structures, including the tunnels and stations. Maintenance-of-road service

vehicles to be used to provide access to these on-line activities will be carried out at other RTD facilities.

Such vehicles are:

1. Conventional light-duty trucks and vans, for use by various mobile crews
2. Specially equipped trucks, with cranes, generators, and tunnel washing equipment for operating on the rail lines
3. Rail flat cars and locomotive.

H. Maintenance Organization and Training: Training will be provided to employees upon receipt of new equipment or introduction of new processes. District-provided training of new employees and upgrading of individuals will be dependent upon District policies and applicable labor agreements. It is anticipated that instructors may be sent to a recently opened heavy rail transit property to gain experience of opening a new system.

### 3.2 FUNCTIONAL DESCRIPTION OF SHOPS

#### 3.2.1 General

A. General: Within the yard complex are the following shops with their function:

1. The main shop building provides the maintenance support for the passenger vehicles. The shop contains the following areas:

- a. Blow-down facility
  - b. Service and inspection area
  - c. Heavy repair area, including truck and wheel area
  - d. Equipment maintenance shops
  - e. Offices
  - f. Rail Control Center.
2. The maintenance-of-way shop handles maintenance and repair of systemwide facility-related equipment components
  3. The main shop will deal with maintenance and repair of work equipment, shop equipment, and various vehicles utilized in maintenance-of-way and other fixed-facility maintenance
  4. Offices in both buildings will provide administrative support of maintenance operations.
- B. Transit Vehicle Maintenance Facilities: The main shop has both heavy repair and service and inspection areas. It is an industrial-type building, containing: 1) high bays with cranes and a flat floor for the heavy repair of trucks and wheels, and 2) service and inspection area containing three pitted tracks for the ready inspection of undercar equipment. There are two 2-level areas, one on the west side of the building and one in the center, separating the two high bays. These areas contain

various component repair shops, support shops, employee facilities, offices, administrative areas, stores, and equipment rooms on the ground floor, and the Rail Control Center and transportation area. There is a loading dock adjacent to the stores, as well as road access to the heavy repair bay where equipment may be unloaded from rail or highway freight vehicles.

The various component repair shops are, in turn, supported by facilities such as the machine shop, welding shop, parts cleaning area, and the stores.

Parts and materials will be transported by small vehicles including lift trucks. The general layout of the facilities will, to the extent possible, anticipate the number and types of movements, and minimize the distance travelled.

The Rail Control Center housed on the second floor brings together the control of signals and switches, the supervision of the line by CCTV, and the control of traction and auxiliary power. This is situated on the second floor on the west side, adjacent to the transportation area.

C. Maintenance-of-Way Activities: The maintenance-of-way building will support systemwide maintenance of the entire fixed physical plant. This support will consist primarily of:

1. Fabrication, repair, and overhaul of components and equipment unique to maintenance-of-way. The repair facilities of the transit vehicle shop will perform work on maintenance-of-way

equipment. The machine shop, welding shop and metals shop, and other support facilities will be similarly utilized. Primary parts and materials support will be supplied by the main store, located in the transit vehicle shop and a satellite store, located in the maintenance-of-way facility. Automatic train control communications and fare collection electronic components will be repaired at Central Maintenance Facility (CMF).

2. Mobile maintenance forces will be dispatched from this facility. Other than shop functions, the work performed by maintenance-of-way forces will be along the guideway and in the stations and other facilities.
  - a. Motor vehicles will be utilized by technicians and other maintenance forces associated with train control, fare collection, station equipment, and other high-technology systems, and will provide minor repair or upkeep of the system.
  - b. Work trains will be utilized for emergency conditions and heavy repairs along the guideway requiring movement of large or heavy materials such as running rail, power rail, crossties, ballast, or heavy maintenance equipment such as cranes, tampers, or rail grinding equipment.
  - c. Some motor vehicles equipped with "Hi-Rail" equipment (vehicles able to travel on both highways and rail tracks) may be utilized

for tasks requiring rail access, but that do not require work trains.

The maintenance-of-way shop comprises a general repair area and an adjacent, single-level area containing various smaller shops, stores, shop equipment rooms, employee facilities, and office and administrative areas. There is a loading dock adjacent to the stores, and road and rail access to the east side of the general repair area. The functional requirements and facilities are described in Section 3.2.8.

The maintenance-of-way shops will include fuel, servicing, and storage facilities for the rail and motor vehicles, as well as a dock area for loading the vehicles. All vehicles will be radio equipped. Vehicles travelling over the road will be dispatched to various work sites by radio. Rail vehicles on the rail line will be governed strictly by Rail Control Center, in accordance with procedures for such movements, and in radio communications with Rail Control Center.

Maintenance-of-Way forces will have convenient access to the stores area and loading dock located at the transit vehicle shop, as well as to the outdoor materials storage area. All new and reconditioned materials will be processed for pickup and delivery by stores forces.

- d. Maintenance administrative support activities shall provide the following functions, which



are housed within the vehicle maintenance shop facilities:

1. Maintenance management
2. Maintenance planning and control
3. Quality assurance
4. Maintenance engineering
5. Administrative and clerical.

