Southern California Rapid Transit District

METRO RAIL PROJECT

PROJECT MANAGEMENT PLAN FOR MOS-1 CONSTRUCTION

SEPTEMBER 29, 1986

REVISION 1: APRIL 1987

DRAFT

PROJECT MANAGEMENT PLAN
FOR
MOS-1 CONSTRUCTION

REVISION RECORD

NOTICE NUMBER	DATE	AFFECTED SECTIONS	COMMENTS
1	4/87	8.0-8.6 TofC	Revised to reflect Dyer/Murray-Richeson memo of 4-10-87.

TABLE OF CONTENTS

INTRODUCTION

INTRODUCTION

This Project Management Plan is designed to provide a framework for administering design and construction of Minimum Operable Segment-1 (MOS-1) of the Downtown Los Angeles to San Fernando Valley Metro Rail Project. The plan has been developed in accordance with the requirements of the Full Funding Contract between the Southern California Rapid Transit District and the Urban Mass Transportation Administration. The plan defines the management responsibilities and roles of project staff; identifies the interactions among project staff and between project staff and other agencies and organizations; and specifies the general procedures and management tools that will be used to ensure effective project control and successful project completion.

This Project Management Plan provides an overview of management requirements rather than a comprehensive specification of the detailed procedures needed to meet those requirements. Detailed definitions of procedures, criteria, and standards are contained in the project documents referenced in this plan. The requirements of these referenced documents are incorporated within the scope of the plan and will be followed by project personnel in implementing the plan. As additional procedures are developed, they will be incorporated in plan revisions.

The plan consists of 13 chapters:

1.0 Project Background and System Description

2.0 Management Organization, Approach, and Responsibilities

3.0 Design Management

4.0 Real Estate Management

5.0 Systems Procurement Management

6.0 Construction Management

7.0 Program Control

8.0 Configuration Management

9.0 Test Management

10.0 Value Engineering

11.0 Quality Assurance/Control

12.0 Maintenance of the Plan

13.0 Reference Documents

The plan will be reviewed quarterly and will be revised and updated as applicable.

1.0 PROJECT BACKGROUND AND SYSTEM DESCRIPTION

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This chapter provides an overview of the project's background and planning decisions and briefly describes the MOS-1 system.

1.1 PROJECT BACKGROUND

The Metro Rail Project, undertaken by the Southern California Rapid Transit District (SCRTD), will have a significant role in the future development of the Los Angeles region. As part of the 1976 Regional Transportation Development Program, Metro Rail is designed to help solve the increasing transportation problems of Los Angeles' high-density urban center--the regional core.

The Metro Rail Project began in 1977, when SCRTD initiated an in-depth analysis of 11 transit alternatives for the regional core. Concurrently, a comprehensive environmental impact analysis was conducted to examine the effects of each alternative on the affected communities. In September 1979, the SCRTD Board of Directors selected its preferred alternative--an 18-mile rail rapid transit line extending from the central business district through the Wilshire Boulevard area to Fairfax Avenue, and then north through Hollywood to the San Fernando Valley.[1]

Preliminary engineering on the 18-mile Metro Rail Project began in June 1980. During the preliminary engineering phase, alternative configurations and designs were investigated, major design and engineering issues were resolved, and cost estimates were produced. The decisions reached during this phase are documented in a series of 12 Metro Rail milestone reports:

1. Preliminary System Definition and Operating Plan (August 1982)

2. System Design Criteria (August 1982)

3. Route Alignment Alternatives (February 1983)

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1 See U.S. Department of Transportation, Urban Mass Transportation Administration, in conjunction with SCRTD, Alternatives Analysis/Environmental Impact Statement/Report, April 1980.

4. Station Location Alternatives (February 1983)

5. Right-of-Way Acquisition and Relocation Policies and Procedures (September 1982)

6. Land Use and Development Policies (January 1983)

7. Safety, Fire/Life Safety, Security and Systems Assurance (March 1983)

8. Systems and Subsystems (May 1983)

9. Supporting Services Plan (March 1983)

10. Fixed Facilities (September 1983)

11. Preliminary Cost Estimate (December 1983)

12. System Plan (February 1984).

Simultaneous with the preliminary design work, an extensive analysis was conducted of the possible impacts of the project on communities along the Metro Rail alignment.[2]

During final design, baseline design documents have been established (see Chapter 3.0) and preconstruction planning has proceeded. Items critical to the construction phase have been studied, and plans have been developed to expedite procurement and construction activities, including:

- Construction procedures incorporating safety requirements for tunneling in gassy ground due to the possible presence of methane gas

- Manuals and procedures covering quality assurance/control, safety/security, and other critical requirements

- Liaison and coordination with utility companies and various other public agencies, and execution of Master Agreements

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2 U.S. Department of Transportation, Urban Mass Transportation Administration, in conjunction with SCRTD, Final Environmental Impact Statement, Los Angeles Rail Rapid Transit Project: Metro Rail, December 1983.

- An integrated, computerized, and operational project control system to monitor costs and schedules
- A configuration control/claims control system established to maintain contract integrity, monitor interfaces between contracts, and process claims as expeditiously as possible
- A comprehensive community relations plan and an equal opportunity plan
- Constructibility and claims avoidance reviews of construction contracts to minimize potential claims and thereby minimize cost growth
- A comprehensive bid solicitation procedure
- Seismic studies
- Continuation of Work Agreement to minimize work interruptions and cost over-runs.

Construction of the Metro Rail system will, because of funding limitations, be accomplished in stages. The initial construction segment will include the yard and shops area and a mainline segment from Union Station to the intersection of Wilshire Boulevard and Alvarado Street. This segment, termed Minimum Operable Segment-1 (MOS-1), is described in the following section of this chapter. Environmental assessments on MOS-1 were conducted in 1984 and 1986,[3] and final design of MOS-1 was essentially completed as of June 30, 1986. Construction of MOS-1 is scheduled to begin in September 1986.

Extensions to the MOS-1 system will be made incrementally as funding permits. The 18-mile Metro Rail system was originally planned to follow a route along Wilshire Boulevard through the Fairfax district and Hollywood to

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3 U.S. Department of Transportation, Urban Mass Transportation Administration, in conjunction with SCRTD, Environmental Assessment: Los Angeles Rail Rapid Transit Project, Union Station to Wilshire/Alvarado, August 1984; and Comments and Responses on the Environmental Assessment for the Los Angeles Rail Rapid Transit Project, Union Station to Wilshire/Alvarado, October 1984. See also U.S. Department of Transportation, Urban Mass Transportation Administration, Re-Evaluation of Environmental Record, June 1986.

the San Fernando Valley. However, concerns about the safety of tunneling through the Fairfax area resulted in a Federal law requiring the SCRTD to reconfigure the alignment to avoid potential methane gas areas as identified by the City Task Force. Four candidate alignments are presently being assessed for serving the Wilshire Corridor and connecting the MOS-1 line with North Hollywood.

1.2 MOS-1 SYSTEM DESCRIPTION

The 4.4-mile MOS-1 alignment, shown in Exhibit 1-1, comprises a yard and shop area and a mainline route served by five stations. The mainline route begins at Union Station, where it turns northwest and runs through the central business district along Hill Street. Turning on Seventh Street, the route heads toward the west side of downtown, past the Harbor Freeway, and continues to the Wilshire/Alvarado Station. The mainline is entirely subway. All line segments will be constructed by tunnel-boring methods, and stations and crossovers will be built by cut-and-cover construction techniques.