### 3.2.2 Service and Inspection Shop

- A. **Function:** The Service and Inspection (S&I) shop performs scheduled inspection, preventive maintenance, component replacement, and minor corrective maintenance on trains out of revenue service. S&I activities are intended to promote fast turnaround of vehicles to maximize transit vehicle availability. Trains would not generally miss more than one rush hour. Vehicles brought into the S&I shop will generally require access to undercar equipment but will not require heavy equipment removal. For these reasons, undercar access in the S&I shop will be provided by underfloor pits. Cars requiring wheel work or other heavy repair will be sent to the heavy repair shop. Repair of vandalism, or replacement of damaged seats or broken glass may be performed in the storage yard.
- B. **Facility:** The S&I shop will occupy a portion of the ground floor in the main shop building and will be rail-accessible from both ends of the vehicle shop. It will be a rectangular high bay and contain three through-tracks, each capable of accommodating six vehicles (maximum system train length). One track will contain a full-length pit.

At each end of the other tracks will be a common pit of two-car lengths, wide enough to include both tracks. All pits will contain lighting to illuminate the vehicle undersides. Electrical and compressed air outlets and lubrication carts will be provided. Pits will have approved safety devices such as removable railings. The two locations without pits will be used for access by lifting equipment to undercar components when replacement of these components is necessary. The rail in these locations will be flush with the floor.

Overhead "stingers" will provide power for car movement, as contact rail in the yard will terminate 65 feet from the shop entrance.

Portable equipment will include stairs and scaffolds for accessing side doors and car bodies, air conditioning service carts, and various special test equipment.

Office space for one supervisor, one clerk, and one lead inspector will be provided. Time clocks, bulletin boards, lockers, showers, restrooms, lunchroom, and first-aid facilities will be required, but may be combined with similar facilities for other shops.

Space for employee tool carts will be provided, along with an area for reviewing reference materials, such as manuals, catalogs, and special instructions.

### 3.2.3 Heavy Repair Shop

- A. Function: The heavy repair shop performs vehicle overhauls, major corrective maintenance, unscheduled replacement of undercar equipment, including wheels and trucks, and accident repairs. Equipment will be removed, transported, and replaced by use of portable lift equipment with special fittings as required for handling various types of equipment and components, e.g., air compressors and converters.

The entire dependent pair will be raised and secured on safety stands, after which trucks will be lowered to the trackway and moved to the truck shop via in-track turntables.

Trucks will be raised by use of built-in underfloor lift tables, for repair on truck stands leaving wheelsets on the track from where they may be rolled.

Dependent pairs of vehicles will be maintained as such, and serviced at the same time. In the event that one car of a pair requires extended periods of time to repair (e.g., body damage), the car may be separated, with only the faulty car brought into the shop and the other placed in a holding area.

Major car body repairs will be performed in the heavy repair shop. Such repairs will be made with the support of the sheet metal shop, where special metalworking capabilities will be available.

B. Facility: The heavy repair shop will occupy a portion of the ground floor of the vehicle shop. The shop will be a rectangular high bay, and will contain three through-tracks, two having two positions, with underfloor carbody and truck lifts for dependent pairs. Underfloor vehicle lifts and truck lifts will be provided initially for two vehicle positions. The remaining six vehicle positions are deferred and will be equipped at the time of construction of additional segments of the line. In-track turntables and tracks to the truck shop will be provided for each track for movement of trucks to the truck shop.

The third track has the underfloor wheel truing machine, which re-profiles wheels, either by operating the train over the machine, or as separate wheelsets.

The shop floor will be sufficiently free of obstructions and will have the structural capability to support the locomotive, portable jacks, and loaded highway and rail freight vehicles brought into the shop for unloading.

Each vehicle position will be equipped with overhead reel-type electrical and compressed air fittings as well as with an overhead Stinger system for in-shop car movement. Lubrication carts will be provided.

Scaffolds and stairs for access to the carbody and entry doors, air conditioning, lubrication, air brake service carts, and portable special test equipment will be provided.

Office space for one supervisor, one clerk, and one lead inspector will be provided. Individual recording cards will be used with time clocks for attendance recording. Bulletin boards, lockers, showers, restrooms, lunchrooms, and first-aid facilities are provided but may be combined with similar facilities for other shops.

Space for employee tool carts with an area for reviewing reference materials such as manuals, catalogs, and special instructions will be included.

#### 3.2.4 Component Repair Shops

The primary task of the component repair shops will be to provide support in the repair of equipment removed from the vehicle. Where there is some similarity with equipment in the bus fleet, components may be repaired at the Central Maintenance Facility. Wayside and fixed plant equipment of the train control, fare collection, communications, and traction power systems will typically be repaired at the maintenance-of-way building or at the CMF.

Equipment will be brought to the appropriate shop and area from the transit vehicle repair bays and from other component repair or support shops where larger assemblies are disassembled. As appropriate, some items may be routed through the parts cleaning facility.

Before delivery to the component repair shops, items will be processed for necessary reporting documentation, scheduled for work, and assigned to an appropriate area or position. Prior to repair, inspection and testing may be required. In some cases, particularly in the early period

of operations, additional documentation and cause-of-failure analyses may be required in order to provide necessary support for the enforcement of warranty and reliability verification programs and the generation of in-house failure analysis.

Some items will be processed and inspected in the component repair shops and, depending upon the extent or nature of repairs required, the items or subcomponents of these items will be sent to contractor shops for that work. Such items will be returned to the component repair shops upon completion of the work.

The operation of the component repair shops will play a major role in determining the success of the the equipment maintenance functions, for it is at these shops that actual repair, rebuilding, and testing will occur. These repair functions will be carried out under conditions of cleanliness, proper illumination, and climate control, with work benches, test equipment, tools and other facilities best suited to the work to be done. The work will be properly supervised and subjected to quality control programs. The component repair shops will impact the system equipment maintenance programs in two major areas:

- o System availability will be influenced by the ability of the component repair shops to provide serviceable equipment on a timely basis.
- o System reliability will be influenced by the quality and correctness of the work done, as reflected by the dependability of the equipment returned to service.

In addition to repair and overhaul activities, the component repair shops will provide support to various equipment performance improvement and failure investigation programs. Modification programs will, in many cases, be implemented at the component level by these shops.

The various component repair shops are described separately in the following sections. These shops are combined or grouped to reflect functional or efficiency considerations. Similarly, administrative areas such as offices, restrooms and other facilities are arranged correspondingly. The component repair shops are as follows:

A. The electronic equipment at the component and assembly level will be maintained at the Central Maintenance Facility. Minor repair and testing will be possible in the Telecommunications Room, which will contain a work bench and store commonly-used electronic components.

B. Electrical Equipment Shop:

1. Function: The electrical equipment shop will have systemwide responsibility for repair and overhaul of electrical (nonelectronic) equipment in transit vehicles.

Tasks in this shop will include dismantling and assembly, replacement of subcomponents and parts, bearing replacement, turning of commutators, and testing of:

a. Electrical machines, both ac and dc, of various sizes, applications, and voltages,

up to and including transit vehicle traction motors. Specialized work such as re-winding and impregnation will be performed by contractors.

b. Items of major equipment such as mechanical reversers, large resistors such as brake grids, and current collector assemblies. Power electronics will be dealt with at the CMF.

c. Small equipment items including relays, power contactors, and switches. Other equipment items may include signals, grade crossing protection devices, wiring, cabling, and harnesses.

2. Facility: The electrical equipment shop will be a large open area, containing individual workstations at benches. Open areas will be provided, with holding jigs and fixtures for large equipment items. An overhead bridge crane will be provided for handling large items. A drill press, grinder, hydraulic press, gear puller, and motor upender will be installed. An open area near the entrance will be utilized for cleaning and documenting items to be repaired.

The electrical equipment shop will be provided, with both special and multipurpose electrical test equipment. Shop power will be available at all work locations, of the characteristics



required for test or operation of various equipment, as appropriate. Compressed air will also be provided.

The shop floor will be capable of supporting lift trucks or other material-handling vehicles. The entry doors will be compatible with this requirement.

Heavy-duty work benches with parts baskets will be provided at each position, and at the receiving area. Fixtures will be provided for holding, storing, and in some cases, stacking various equipment items.

Provision for an overhead bridge crane will be made for moving and positioning large equipment items, such as propulsion motors. This will be installed in the future.

C. Air Brake Shop:

1. Function: The air brake shop will have responsibility for servicing and repair of the transit vehicle air brake systems, suspension leveling valves, coupler air valves, shop and maintenance-of-way air compressors, and associated air-operated equipment and piping.

Typical tasks will include dismantling, cleaning, parts reconditioning and replacement, and reassembly and testing.

2. Facility: The air brake shop will contain specific areas for working various types of

equipment, some of which require a very clean environment. Areas will include space for a component test rack, which will require compressed air at transit vehicle operating pressure and an electrical power supply.

All workstations will have workbenches with parts baskets. A shop crane, grinder, and surface grinder will be provided in the area where compressors and any other heavy items must be handled.

Special test equipment and shop equipment may be required, such as cylinder honing devices, depending on the design of individual components. Shop power and compressed air reduced to the required testing pressure will be installed.

The shop floor will be capable of supporting lift-trucks or other material-handling vehicles. A storage and viewing area for technical reference documentation will be provided, with an area for employee tool carts.

D. Air Conditioning Shop:

1. Function: The air conditioning shop will have responsibility for transit vehicle and other air conditioning system components, including refrigerant compressors, evaporators, condensers, dryers, hoses, thermostats, and refrigerant lines.

Typical tasks will include dismantling, parts inspection, cleaning, repair replacement, reassembly, and pressure testing. If complete units are to be serviced, refrigerant charging capability will be required.

2. Facility: The air conditioning shop will consist of an enclosed area containing areas arranged for work on specific types of equipment. Shop placement, layout, ventilation, and furnishings will be conducive to maintaining a clean working environment.

Pressure testing and purging apparatus will be required. If necessary, refrigerant charging facilities will be supplied. A test cart for checking out air conditioning equipment will be provided.

A drill press, a bandsaw, a hydraulic press, and a grinder will be installed.

The shop floor and entry doors will be compatible with lift trucks or other materials handling vehicles.

Hand tools will be provided for repair of air conditioning equipment.

Space will be provided for materials processing, technical documentation storage and review, and for placement of employee tool carts.

### 3.2.5 Support Shops

The various support shops will primarily provide specialized maintenance services to the heavy repair, S&I, component repair, and maintenance-of-way shops. In addition, some support shops will provide direct maintenance and repair of various equipment items.