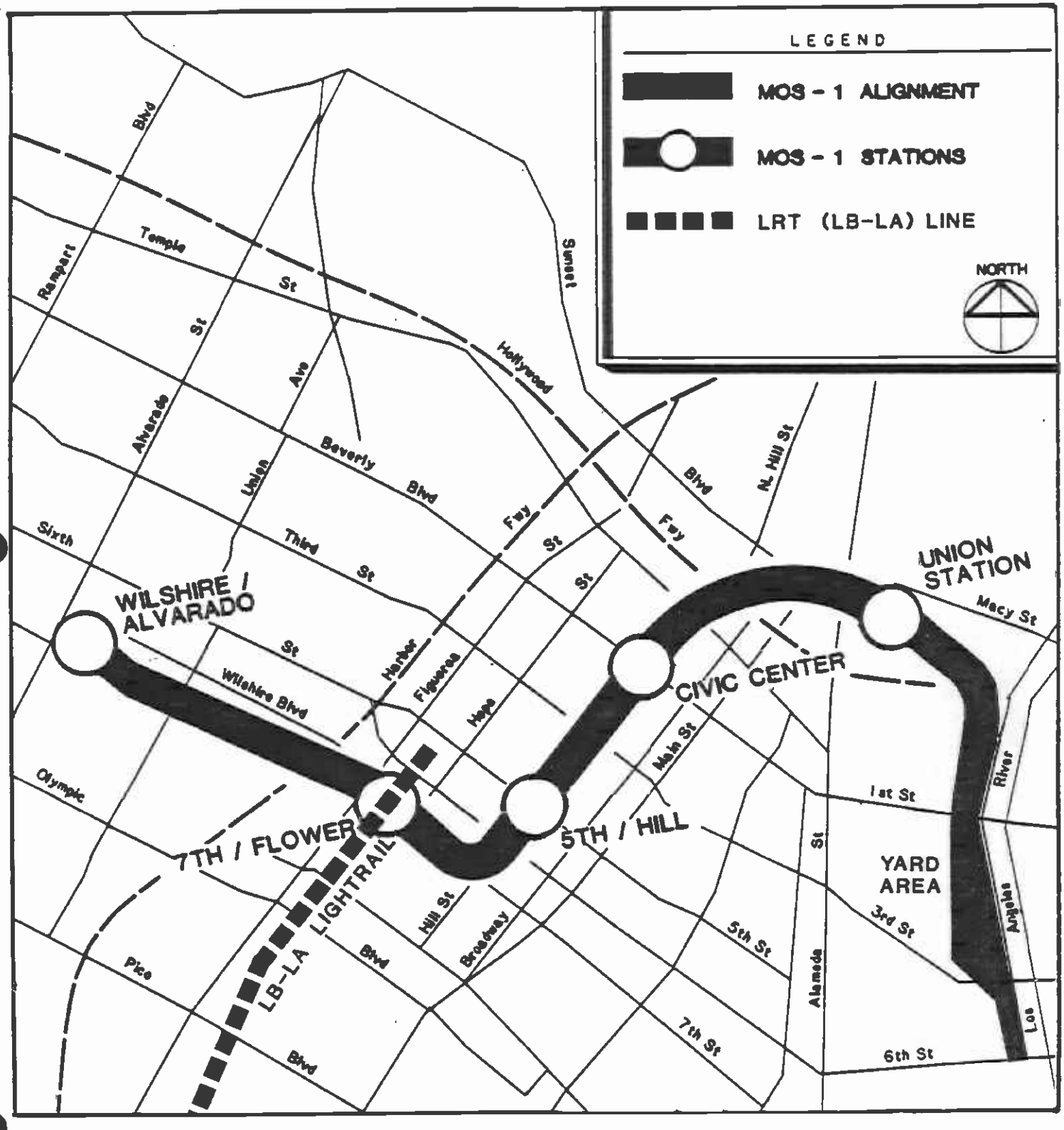
The mainline portion of MOS-1 will include three double crossovers. Two of the crossovers will be located at either end of Union Station, and one will be located at the east end of the Wilshire/Alvarado Station. The system will be integrated with the existing bus network and with the Long Beach-Los Angeles (LB-LA) light rail line. The 7th/Flower Station will serve as the connecting point between the Metro Rail and the LB-LA light rail line.

The vehicles for the system will be stainless steel, standard gauge, 75-foot-long rail cars, which will be configured in dependent pairs. They will be capable of operating at speeds up to 70 miles per hour. They will operate on 750 VDC power and will be capable of regenerative braking. Each single vehicle will have a capacity of 59 seated passengers, one wheelchair passenger, approximately 110 standing passengers at normal loads, and approximately 160 standing passengers at crush loads.

MOS-1 trains will be provided with Automatic Train Protection (ATP) and Automatic Train Operation (ATO) equipment to ensure safe speed and separation of trains, and provide automatic speed regulation and precise station stops.

Stations have been designed for unattended operation and will have automatic fare collection equipment. The fare structure will be based on a single zone. Stations will have either center or end mezzanines. Escalators and

EXHIBIT 1-1
Alignment of Initial Segment of Metro Rail System



stairs will provide normal vertical circulation between surface, mezzanine, and platform levels; in addition, one elevator for the elderly and handicapped will be installed at each station. Additional exits will be provided for use in emergencies. Some stations will have adjacent parking facilities, pick-up/drop-off areas, and/or bus pull-in areas to accommodate patrons arriving by automobile or by bus.

Ridership on the MOS-1 segment by the year 2000 is projected to be approximately 55,000 per day. An estimated two-thirds of these passengers will be connecting to SCRTD bus routes serving the five Metro Rail stations. During peak hours, the maximum loading will be from Union Station in the morning and to Union Station in the evening. The 24-hour loading pattern, however, has relatively constant loadings on each link, with the heaviest travel between the Wilshire/Alvarado and 7th/Flower Stations.

2.0 MANAGEMENT ORGANIZATION, APPROACH, AND RESPONSIBILITIES

2.0 MANAGEMENT ORGANIZATION, APPROACH, AND RESPONSIBILITIES

This chapter describes the organizational structure of the SCRTD and of the Metro Rail Project team and identifies SCRTD's general approach to management of the Metro Rail Project. The chapter also describes the responsibilities and authorities of Metro Rail Project staff and of other SCRTD departments, and outlines the relationship between SCRTD and the outside agencies involved in the project.

2.1 ORGANIZATION AND APPROACH

The SCRTD has responsibility for operating transit service within the Los Angeles area and for the design, construction, and operation of heavy rail rapid transit and the operation of light rail systems. The SCRTD is governed by state law and is administered by a Board of Directors, which is delegated authority to appoint the General Manager.

The General Manager is responsible for carrying out Board policies and direction and for overall management of the SCRTD, including the Metro Rail Project. The organization of the SCRTD is shown in Exhibit 2-1.

Within the SCRTD, responsibility for all transit facilities projects, including the Metro Rail Project, is centralized within the Transit Systems Development (TSD) Department. Reporting directly to the General Manager, the Assistant General Manager for Transit Systems Development has overall responsibility for the management, coordination, and control of Metro Rail Project staff and activities. He is supported by the TSD Directors of Technical and Administrative Services, Program Control, Transit Facilities, Systems Design and Analysis, Construction Management, and Real Estate and Development, and their staffs. To assist in administering the Metro Rail Project, TSD has retained the services of four consultant organizations: a General Consultant, a Systems Engineering and Analysis Consultant, a Construction Management Consultant, and an Insurance Consultant. The TSD Department and its consultants constitute the core Metro Rail Project team, as shown in Exhibit 2-2. In addition, the project team includes Metro Rail committees established to provide expertise in specific project areas; these committees