The support shops have a more heavily industrial function than that of component repair. Equipment items to be repaired as well as the shop equipment to be used will consist of relatively large and heavy items requiring appropriate material-handling capability.

The support shops are identified and described as follows:

#### A. Wheel Truing Facility:

1. Function: The wheel truing facility shall maintain the correct profile and surface of transit car wheel treads and flanges, the proper dimensional relationships of wheel diameters on the same axles, trucks, and vehicles, and shall be used to remove surface irregularities such as "flat spots." These actions are required to ensure proper ride and tracking characteristics, to reduce overall wheel wear and noise. They prevent unsafe conditions that may arise from deep flanges, which may split switches or thermal cracks propagating through the rim.

Vehicles will be routed to the wheel truing facility in response to scheduled program requirements or as a result of deficiencies noted

during inspection. The vehicle will be placed over the wheel truing equipment, where wheel diameters will be automatically measured and the wheels turned and profiled to the specified values.

2. Facility: An underfloor wheel truing machine, suitable for machining wheels on or off its vehicle, with accessories for chip collection, axle raising and lowering, wheel rotation, and wheel diameter measuring and recording will be provided, along with necessary rail gates. The wheel truing equipment will be located beneath a single through-track within the main shop. This track will be rail-accessible from either end of the shop. The equipment will be at the southernmost point of this shop track to permit the truing of any wheels in a dependent pair without causing interference to work underway on adjacent vehicles on the same track.

B. Truck Shop:

1. Function: The truck shop shall repair and overhaul transit vehicle trucks. Trucks will be removed from vehicles in the heavy repair shop and rolled via turntables and associated trackways to the truck shop, where they will be placed into either a workstation or a holding area.

Many truck-associated major components will be removed at the truck shop and sent to component

repair, contract, or other shops for the required work. These components include suspension elements, brake cylinders, propulsion motor, gear boxes, wheels and axles, speed sensors, and track-mounted antennae and cables. The majority of work done in the truck shop will be associated with component exchange. Truck functional parts may occasionally be repaired at other support or component shops or replaced in kind with new material.

2. Facility: The truck shop will be an open high-bay adjacent to the heavy repair area. Workstations will consist of locations and fixtures for placing trucks above the floor so as to provide all-around work access. Worktables and parts baskets will be provided adjacent to the access trackway. Storage space for additional trucks, large replacement parts, and special tools will be provided. The shop floor will be configured to permit the movement of materials-handling vehicles, except at the workstations and truck storage area. The 10-ton overhead crane in the heavy repair area will extend into the truck shop and will be capable of lifting, moving, and placing complete trucks or components. The shop is located adjacent to the wheel shop and the machine shop.

The shop will have a trackway for storing trucks and truck hoists to raise a complete truck to appropriate height for access to all areas of the truck. Portable jacks and lift drop tables will be provided for handling any parts that must be lowered for removal.

Heavy-duty worktables will be provided at each workstation.

C. Wheel Shop:

1. Function: The wheel shop performs all work related to the wheel and axle. This may eventually include dismounting and pressing wheels, bearings, and drive gears from and onto axles; boring wheels and machining axles for proper fit; replacing journal bearings and drive gears; and inspecting and nondestructively testing these components. The wheel press, wheel borer, and axle lathe have been deferred for MOS-1.
2. Facility: The wheel shop will be an open area adjacent to the heavy repair area, the wheel truing facility, and the truck shop. Provision is made for future installation of a wheel press and borer. Ready access to the truck shop will be available via the shared shop track.

Shop and reel-type compressed air and electrical fittings for clean-up and power tools will be supplied. The design of the floor and machine installations will provide protection against various metal chips, turnings, and hot metal that will fall onto the shop floor and other surfaces. Materials holding and handling equipment will be provided, and laid out to minimize distances traveled and number of moves in performance of the various tasks and sequences. The 10-ton overhead crane in the

heavy repair area will extend into the wheel shop as well as the truck shop.

Provision is made for a wheel press, capable of withdrawing and pressing work train and transit vehicle wheels, journal bearings and drive gears, and for a wheel boring mill capable of accurately boring wheel centers. Equipment for nondestructive testing will be provided.

Shop layout and materials handling facilities design will be coordinated with those of the truck shop and wheel truing facility in order to provide easy materials movement between those facilities.

D. Machine Shop:

1. Function: The machine shop shall provide general-purpose metalworking capabilities for mostly nonroutine requirements, in support of transit vehicle activities. Components requiring infrequent repair, such as couplers, may be assigned to the machine shop. Routine mechanical repair, such as attaching disc brake pads to backing plates, may be performed at this facility.
2. Facility: The machine shop will be a securable room with various machine tools. The shop floor and layout will accommodate access by lift-trucks and other material-handling vehicles. A 2-ton jib crane will be provided within this shop for lifting heavy components.



The machine shop will be equipped with industrial-type machine tools, including drill presses, milling machines, grinders, a band saw, a power hacksaw, and various smaller machine and hand tools as required, including various gauges and other measuring instruments. Shop power and compressed air will be provided.

A lathe capable of turning an axle is deferred for MOS-1. Workbenches, worktables, and parts bins will have securable lockers for storing high-value materials, tools, and accessories.