EXHIBIT 2-1
Organization of SCRTD

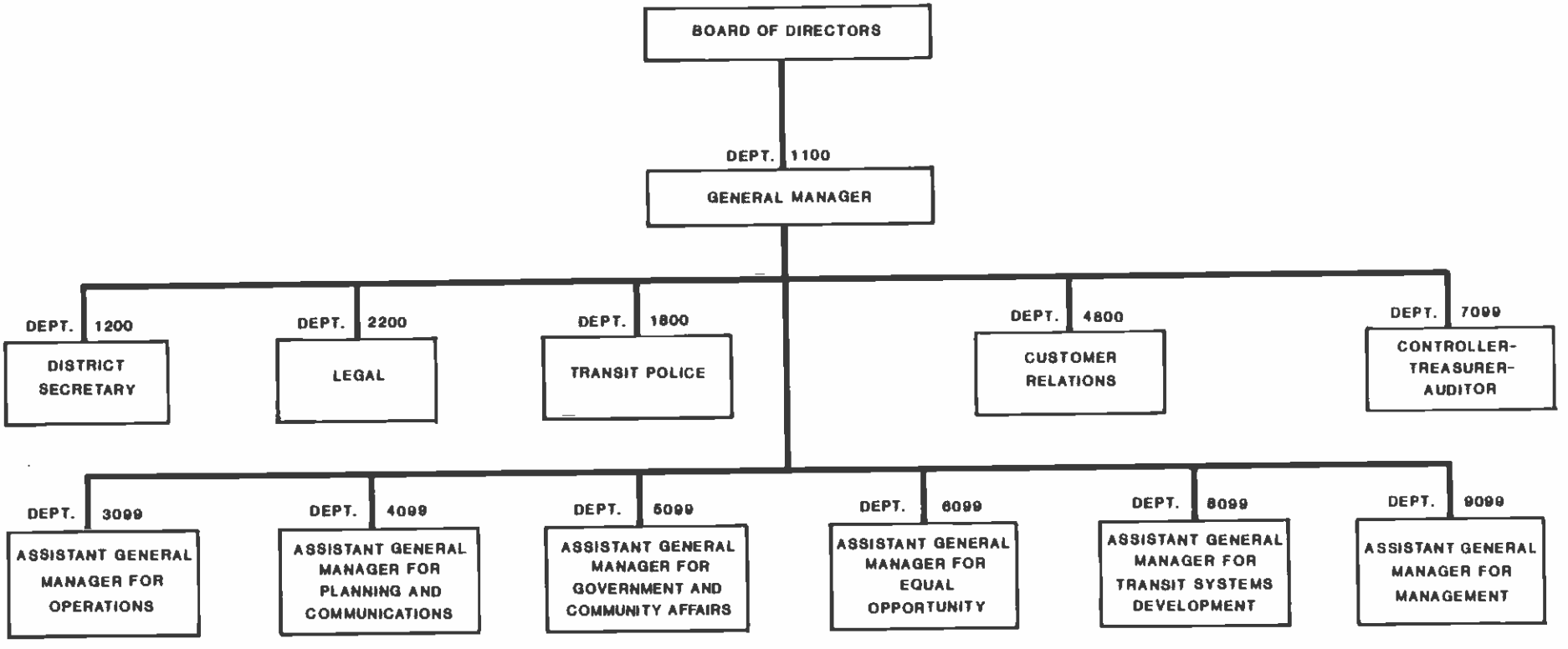
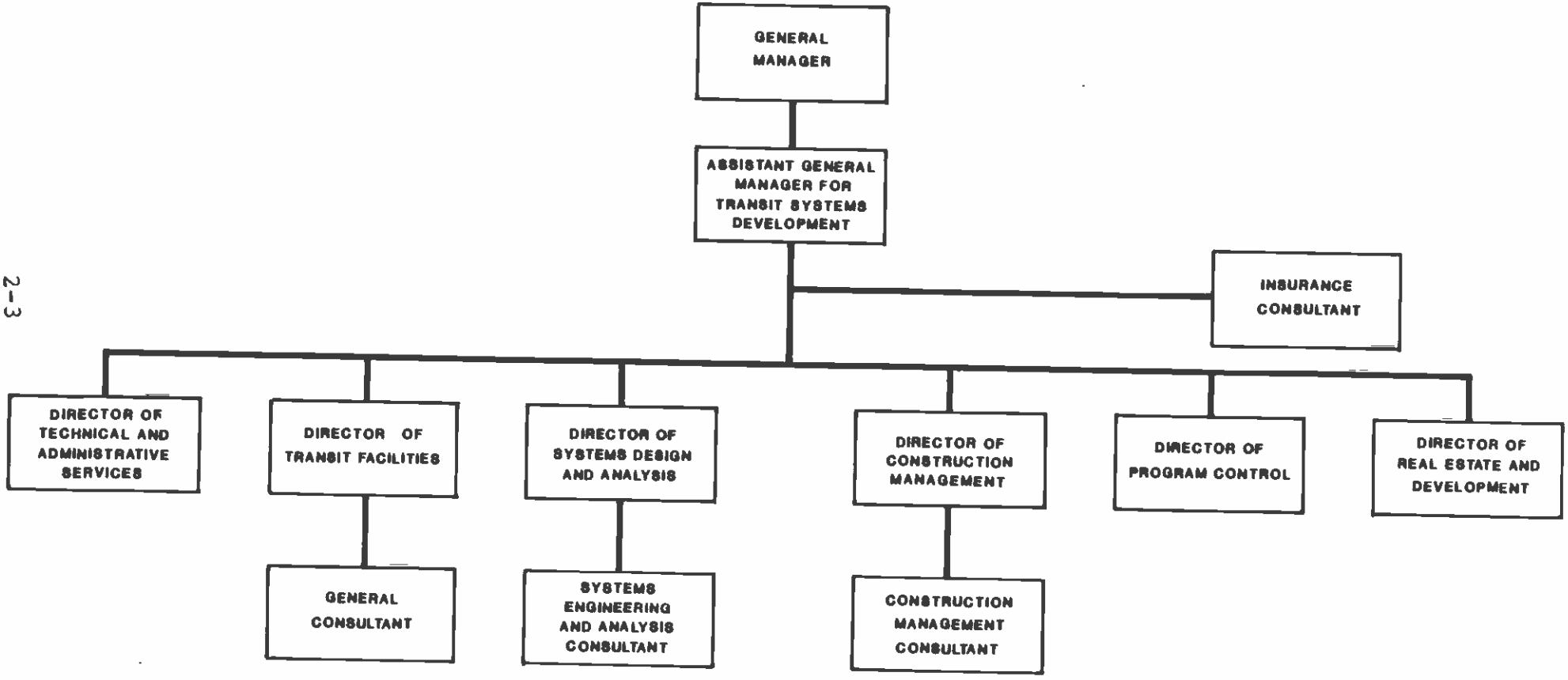


EXHIBIT 2-2
Organization of Metro Rail Core Project Team



consist of representatives from the TSD Department and its consultants and, as appropriate, from other SCRTD departments and outside agencies.

This project team structure provides clear lines of communication and authority, with project management responsibilities being delegated from the SCRTD Board of Directors through the General Manager to the Assistant General Manager/TSD, and from thence to project team staff.

Project responsibilities are centralized under the Assistant General Manager/TSD, and all design, procurement, and construction activities are managed by designated TSD Directors. Consultant organizations act as extensions of the Director's staff and, like internal TSD staff, are under his direct control. Each consultant organization is headed by a Project Manager, who has overall responsibility for controlling and monitoring his organization's performance and for reporting on that performance to the responsible TSD functional Director, to the TSD Director of Program Control, and to the Assistant General Manager/TSD.

Further management control is exerted at the contract level by the designation, for each procurement and construction contract, of a TSD Project Engineer. Under the direction of the responsible functional TSD Director, the Project Engineer has responsibility for detailed oversight of contract performance. The Project Engineer is responsible for coordinating, reviewing, and approving contractor work procedures; for providing direction and guidance to the consultant organization responsible for managing the contract's accomplishment; for monitoring and reporting on work performance; and for coordinating the activities required to resolve problems.

The project team approach provides the needed skills and staffing levels required by a large and complex project, with coordination and control being exerted through a clear delineation of responsibilities; the establishment of procedures defining how all portions of TSD and its supporting groups and consultants will accomplish and control work activities and document satisfactory performance; and comprehensive program control mechanisms for monitoring cost, schedule, and quality performance. Those controls include formal reporting requirements, including the submission of written progress reports and the conduct of status review meetings. Each TSD Director must submit a monthly progress report to the Assistant General Manager/TSD. All consultant organizations and contractors must also provide formal monthly progress reports, which are reviewed and assessed by TSD Directors. These individual progress reports are reviewed by the Director of Program Control and are used in compiling

monthly and quarterly progress reports on the overall status of the entire project, copies of which are distributed to SCRTD managers and to outside funding agencies for review.

In addition, the Assistant General Manager/TSD holds weekly project status review meetings attended by TSD Directors and the Project Managers of consultant organizations, at which progress is reviewed, problems and corrective actions are identified, and responsibility for implementing such action is assigned. Similarly, each TSD Director holds weekly or biweekly progress review meetings with his staff and consultants.

These reporting requirements ensure the timely dissemination of project information and facilitate project coordination and control. They are basic components of the management process delineated in the following pages of this plan. Implementation of this process is the responsibility of all project team members, under the overall direction of the Assistant General Manager/TSD. Specific responsibilities are identified below.

2.2 METRO RAIL PROJECT TEAM RESPONSIBILITIES

This section describes the roles and responsibilities of each of the major elements of the Metro Rail Project team:

- TSD Department
- Consultants
- Committees.

2.2.1 Transit Systems Development Department

The TSD Department is responsible for all activities related to the design, procurement, construction, and activation of the Metro Rail system, including meeting cost, schedule, and performance objectives. The responsibilities of each office within the TSD Department are discussed in the following paragraphs.