E. Battery Shop:

1. Function: The battery shop shall service and maintain large batteries for transit vehicle and wayside utilization.

Servicing will include cleaning, testing, and charging the batteries. Some minor repairs will be performed. New batteries will be stored, dry, in the stores. Prior to issue, they will be taken to the battery shop for addition of fluids, charging, and testing. A supply of batteries, the number and type to be determined by the configuration of the system, will be maintained on hand, in charged condition, at all times. Battery fluids, with approved handling and safety equipment, will be stored in the battery shop.

2. Facility: The battery shop will be an enclosed room, adjacent to an exterior wall to enable proper ventilation. Safe storage facilities

for battery fluids will be provided. Batteries will be stored and charged on tiered racks. An electrically-powered lift truck will be provided for moving batteries to and from the shop.

A readily-accessible water supply and an employee shower outlet and eye-wash basin will be provided in case of fluid spills or other accidents. An industrial vacuum cleaner will have the capability of use with corrosive liquids.

Storage facilities and handling devices for battery fluids will meet the applicable safety standards.

Tiered racks will be provided for storing the various sizes of batteries that will be handled. Battery charging equipment, necessary cables, and power supply will be supplied.

The shop ventilation system will be in accordance with applicable CAL/OSHA or other safety standards.

F. Welding Shop:

1. Function: The welding shop will provide various types of welding capabilities for mostly nonroutine requirements, in support of transit vehicle and maintenance-of-way activities. Capabilities will include both shop and portable welding, forming various shapes by torch cuttings; and fabrication of necessary items.

2. Facility: The welding shop will be an enclosed area adjacent to an exterior wall and entrance, to permit provisions for appropriate ventilation to the outside. Pick-up and delivery will be provided via doors to both the heavy repair and S&I areas. The welding shop will be close to the machine shop, to which much of its output will go. The shop will be accessible by lift trucks. A 2-ton jib-type crane will be provided with the shop for lifting heavy material.

Workstations will have workbenches and heavy-duty tables for placing items in work.

Racks, bins, and lockers will be provided for storing materials and supplies. Fixtures will be provided for housing gas cylinders and electrical supply and voltage control equipment.

Welding equipment will include electrical arc welding, gas welding, brazing, and any others that may be required.

The welding shop will conform to all applicable fire, safety, and environmental protection requirements.

The shop will be provided with approved fixtures for storing and securing torches, gas cylinders, and electrical apparatus as well as workbenches, worktables, parts bins, racks and lockers, and movable screens.

G. Metals Shop:

1. Function: The metals shop will provide capabilities in repairing and fabricating various sheet metal items and assemblies, including equipment boxes and lockers, hatch covers, side doors, enclosures and signs. In addition, transit vehicle glazing replacements and body repairs will be staged from the metals shop.
2. Facility: The metals shop will be an enclosed area containing workstations and shop equipment, including various size breaks, punch machines, drill presses, shears, and specialized hand tools. Storage racks, lockers, and bins will house items awaiting repair, spare parts, tools and hardware, and material stocks.

The shop floor and entrances must accommodate lift trucks and other material-handling vehicles. Workbenches, parts bins, shelves, and lockers with fixtures for storing sheet metal and related supplies will be provided. A sheet metal power break for bending and shearing and hand tools such as drills, shears, clamps, and other forming tools will be provided. Space will be allowed for employee tool carts.

The metals shop will be in proximity to the machine shop and welding shop for effective work flow.

H. Parts Cleaning Area:

1. Parts cleaning will be performed in this area in support of the component and support shops.

Frames, boxes, housings, etc., will require specialized cleaning, and possibly sand blasting. Items will be sent from other shops to be cleaned as part of the equipment overhaul requirements.

2. Facility: The parts cleaning area will be adjacent to an exterior wall for exhaust extraction and will extend beyond the wall onto a paved outdoor apron having some degree of cover. This outdoor apron will be used to clean large items. The cleaning shop and apron will be drained. Fixtures will be provided for storing cleaning supplies and equipment. Dip-tanks and sand, bead, or shot blasting tanks will be provided. Compressed air with appropriate hoses and nozzles for cleaning and drying and an electrically powered steam cleaner will be provided for the outdoor area. Cleaning and scrubbing solvents and detergents will be stored. The drainage system will comply with applicable environmental protection requirements.

### 3.2.6 Systemwide Stores

- A. Function: The Office of Contracts, Purchases, and Material will have responsibility for stores-related activities, including:
  1. Storage, handling, and issue of spare parts, assemblies, consumable materials, and repairable components.

2. Shipping and receiving of various items to and from the contractors, and scrap or surplus materials to salvage disposition.
  3. Accounting and control of District materials for inventory control, maintenance of required stock levels, control of costs, materials location tracking, and warranty management.
  4. A main stores area is located in the transit vehicle shops facility. This will be the principal point of receiving, storage, and issue of material for the shops, but some specialized items will be stored at CMF. The main stores area will control satellite material points which will include:
    - a. Local stocks of low-value, high-turnover items in the shops.
    - b. Local stocks of high-value materials in secure storage, at such locations as the maintenance-of-way shop.
    - c. The outdoor materials storage areas, as described in Section 2.2.7.B.
- B. Facility: The systemwide stores area will be a large, enclosed area containing storage racks for large and palletized materials; shelves for small items, loose or packaged; bins for small items in bulk; and special fixtures for irregularly shaped items, or those not readily placed in standard fixtures.