2.2.1.1 Technical and Administrative Services

The Director of Technical and Administrative Services is responsible for contract administration and office management, as follows:

- Processing of Board agenda items, invoices, contracts and contract amendments, and purchase requisitions

- Administration of the Owner-Controlled Insurance Program
- Monitoring and maintenance of payroll records
- Maintenance of personnel records
- Provision of general office support services.

2.2.1.2 Systems Design and Analysis

The Director of Systems Design and Analysis is responsible for systems design, systems engineering and analysis, and systems safety and assurance efforts, including:

- Design of all Metro Rail operating systems, including passenger vehicles, train control, communications, fare collection, traction power, and auxiliary vehicles
- Management of passenger vehicle and fare collection equipment procurement
- Determination of system requirements, identification of system interfaces, and monitoring of system design to ensure conformance to criteria and interface requirements
- Development of systems analysis tools
- Evaluation of system alternatives and optimization of system design
- Development of operating strategies, projection of operating statistics, and estimation of costs
- Operations planning duties, including development and updating of the system operating and maintenance plans and management of system testing and activation
- Establishment of requirements and criteria for safety, fire/life safety, security, reliability, maintainability, and quality assurance and development of implementation plans
- Reviews to ensure that safety and systems assurance criteria are incorporated in the design and construction of facilities and equipment.

The Director is responsible for directing the efforts of the Systems Engineering and Analysis consultant and the systems-related design, operations and maintenance planning, and safety and systems assurance work of the General Consultant.

2.2.1.3 Transit Facilities

The Director of Transit Facilities is responsible for managing and coordinating facility engineering, architectural design, and environmental efforts, as follows:

- Preparation of environmental documents relating to the Metro Rail Project, including environmental reports, impact statements, studies, and compliance reports
- Development of architectural criteria, facility designs, and alternative design approaches and schematics
- Development of criteria, standards, drawings, and specifications for civil, structural, and mechanical portions of the project
- Performance of right-of-way engineering and right-of-way certification
- Negotiation of Master Agreements with affected public agencies and private utility companies and coordination of designs with affected railroads
- Administration of Master Agreements and review and coordination of all utility issues relating to the Metro Rail Project.

The Director is responsible for directing the efforts of the General Consultant and section designers engaged in facilities design and engineering.

2.2.1.4 Construction Management

The Director of Construction Management is responsible for managing and coordinating Metro Rail construction-related activities and procurement activities (excluding procurement of passenger vehicles and fare collection equipment), as follows:

- Review of bid documents to ensure feasible, practical, economical, and safe construction

- Participation in the evaluation of construction contract bids to determine responsibility and responsiveness of the apparent low bidders
- Preparation of Notices-to-Proceed to contractors
- Direction of the construction safety program
- Coordination and processing of all construction contract changes
- Monitoring, coordination, and oversight inspection of assigned procurement and all construction activities
- Monitoring and coordination of the performance of Master Agreement work
- Review of and recommendation for approval of progress and final payments to contractors
- Recommendation for final acceptance of construction contract and assigned procurement contract work
- Participation in testing, start-up, and activation activities.

The Director is responsible for directing the efforts of the Construction Management consultant.

2.2.1.5 Real Estate and Development

The Director of Real Estate and Development is responsible for all purchase and lease acquisitions in support of certified Metro Rail real property needs, including real estate appraisals, acquisition and relocation, and development needs. Specific responsibilities include:

- Management of the purchase or lease of real estate
- Management of owned property until construction
- Performance and review of property appraisals
- Initiation and monitoring of condemnation activities
- Selling or leasing of excess real estate
- Development and management of relocation programs

- Negotiation, implementation, and administration of joint development/value capture agreements.

2.2.1.6 Program Control

The Director of Program Control is responsible for developing and maintaining the cost, scheduling, estimating, and related information needed to properly manage the Metro Rail Project, including:

- Design and operation of systems to monitor current status and forecast progress in meeting integrated cost and schedule performance objectives
- Preparation and updating of summary and detailed schedules
- Preparation and updating of baseline budgets and the project Financial Plan
- Preparation of regular project progress reports and evaluation of performance
- Review and analysis of construction and procurement expenditures and cost estimates to determine reasonableness and consistency with the Financial Plan
- Identification of potential budget or schedule problems and development of recovery plans
- Development and maintenance of contingency plans for addressing likely problem areas.

2.2.2 Consultants

The Metro Rail Project is supported by four consulting organizations, as described below.

2.2.2.1 General Consultant (GC)

The GC is responsible for the design of all facilities and systems and the preparation and dissemination of contract documents. The GC provides support during construction/procurement for evaluation and engineering of design changes. The GC on the Metro Rail Project is Metro Rail Transit Consultants, a joint venture of Parsons, Brinckerhoff, Quade & Douglas Inc.; Daniel, Mann, Johnson & Mendenhall; Kaiser Engineers Corporation; and Harry Weese & Associates.

2.2.2.2 Systems Engineering and Analysis (SE&A) Consultant

The SE&A consultant is responsible for operations and maintenance planning; safety, security, and system assurance support; management information system development; systems design special studies; and system test planning. The SE&A consultant has been assigned responsibility for managing the procurement of passenger vehicles and fare collection equipment. The SE&A consultant is Booz, Allen & Hamilton Inc.

2.2.2.3 Construction Management (CM) Consultant

The CM consultant is responsible for the management of all transit facility construction and the procurement of all equipment, except passenger vehicles and fare collection equipment. The CM consultant's scope of work also includes the enforcement of safety and security, quality assurance, and equal opportunity requirements related to construction activities, and the provision of support for system testing and start-up. The CM consultant is PDCD, a joint venture of the Ralph M. Parsons Company; Dillingham Construction, Inc.; and De Leuw Cather and Company.

2.2.2.4 Insurance Consultant

An Insurance Consultant has been retained as District Insurance Administrator for SCRTD's Owner-Controlled Insurance Program (OCIP). The District Insurance Administrator is responsible for procuring insurance for construction contractors and subcontractors (Workers' Compensation and Employer's Liability, Liability and Excess Liability, and All Risk Course of Construction), servicing insurance claims, administering a bond packaging program for eligible subcontractors, and providing loss-prevention services. The District Insurance Administrator on the Metro Rail Project is a joint venture formed by Fred S. James & Company of California, Inc.; Okasaka, Ortiz & Ciocatto Insurance Associates; Kadowaki Associates International Corporation; and Rideau & Associates Insurance Agency.

2.2.3 Metro Rail Committees

To ensure supportive interaction among the Metro Rail Project team, other SCRTD organizations, and representatives of outside agencies, several working committees have been established. The committees act as review boards of on-going technical activities; review analyses and reports; and provide a forum for coordinating design, procurement, construction, operations, and maintenance issues.

2.2.3.1 Fire/Life Safety Committee

A permanent Fire/Life Safety Committee (FLSC) has been established to facilitate the interchange of information, develop fire/life safety criteria, and make evaluations and recommendations relative to fire and panic safety. The FLSC is chaired by the TSD Supervisor of Safety and Systems Assurance and includes representatives from the GC, CM, and SE&A consultants and from the:

- City of Los Angeles Fire Department
- Consolidated Fire Protection District of Los Angeles County.

The FLSC was established by a charter signed by the SCRTD and the Board of Fire Commissioners on September 8, 1983. The FLSC meets on a regularly scheduled basis.

2.2.3.2 Security Subcommittee

A permanent Security Subcommittee to the FLSC has been established. The Security Subcommittee is charged with facilitating the exchange of information and making recommendations and evaluations relative to rail system security. The Security Subcommittee is chaired by the TSD Supervisor of Safety and Systems Assurance and consists of representatives from the GC, CM, and SE&A consultants and from the:

- SCRTD Transit Police
- Los Angeles City Police Department
- Los Angeles County Sheriff's Department
- Los Angeles County Coroner/Medical Examiner's Office

The Security Subcommittee meets on a regularly scheduled basis.

2.2.3.3 Operations and Maintenance Committee

The SCRTD has established a Metro Rail Operations and Maintenance (O&M) Committee. The O&M Committee coordinates the exchange of information and establishes policies relating to operation and maintenance of the Metro Rail system. The O&M Committee is chaired by the TSD Manager of Systems Engineering and Analysis and includes representatives from TSD Systems Design and Analysis (Safety and Systems Assurance, and Systems Design); SCRTD Department

of Operations (Rail Transportation, Facilities Maintenance, Equipment Maintenance); and the GC and SE&A consultant.

The O&M Committee meets on a regularly scheduled basis. The O&M committee recently established a Maintenance Integration Subcommittee, which is charged with working cooperatively with LACTC and and its General Consultant, Southern California Rail Consultants, to integrate maintenance planning activities for the Metro Rail, light rail, and bus systems.

2.2.3.4 Safety Certification Review Team

A critical element of the Metro Rail safety certification program is the requirement for the systematic evaluation of evidence by a team of experienced safety personnel. The safety certification program establishes a Safety Certification Review Team charged with the safety review, evaluation, and approval of all safety-related documentation. The Review Team is chaired by the TSD Supervisor of Safety and Systems Assurance and consists of voting representatives from TSD Systems Design and Analysis, Transit Facilities, and Construction Management; SCRTD Department of Operations (Rail Transportation, Facilities Maintenance, and Equipment Maintenance); and SCRTD Transit Police.

The Review Team is supported by non-voting representatives from the GC, CM, and SE&A consultants, and a fire department representative from the FLSC.

2.3 RESPONSIBILITIES OF OTHER SCRTD DEPARTMENTS

This section identifies the responsibilities of other SCRTD departments in supporting Metro Rail Project management.

2.3.1 Department of Management

The Department of Management is responsible for administrative services, personnel, contracts and purchasing, labor relations, risk management, and general management and budget functions within the SCRTD. For the Metro Rail Project, the Department will provide those functions in support of the TSD Department in design, procurement, and construction activities.

Much of this support will be provided by the Office of Contracts, Procurement, and Materiel (OCPM) within the Department of Management. OCPM will issue Requests for Proposals and Invitations to Bid; will receive and participate in evaluating proposals and bids; will issue purchase orders; and will issue and administer contracts.

2.3.2 Department of Controller, Treasurer, Auditor

This Department is responsible for the fiscal management of the SCRTD, including accounting, cash management, investments, and internal and external auditing activities. For the Metro Rail Project, the Department will assist in managing allocated project funds and will conduct audits of consultants, contractors, and suppliers.

2.3.3 Legal Department

The Legal Department is responsible for all of the legal affairs of the SCRTD. For the Metro Rail Project, the Department will review and approve contracts, defend the SCRTD in any lawsuits, assist in contract negotiations and negotiations for property acquisition and joint development along the right-of-way, and manage the Hearing Officer process in appeals to benefit assessments.

2.3.4 Transit Police Department

The Transit Police Department is responsible for augmenting local law enforcement efforts to provide security and protection for transit patrons. In addition, the Department has the responsibility for the internal security of SCRTD employees, revenues, and property. For the Metro Rail Project, the Transit Police Department will participate in security planning efforts.

2.3.5 Department of Operations

The Department of Operations is responsible for all transit operations, maintenance, and service scheduling. For the Metro Rail Project, the Department will review operations and maintenance plans; recruit and train operations staff; and participate in system start-up, check-out, and turn-over.

2.3.6 Department of Planning and Communications

The Department of Planning and Communications is responsible for transit service planning and analysis, public and passenger communications, news media relations, and promotional and advertising programs. For the Metro Rail Project, the Department is responsible for news media relations and promotional and advertising programs; preparing ridership forecasts; conducting alternative analyses; and ensuring service integration of the bus, Metro Rail, and light rail systems, including the development of an integrated fare policy. The Department is also responsible for all joint development planning, including the development of station area master plans, the formation of benefit assessment districts, and the

maintenance of benefit assessment files. The Planning Department is presently completing evaluations of alternative alignments of Metro Rail extensions for the Congressionally Ordered Reengineering Study, and is responsible for preparing the Supplementary Environmental Impact Statement/Supplementary Environmental Impact Report (SEIS/SEIR).

2.3.7 Department of Customer Relations

The Department of Customer Relations is responsible for handling routine inquiries concerning transit services and for receiving customer complaints. The Department will become involved in the Metro Rail Project during pre-revenue system operations to answer questions concerning service hours, fares, etc.

2.3.8 Department of Government and Community Affairs

The Department of Government and Community Affairs has overall responsibility for SCRTD's relations with Federal and state governments and special commissions, and also has responsibility for executing and monitoring all SCRTD policies and instructions regarding community relations, local government affairs, and complaint mitigation and problem resolution. For the Metro Rail Project, the Department is responsible for directing a community relations program applicable to the communities affected by the construction effort. The Department is also responsible for providing information on and facilitating community participation in the decision-making process on the re-analysis of and SEIS/SEIR work on the alignment of Metro Rail extensions.

2.3.9 Department of Equal Opportunity

The Department of Equal Opportunity is responsible for ensuring the compliance of SCRTD programs with appropriate Federal and state employment legislation. For the Metro Rail Project, the Department will recommend contract-specific Disadvantaged Business Enterprise/Women's Business Enterprise (DBE/WBE) goals; evaluate bids for compliance with those goals; monitor compliance with DBE/WBE goals, labor standards, and EEO requirements; and maintain a listing of certified disadvantaged and women-owned businesses.

2.3.10 District Secretary

The primary function of the District Secretary is to carry out the processes necessary to ensure that the meetings of the Board of Directors are conducted in a timely fashion and are conducted in accordance with relevant laws

and SCRTD rules and regulations. The District Secretary will assist Metro Rail Project staff by acting as the official repository for all expired contracts, by providing minutes of Board meetings, and by assisting in the submission of documents to the Board.

2.4 OUTSIDE ORGANIZATIONS

The successful completion of the project will require close cooperation between the SCRTD and many outside organizations. The roles of the primary agencies with which the SCRTD must interface are described below.

2.4.1 Urban Mass Transportation Administration

The Urban Mass Transportation Administration (UMTA) is the agency through which Federal funding of the project is channeled. As such, UMTA is responsible for monitoring the progress of the project. To enable UMTA to fulfill that responsibility, the SCRTD will provide UMTA with copies of monthly and quarterly progress reports describing project accomplishments, problems, funds expended, etc. In addition, the SCRTD will meet hold quarterly project status review meetings which will be attended by representatives of UMTA and other funding agencies.

2.4.2 Project Management Oversight (PMO) Contractor

An independent contractor will be retained by UMTA to provide oversight on SCRTD's management of the Metro Rail Project. The PMO will report directly to UMTA on project progress and problems, including cost, schedule, and quality issues.

2.4.3 Los Angeles County Transportation Commission (LACTC)

As the transportation planning and policy agency for Los Angeles County, the LACTC has the role of local funding agency for all regional transit projects, including the Metro Rail Project. As such, the LACTC is responsible for ensuring cost-effective utilization of funds allocated to each project. To enable the LACTC to fulfill this function, the SCRTD will provide LACTC with copies of monthly and quarterly progress reports describing the cost and schedule status, accomplishments, and problems of the Metro Rail Project. LACTC representatives will also attend quarterly project status review meetings held by the SCRTD.

In addition, the LACTC is responsible for developing light rail systems in Los Angeles, the first projects of which are the Long Beach-Los Angeles and Century Freeway

light rail lines. The light rail lines will be operated by the SCRTD and will share a common station with Metro Rail MOS-1 at the 7th/Flower Station. The SCRTD has received a work authorization from the LACTC to design and construct the light rail station and tail tracks at 7th/ Flower, including procurement of common equipment elements. The two agencies are formulating a cooperative agreement to ensure the integration of the light and heavy rail systems through the use of joint technical working groups, the adoption of common design criteria, and the review of each other's program documents.

2.4.4 City of Los Angeles

As a funding agency of the Metro Rail Project, the City of Los Angeles will monitor the progress of the project. The SCRTD will provide the city government with copies of monthly and quarterly reports identifying the project's cost and schedule status, areas of concern, and recommended corrective actions. In addition, representatives of the city government will attend quarterly project status review meetings held by the SCRTD.

In addition, the SCRTD has entered into a Master Agreement with the City of Los Angeles to provide for the relocation of city facilities impacted by Metro Rail construction and to provide city assistance to the SCRTD in the areas of transportation engineering, fire safety, and police security. (See Sections 2.4.8, 2.4.12, 2.4.14, and 2.4.16 for a description of city agencies covered under this Master Agreement.)