The racks will be arranged for high stacking. Hand-operated power lift devices as well as lift trucks will be used to place and remove materials. Aisles compatible with the material-handling equipment have been specified.

A cage or other type of secure storage area will be provided for small, high-value items.

Office accommodations and an area for administrative personnel and files, reference materials, and a computer terminal for TRANSMIS will be provided.

Access from the loading dock and material receiving area to the the store will be controlled.

The issue counter is accessible from the shop areas, with space and facilities for forms preparation, parts catalog review, and for clerks and files.

The tool room is securable, with storage cabinets and shelves, and an issue counter separate from the main issue counter will be provided.

All entrances will be equipped with security doors and locks. The floor and aisles will be capable of supporting and providing room for maneuvering lift trucks and other material-handling equipment.

Industrial racks, shelving, and bins will be configured for high stacking of pallets. The floor and storage equipment will have graphics applied to indicate location within the store. Part numbers and descriptions will also be applied.

The loading dock will be proportioned, and structurally compatible with loading and unloading of highway truck trailers.

A shipping and receiving area is readily accessible from the store and the loading dock. This area shall be configured in such a manner that entry to the store from the dock and shipping and receiving area can be prevented.

The materials issue counter will maximize access from the various shops and secure the counter area when the store is not staffed.

A security area will be enclosed by wire mesh or similar material. All entrances will have locks.

Office accommodations will be provided within the store, with space for a computer terminal and various catalogs and forms.

### 3.2.7 Blow-down Facility

- A. Function: This facility provides light undercar cleaning of transit vehicles, using compressed air, before the vehicles are brought into the shop. This cleaning or "blow-down" is performed to remove accumulated grease, dirt, dust, and other foreign matter from the undercar equipment to protect the equipment and to facilitate undercar maintenance.

Vehicles will be blown down overnight before entering the shop. Blow-down will be accomplished by a maintenance worker, using a hand-held compressed



air lance with an appropriate nozzle. Fixed nozzles may also be installed. The dirt will be collected for disposal and the filtered air exhausted.

- B. Facility: The blow-down facility will be located in the transit vehicle shop building, but will be separated from the remainder of the building. It will include a through-track over a pit which will be one dependent-pair long, so that employees standing in the pit can remove loose foreign matter from the entire undercarriage of the transit vehicle. The pit will be sheltered to provide protection from the elements.

Compressed-air for the blow-down nozzles will be provided along the pit. The pit will be drained and illuminated, and a water supply for cleaning the pit will be provided along with water treatment or reclamation facilities, as needed. A means of trapping and collecting airborne matter will be provided. The equipment will conform to CAL/OSHA requirements.

### 3.2.8 Maintenance-of-Way Shop

- A. Function: The maintenance-of-way shop will provide for maintenance and repair of equipment removed from wayside systems and of maintenance equipment, including:

1. Track and special trackwork
2. Traction power substations and distribution system

3. Buildings and structures including stations, tunnels, and support systems.

It will also provide for the shop repair of wayside systems and serve as a staging areas for maintenance-of-way crews that are dispatched into the field for wayside work. It will also serve as the headquarters for the administration of all Metro Rail maintenance-of-way activity.

MOW shop activity will include:

1. Assembly and repair of special trackwork items such as switch machines with electrical equipment routed to the component repair shops in the main shop building
  2. Repair and servicing of MOW auxiliary equipment and maintenance shop equipment
  3. Repair of building and structure-related items, including carpentry, glazing, fixtures, sign-painting, and fabrication of various items
  4. Track crew staging and dispatching.
- B. Facility: The maintenance-of-way shop will be located in a separate building near the main shop building and will consist of the following areas:
1. A general repair area with a large open area including a large "lay-down" area for various repairs. Machine tools, rail-saws, hand tools,

a portable welding outfit, industrial workbenches, worktables, and parts and materials storage will be provided. Shop power, compressed air, and tool cart storage will be installed.

The motor vehicle repair and specialized repair tasks, such as engine overhaul, body and paint work, and parts rebuild will be done elsewhere. Locomotive and flat car repairs will be accomplished in the main shop or by contractor.

2. A carpentry shop will be provided with workbenches, materials, storage fixtures, and carpentry hand and power tools including drill presses, lathes, joiners, table saws, sanders, routers, and small power tools. Compressed air and shop power will also be provided.
3. An employee reporting area which will provide an assembly area will contain a time-clock and bulletin board. Employee facilities for the entire facility, including restrooms, shows, locker rooms, a lunchroom, and a first-aid facility will be provided.
4. An administrative area will be provided for the Metro Rail maintenance-of-way organization, containing offices for management and supervisory personnel, areas for clerical and administrative personnel files, a computer terminal, and a communications center with telephone and radio equipment for contacting, controlling, and dispatching mobile crews.

5. A loading dock will be provided to enable the loading and unloading of tools, material, and equipment items into trucks and onto flat cars. Rail will be flush to the pavement to permit access by either rubber-tired or steel-wheel vehicles to the loading dock.
6. A store and tool room will be provided under the control of the Office of Contracts, Purchasing and Material.
7. A paved outdoor work area where large items of trackwork may be placed and repaired.

The maintenance-of-way shop roadways, parking lots, and loading docks will allow access, maneuvering, and parking of commercial delivery vehicles and District motor vehicles including sedans, heavy trucks, and light trucks and vans. Exterior access to the main gate, the main shop, the yard road network, and the outside materials storage area will be provided for authorized vehicles.