2.4.5 County of Los Angeles

The SCRTD and the County of Los Angeles have entered into a Master Agreement to provide for the relocation of county facilities impacted by Metro Rail construction in the vicinity of the County Courthouse and within the Los Angeles Flood Control District. The Master Agreement also covers the provision of services by the County Sheriff's Department and the County Coroner/Medical Examiner (see Sections 2.4.14 and 2.4.15).

2.4.6 California Department of Transportation (Caltrans)

Caltrans is responsible for planning, design, construction, operation, and maintenance of state highways in California, and for development and operation of public transportation services. The SCRTD must coordinate with Caltrans with regard to all encroachments of the Metro Rail system upon Caltrans' rights-of-way. The SCRTD has entered into a Master Agreement with Caltrans to facilitate such coordination, which includes incorporating Caltrans'

requirements concerning the design and construction of the Metro Rail facilities. Once the design is acceptable, Caltrans issues a permit to construct the facility. Areas of encroachment in MOS-1 include:

- District A-130 Contract, crossing of Santa Ana Freeway and Vignes Street
- District A-141 Contract, crossing of Santa Ana Freeway and Hill Street
- District A-171 Contract, crossing of Harbor Freeway and 7th Street.

In addition, Caltrans is the state agency responsible for disbursing funds allocated to the Metro Rail Project by the California Transportation Commission, and is responsible for monitoring project performance. Consequently, Caltrans will be provided with copies of monthly and quarterly progress reports on the project's status, and Caltrans' representatives will attend quarterly project status review meetings held by the SCRTD.

2.4.7 California Public Utilities Commission (CPUC)

The California Public Utilities Commission has responsibility for safety oversight of rail rapid transit systems in the state. To fulfill that responsibility, the CPUC will monitor the Metro Rail safety program and the certification of the system for revenue service. The SCRTD will conduct regular meetings with the CPUC to allow that mission to be accomplished. The CPUC will be asked to review and concur with selected safety-related documents.

2.4.8 Los Angeles City and County Fire Departments

The City and County fire departments, under C.A.C. Title 19, have jurisdiction over fire and panic safety. Within the Metro Rail Project, a Fire/Life Safety Committee has been formed to facilitate the interchange of information, make evaluations and recommendations, and set requirements relative to system design, construction, and operation for the purpose of minimizing fire and life safety hazards to the public and SCRTD employees.

2.4.9 Los Angeles City Department of Planning

The Department of Planning is responsible for all land use planning throughout the City of Los Angeles, including the establishment of zoning regulations. The SCRTD and the Department are coordinating as necessary to ensure that land use in the area of Metro Rail facilities will properly integrate with the transit system.

2.4.10 Los Angeles Community Redevelopment Agency (CRA)

The CRA is responsible for master planning within designated redevelopment areas in the City of Los Angeles. Because four of the five MOS-1 stations will be located in redevelopment areas, the CRA is responsible for reviewing station design concepts to ensure that they are compatible with redevelopment goals.

2.4.11 Los Angeles Department of Water and Power (LADWP)

The SCRTD and the LADWP have entered into Master Agreements concerning the power and water relocations required for the construction of Metro Rail facilities. LADWP Power Systems will construct new ductbanks, pull and splice cable, and equip new substations prior to station construction. LADWP Water Systems will install new water mains and laterals and will make new service connections prior to station work. The LADWP will also supply water and power services to the operational system, and the SCRTD is coordinating as necessary with the LADWP to ensure that Metro Rail designs will facilitate the provisions of those services.

2.4.12 Los Angeles City Department of Transportation

The Los Angeles Department of Transportation will approve and monitor traffic detourings required by the construction of Metro Rail facilities. During preconstruction, the Los Angeles Department of Transportation has developed worksite traffic control plans that outline the traffic detours to be installed during construction. These traffic control plans have been incorporated in contract documents.

2.4.13 Santa Fe Railroad

The SCRTD has entered into a Master Agreement with the Santa Fe Railroad to support construction/reconstruction of the yard and shop area and, as necessary, to facilitate construction at other areas where Metro Rail will impact Santa Fe facilities.

2.4.14 Los Angeles Police Department and Los Angeles County Sheriff's Department

The SCRTD will coordinate with these departments regarding enforcement for noise and construction activities in compliance with variances and permits. Representatives from these departments serve on the Metro Rail Security Subcommittee.

2.4.15 Los Angeles County Coroner/Medical Examiner

The SCRTD will coordinate with the Los Angeles County Coroner/Medical Examiner (through the Metro Rail Project Archaeologist) if any human remains are encountered during construction. A representative from this office also serves on the Metro Rail Security Subcommittee.

2.4.16 Los Angeles City Bureau of Public Works

The City of Los Angeles Bureau of Public Works is responsible for design approval and inspection of work involving rearrangement of city facilities and new facilities to be maintained by the city.

2.4.17 Southern California Gas Company

Under the terms of a Master Agreement with the SCRTD, the Southern California Gas Company will relocate gas mains and laterals required for Metro Rail construction and will construct new mains, install new gas meters, and make new service connections.

2.4.18 Pacific Bell

Pacific Bell will relocate existing facilities as necessitated by Metro Rail construction and will build new telephone ductbanks, pull and splice cable, and make new building connections as required to supply telephone service to Metro Rail facilities. A Master Agreement has been signed between the SCRTD and Pacific Bell.

2.4.19 Chevron

The SCRTD has entered into a Master Agreement with Chevron to support specific facility rearrangements within the yard and shop area.

2.4.20 Western Union and Communicom

To facilitate the relocation of underground conduits and cables required by Metro Rail construction, SCRTD has signed Master Agreements with Western Union and with Communicom.

3.0 DESIGN MANAGEMENT

3.0 DESIGN MANAGEMENT

The design of the MOS-1 segment of the Metro Rail system is virtually complete. Responsibility for the management of design activities is as follows:

- The TSD Director of Transit Facilities is responsible for the design of all stations, tunnel segments, yard and shop facilities, and the specification of facility-related equipment, such as elevators, escalators, and ventilation fans. Facilities design documents are prepared by the GC's Facilities Design Section and their section designers.

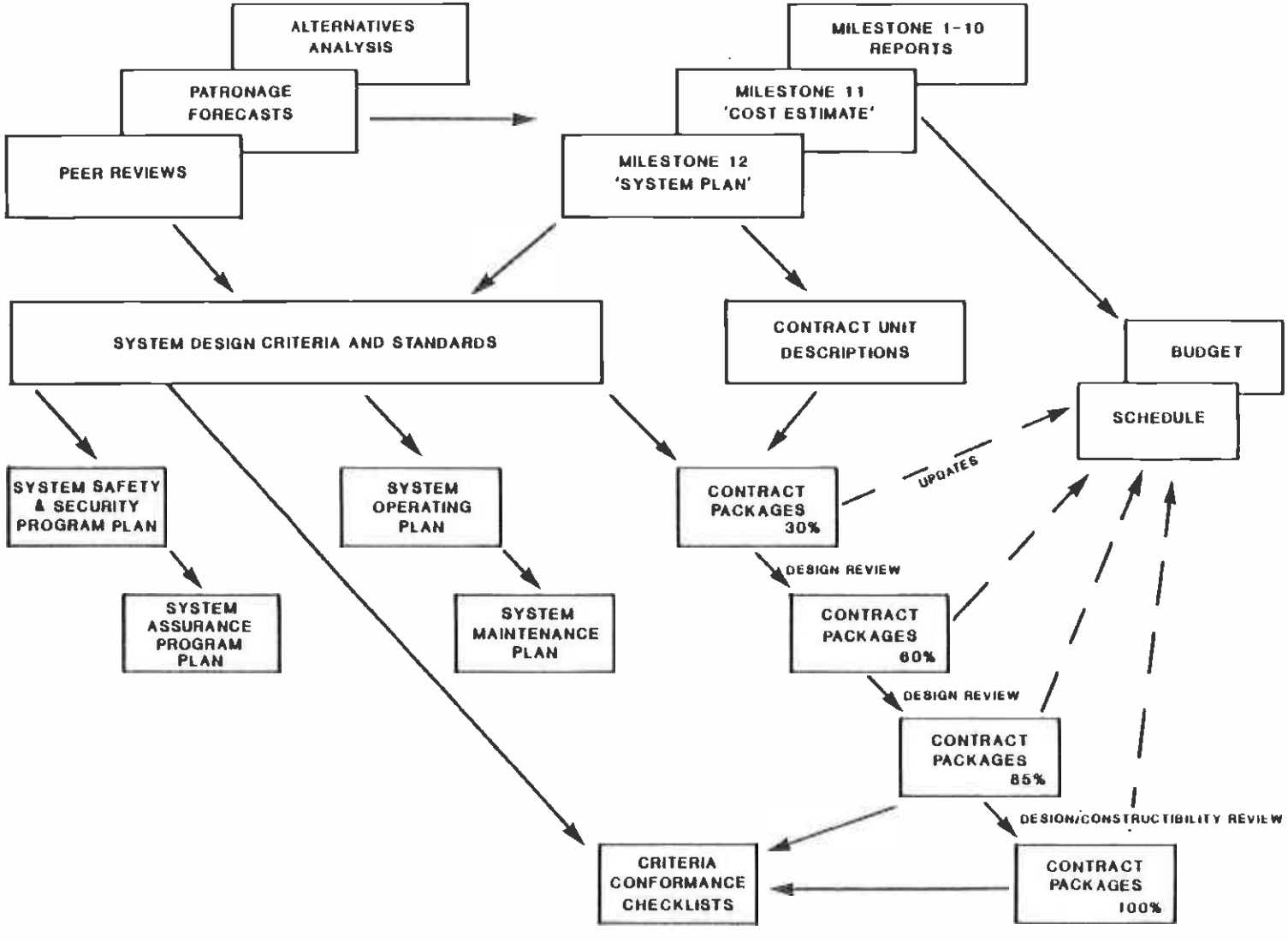
- The TSD Director of Systems Design and Analysis is responsible for the design and specification of passenger vehicles, train control equipment, traction power equipment, fare collection equipment, and communications equipment. In addition, he is responsible for operations and maintenance planning and for system safety, security, and dependability. Systems design documents are prepared by the GC's Systems Design Section. Program planning documents are prepared by the SE&A consultant.