A single track, suitable for use by work-train locomotives and cars, will be provided from the yard into the loading dock area. The floor inside the shop will be configured to allow movement of hand carts and material-handling vehicles over the loading area.

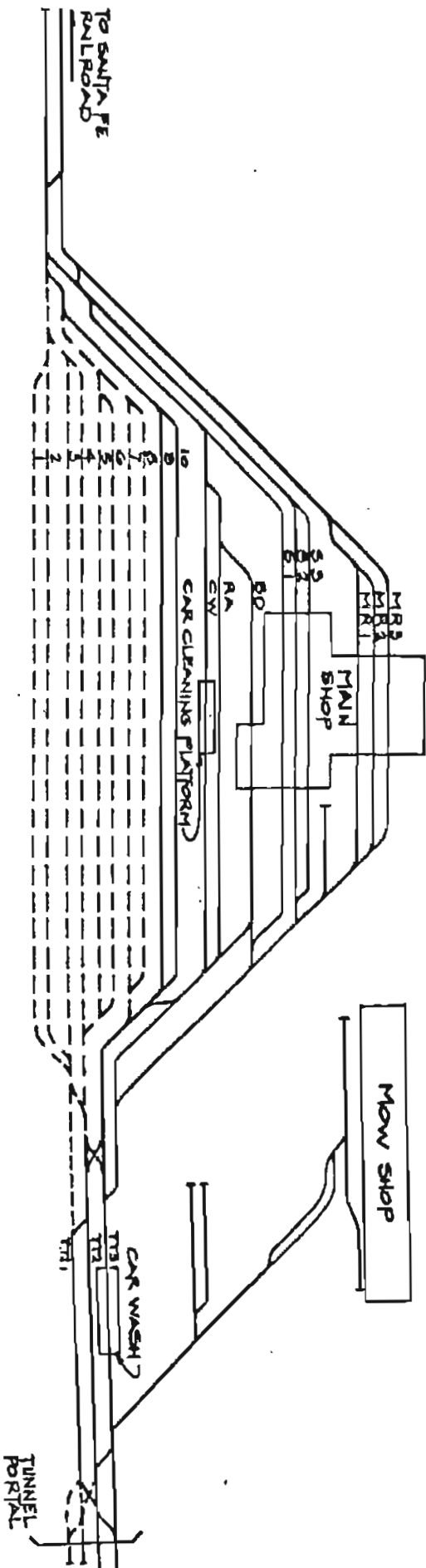


FIGURE 1

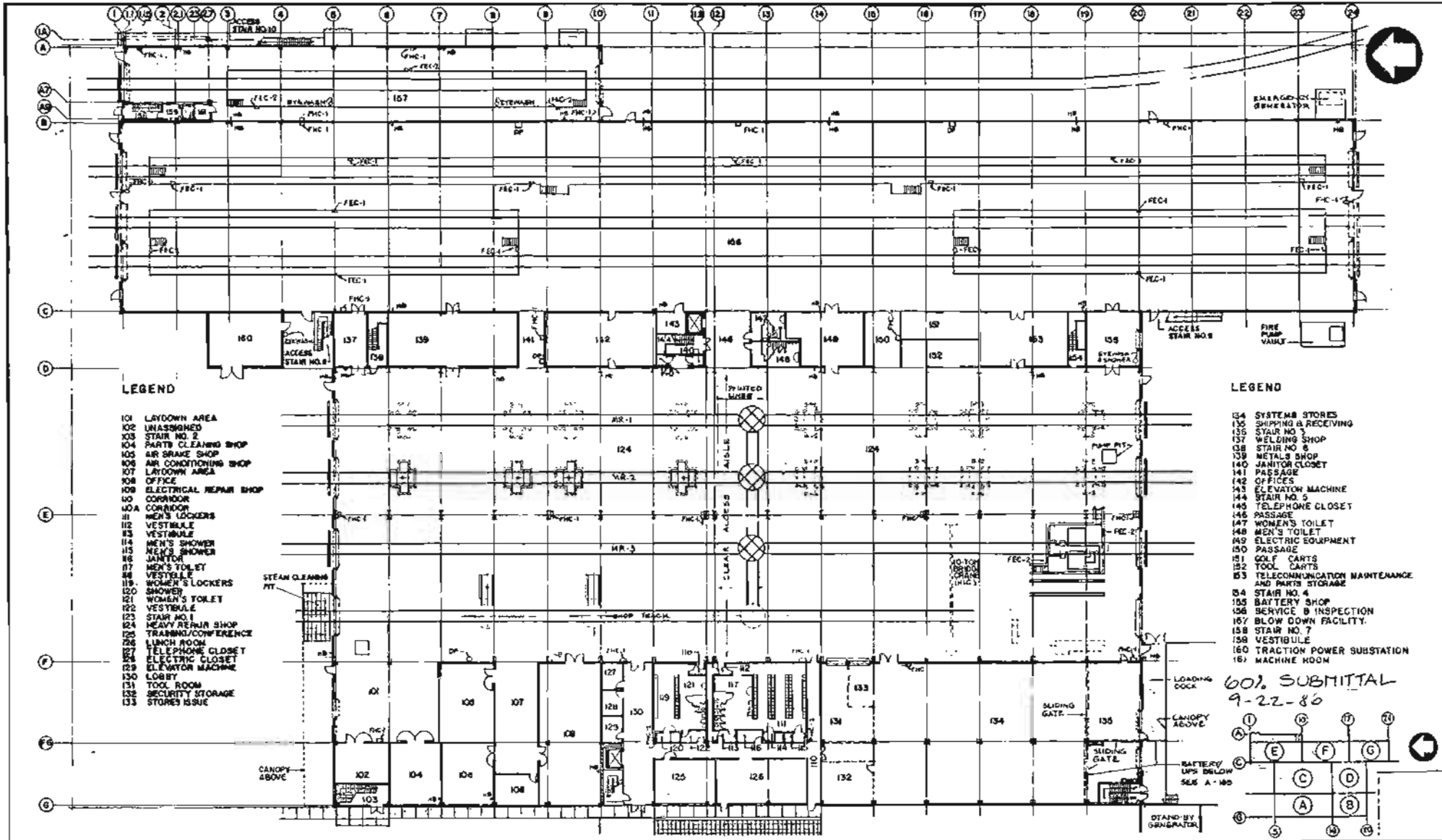
# METRO RAIL YARD-TRACK SCHEMATIC

FOR 12A112, 111S & 1130 CONTRACTS

-----TRACK DEFERRED FOR 1105-1

DESIGNED BY: J.M.C.	DRAWING NO.
DRAWN BY: E.A.	SK-416
CHECKED BY: F.K.	DATE: 11/15/66
SCALE: NONE	DATE: 11/15/66

FIGURE 2  
 MAIN SHOP BUILDING - MAINTENANCE SHOPS



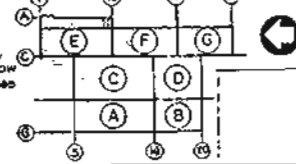
LEGEND

- 101 LAYDOWN AREA
- 102 UNASSIGNED
- 103 STAIR NO. 2
- 104 PARTS CLEANING SHOP
- 105 AIR BRAKE SHOP
- 106 AIR CONDITIONING SHOP
- 107 LAYDOWN AREA
- 108 OFFICE
- 109 ELECTRICAL REPAIR SHOP
- 110 CORRIDOR
- 111 MEN'S LOCKERS
- 112 VESTIBULE
- 113 VESTIBULE
- 114 MEN'S SHOWER
- 115 MEN'S SHOWER
- 116 JANITOR
- 117 MEN'S TOILET
- 118 VESTIBULE
- 119 WOMEN'S LOCKERS
- 120 SHOWER
- 121 WOMEN'S TOILET
- 122 VESTIBULE
- 123 STAIR NO. 1
- 124 HEAVY REPAIR SHOP
- 125 TRAINING/CONFERENCE
- 126 LUNCH ROOM
- 127 TELEPHONE CLOSET
- 128 ELECTRIC CLOSET
- 129 ELEVATOR MACHINE
- 130 LOBBY
- 131 TOOL ROOM
- 132 SECURITY STORAGE
- 133 STORES ISSUE

LEGEND

- 134 SYSTEMS STORES
- 135 SHIPPING & RECEIVING