The design of the Metro Rail system has evolved during the preliminary engineering and final design phases. The preliminary engineering phase focused on the establishment of basic design concepts with input from the public, outside agencies, and the transit industry; and on the preparation of environmental impact studies and assessments. The final design phase focused on the preparation of contract packages, design details, interface management, and the plans and procedures necessary for construction and procurement management.

The evolution of the system design is illustrated in Exhibit 3-1 and is briefly described in the following paragraphs.

During preliminary engineering, alternative analyses were conducted of route alignments and station locations. The preferred alignment resulted in ridership estimates used to size system elements (e.g., station platforms, fleet size). In addition, peer reviews were conducted to gain from the experience of other rail transit systems.

EXHIBIT 3-1
Design Management Process



Finally, the basic design requirements were refined during an extensive public participation process, involving the adoption of 12 milestone reports.

Metro Rail System Design Criteria and Standards were established based on the decisions reached during preliminary engineering. These criteria and standards were used by all design engineers to ensure consistency between SCRTD requirements and the specifications for all system elements.

Specifications and contract drawings, consistent with basic design criteria, were developed incrementally, with SCRTD design reviews at the 30, 60, and 85 percent levels of completion. The design reviews included inputs from transit equipment manufacturers and other transit systems. Changes to the baseline budget and schedule resulting from design changes were reflected in updates to the Metro Rail Financial Plan.

Any design changes that were not in conformance with the System Design Criteria and Standards or the baseline schedule and budget were subjected to a formal change control process. Such changes were reviewed by SCRTD staff, consultants, and relevant committees to assess the costs, benefits, and consequences of the change. Once a change was approved, the relevant System Design Criteria and Standards and design documents were revised.

In addition to the System Design Criteria and Standards, the design of the Metro Rail system is reflected in the following key baseline documents:

- Standard and directive drawings
- System Operating Plan
- System Maintenance Plan
- System Safety and Security Program Plan
- System Assurance Program Plan
- Design directives
- Contract packages.

Each of the baseline documents is described in the following pages of this chapter. Changes to any baseline documents will continue to be subjected to the configuration management controls described in Chapter 8.0. These controls include the conduct of design reviews on construction shop drawings and on major system procurements (passenger vehicles, train control, fare collection, and communications systems) to ensure that the procured systems conform to basic design requirements.

3.1 SYSTEM DESIGN CRITERIA AND STANDARDS

Design criteria and standards define detailed functional requirements for all elements of Metro Rail and are the basis on which the design of facilities and system elements has proceeded. The criteria and standards are presented in five volumes:[1]

- Volume 1 - Systemwide
- Volume 2 - Civil/Structural
- Volume 3 - Stations
- Volume 4 - Mechanical/Electrical
- Volume 5 - Subsystems.

The systemwide criteria define requirements for contract drawings, fire/life safety, system safety, security, and system assurance.

The civil/structural criteria define requirements for all facilities (tunnels, stations, yard and shops) and functional criteria for certain elements (trackwork, yard and shops).

The station criteria define requirements (primarily architectural) for all Metro Rail stations, including such elements as acoustics, heating, ventilating and air conditioning, landscaping, lighting, parking lots, and station security.

The mechanical/electrical criteria define requirements for elements that include elevators and escalators, electrical systems, plumbing, heating, ventilating and air conditioning, and requirements for corrosion, noise, and vibration control.

The subsystems criteria define requirements for passenger vehicles, train control, communications, traction power, fare collection equipment, and auxiliary vehicles.

The development of the Metro Rail System Design Criteria and Standards has drawn heavily on the experience of other recently constructed rail rapid transit systems, as reflected in the criteria and standards of those systems, to ensure the incorporation of proven design concepts and parameters.

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1 SCRTD Metro Rail Project, System Design Criteria and Standards, 5 vols., 1983 as revised.

3.2 STANDARD AND DIRECTIVE DRAWINGS

Standard drawings have been prepared that define and describe those elements that will be used repetitively throughout the Metro Rail Project. Directive drawings have been prepared that define the general configuration of facilities for the guidance of section designers.

3.3 SYSTEM OPERATING PLAN

The System Operating Plan (SOP) has been developed in concert with the system design, for the system's operating characteristics both influence and are influenced by the system's design characteristics.[2] The SOP documents the manner in which design elements will be used to attain requisite operational criteria. The SOP was developed by the Systems Design and Analysis Office, with guidance from the Operations and Maintenance Committee, and received project-wide review to ensure conformance between operational criteria and system design requirements. The SOP will be updated periodically throughout the project as more detailed information becomes available.

The SOP describes the Metro Rail system; presents passenger service characteristics and related data; outlines the staff organization and responsibilities for operations; describes the equipment to be used for controlling system operations; describes the normal operating routine; discusses operational problems that may occur and presents mitigation measures; outlines fare collection equipment and practices; discusses the collection and processing of revenue from the Metro Rail system; and outlines the interaction between the Metro Rail operating and maintenance functions. The plan does not provide detailed procedures for operating the system or for responding to emergency situations. Rather, it provides a general overview of operations from which rules and procedures can be prepared.

3.4 SYSTEM MAINTENANCE PLAN

The System Maintenance Plan (SMP) is a companion document to the SOP.[3] The SMP addresses the requirements for maintaining Metro Rail facilities and equipment. The

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2 SCRTD Metro Rail Project, System Operating Plan, September 1986.

3 SCRTD Metro Rail Project, System Maintenance Plan, Draft, June 1986.

Systems Design and Analysis Office was responsible for developing the SMP, with guidance from the Operations and Maintenance Committee. Like the SOP, the SMP received project-wide review to ensure conformance with system design requirements. The SMP is a dynamic document that will be periodically updated as more detailed information becomes available.

The SMP identifies the SCRTD's policies and objectives for maintenance of the Metro Rail system; prescribes the preventive and corrective maintenance programs that will maximize the availability and dependability of Metro Rail facilities and equipment; describes a functional organization for the managing of the Metro Rail maintenance programs; describes the management process for controlling maintenance work and handling interfaces with other SCRTD functions; and provides the framework for the development of comprehensive maintenance manuals and training programs.

3.5 SYSTEM SAFETY AND SECURITY PROGRAM AND SYSTEM ASSURANCE PROGRAM PLANS

The Metro Rail safety, security, and system assurance program consists of a series of activities required during various phases of the Metro Rail Project to meet the safety, security, and system assurance requirements established by the Metro Rail System Design Criteria and Standards. The program includes a specification of the management structure, techniques, and methodology needed to achieve acceptable levels of safety, security, and system dependability.