- 136 STAIR NO. 3
- 137 WELDING SHOP
- 138 STAIR NO. 6
- 139 METALS SHOP
- 140 JANITOR CLOSET
- 141 PASSAGE
- 142 OFFICES
- 143 ELEVATOR MACHINE
- 144 STAIR NO. 5
- 145 TELEPHONE CLOSET
- 146 PASSAGE
- 147 WOMEN'S TOILET
- 148 MEN'S TOILET
- 149 ELECTRIC EQUIPMENT
- 150 PASSAGE
- 151 GOLF CARTS
- 152 TOOL CARTS
- 153 TELECOMMUNICATION MAINTENANCE AND PARTS STORAGE
- 154 STAIR NO. 4
- 155 BATTERY SHOP
- 156 SERVICE B INSPECTION
- 157 BLOW DOWN FACILITY
- 158 STAIR NO. 7
- 159 VESTIBULE
- 160 TRACTION POWER SUBSTATION
- 161 MACHINE ROOM

60% SUBMITTAL  
 9-22-80



<p>REV. DATE BY DES. APP. DESCRIPTION</p>	<p>THE PREPARATION OF THIS DRAWING HAS BEEN PROVIDED IN PART THROUGH A GRANT FROM THE U.S. DEPARTMENT OF TRANSPORTATION, UNDER MAJOR TRANSPORTATION INVESTIGATION, UNDER THE MAJOR ROAD TRANSPORTATION ACT OF 1966, AS AMENDED AND IN PART BY THE REVENUE OF THE DISTRICT OF COLUMBIA GRANT AND BY THE STATE OF CALIFORNIA.</p> <p>DESIGNED BY                  R. J. BOYCE                  INITIAL ISSUE                  NOV 12 NOV. 84</p>	<p>REVISIONS BY DATE DESCRIPTION</p>	<p>APPROVED BY                  Robert J. Boyce</p>	<p>APPROVED BY                  Howard J. Schickel</p>	<p>CONTRACT NO. A112                  DRAWING NO. A102                  SCALE 1" = 20'                  SHEET NO. 79</p>
---	--	--------------------------------------	---	--	--