Two program planning documents have been developed to define the technical and management tasks necessary to implement the safety, security and system assurance program: a System Safety and Security Program Plan and a System Assurance Program Plan.[4] The program plans define the activities and management controls, plans, and monitoring processes needed to ensure that:

- Safety, security, reliability, maintainability, and quality assurance requirements are incorporated into the design of Metro Rail facilities and equipment.
- Potential hazards associated with the Metro Rail system are identified and then eliminated or

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4 SCRTD Metro Rail Project, System Safety and Security Program Plan, January 1985; and System Assurance Program Plan, February 1986.

minimized to obtain an acceptable level of safety and security.

- Historical data generated by the newer transit properties (which have characteristics similar to the SCRTD Metro Rail) are analyzed and used to support the SCRTD Metro Rail Project.

- Potential reliability and maintainability problems associated with Metro Rail equipment designs are identified and actions are taken to eliminate or minimize the problems.

- Manufacturers and suppliers comply with the quality standards established by the SCRTD.

- Steps required to ensure proper maintenance management of Metro Rail facilities and equipment are implemented prior to the start of revenue operations.

- Safety, security, and fire/life safety considerations are coordinated with system assurance efforts.

Like the preceding documents, the program plans have been developed in concert with system design elements. The plans were developed by the Systems Design and Analysis Office, with guidance from the Fire/Life Safety Committee and Security Subcommittee, and received project-wide review. The program plans will be updated prior to the start of each new phase of Metro Rail activity (Construction/Acquisition, Pre-Operational Testing, Start-Up Operations) to:

- Review progress on tasks accomplished in the prior phase

- Refine and improve the current task descriptions and activities for the present phase

- Identify new tasks which may be required as the system progresses

- Explain in detail the safety-related tasks and responsibilities for the next phase.

3.6 DESIGN DIRECTIVES

Design Directives have been used to document and disseminate policy directions affecting design, new design requirements, or clarifications to existing requirements. The Design Directive process has provided a rapid means

for disseminating design information and has not been intended to duplicate or replace the Change Request process (see Chapter 8.0 for a description of Change Requests). All Design Directives will continue to be reviewed and approved by the Assistant General Manager/TSD and the Directors of Transit Facilities, Systems Design and Analysis, and Program Control.[5]

Four Design Directives have been issued during the preliminary engineering and final design phases:

- DD-001, "Metro Rail Project Design Patronage"
- DD-002, "Accommodation of Patronage Growth, Metro Rail Project"
- DD-003, "Metro Rail Project -- MOS-1 Design Patronage"
- DD-004, "Accommodation of Patronage Reduction, System Reduction -- MOS-1, Metro Rail Project."

3.7 CONTRACT PACKAGES

Contract packages have been developed for each Metro Rail facility and for each major system (e.g., passenger vehicles, fare collection, communications, and train control). The design of the facilities, systems, and equipment in each contract package has been based on the design criteria, standards, codes, and design directives established for the project. The designs have been subjected to design reviews to ensure their accuracy and compliance with the fundamental requirements. The contract packages have been sized to encourage competition and to allow efficient monitoring by the SCRTD. They correspond to the Metro Rail Contract Unit Descriptions, which include three general types of contracts:[6]

- Facility contracts
- Systems contracts
- Master Agreements.

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5 See MRTC, Metro Rail Project Configuration Management Implementation Plan and Procedures Manual, Procedure No. E.2.2, "Design Directives: Origination, Processing, and Approval," 7 December 1983.

6 SCRTD Metro Rail Project, Contract Unit Descriptions: Minimum Operable Segment-1, July 1986.

3.7.1 Facility Contracts

Facility contracts include stations, yard and shop facilities, and tunnels. Facility contracts are broken into Stage I and Stage II contracts. Stage I construction generally includes all civil and structural construction plus embedded items for installation of architectural finishes, embedded mechanical items, and electrical conduits, unless specifically included elsewhere. Other items of work include demolition, site clearing, underpinning, dewatering, excavation support systems, decking, instrumentation, excavation, backfill, pavement, sidewalks, curbs and gutters, pavement markings, traffic stripes, signs, traffic signals, maintenance of traffic, fencing, utility rearrangement, concrete, structural steel, reinforcing steel, waterproofing, emergency access exterior doors, ventilation shaft gratings at street level, interior walls, and sleeves through walls for future conduit work.

Stage II construction includes all architectural work, civil site work, landscaping, and mechanical and electrical work except those items embedded in Stage I construction, unless specifically included elsewhere. Other items of work include irrigation systems, benches, topsoil, trees, exterior slab on grade concrete, granite, stainless steel and aluminum assemblies, steel stairs, railing, sprayed-on fire proofing, fillers, gaskets, sealants, doors and frames, finish hardware, glazing, floor and wall tiles, acoustical panels, coatings, painting, identifying devices, telephone enclosures, toilet accessories, and ash and waste receptacles. Also included are all plumbing and mechanical work and all electrical work, including portions of the systems installation work which are identified in the scopes of work of facility contracts.

3.7.2 Systems Contracts

Equipment procured on a systemwide basis includes passenger vehicles, train control equipment, traction power equipment, communications, fare collection, auxiliary vehicles, operational graphics, escalators, elevators, contact and running rail, shop equipment, ventilation equipment, and such items as fire suppression equipment, furniture, and artwork.

Systems contracts include a variety of approaches:

- Procurement
- Installation
- Procure and install.

3.7.3 Master Agreements

Master Agreements to support facility rearrangements required by Metro Rail construction, including the relocation of telephone, water, power, gas and oil lines and cable TV conduits, have been executed with local agencies and companies. Exhibit 3-2 lists current Master Agreements.

EXHIBIT 3-2
Metro Rail Master Agreements: Status as of September 1, 1986

AGENCY	TYPE OF AGREEMENT	DESIGN-CONTR. RQMNTS		CONSTR-CONTR.RQMNTS		SIGNED AGREEMENT
		UTILITY	SCRTD	UTILITY	CONTRACTOR	
Caltrans	Facilities Rearrangement	Yes	Yes	Yes	Yes	04/23/84
City of Los Angeles	Facilities Rearrangement	Yes	Yes	Yes	Yes	11/11/83
County of Los Angeles	Facilities Rearrangement	Yes	Yes	Yes	Yes	11/28/84
Dept of Water & Power - Water	Facilities Rearrangement	Yes	No	Yes	No	03/14/84
Dept of Water & Power - Power	Facilities Rearrangement	Yes	Yes w/app. of Util.	Yes	UG conds. w/app. Util.	09/17/84
Chevron	Specific Rearrangement	Yes	No	Yes	No	07/01/85
Pacific Bell	Facilities Rearrangement	Yes	Yes	Yes	Yes w/app. of Util.	02/24/84
Santa Fe Railway	Acquisition of First St Yards	Yes	No	Yes	No	04/08/85
Southern Calif. Gas Company	Facilities Rearrangement	Yes	Yes w/app. of Util.	Yes	Yes w/app. of Util.	11/12/84
Western Union Telegraph Co.	Facilities Rearrangement	Yes	Yes	Yes	Yes except cablework	02/24/84
Communicom (Cable TV)	Facilities Rearrangement	Yes	Yes	Yes	Yes except cablework	05/29/84

4.0 REAL ESTATE ACQUISITION AND MANAGEMENT

4.0 REAL ESTATE ACQUISITION AND MANAGEMENT

Real estate acquisition and management for the Metro Rail Project encompasses two programs: the Metro Rail real estate acquisition program and the Metro Rail joint development program. The acquisition program specifies comprehensive policies and procedures to ensure the timely availability of real estate for construction of Metro Rail, and to ensure the fair, uniform, and equitable treatment of any persons displaced from their homes or businesses as a result of the acquisition of needed real estate. The joint development program has been established to enable the SCRTD to raise a portion of the cost of constructing, operating, and maintaining the Metro Rail system by "capturing" some of the increased property value that will result from the economic activity generated by investments in Metro Rail. The joint development program is also designed to ensure the proper integration of land use with the Metro Rail system.

The TSD Director of Real Estate and Development has principal responsibility for implementing the Metro Rail real estate acquisition and joint development programs, each of which is described in the following sections of this chapter. Final authority for all real estate decisions rests with the SCRTD General Manager and Board of Directors.

4.1 REAL ESTATE ACQUISITION PROGRAM

The acquisition of right-of-way (ROW) is a necessary prerequisite to the start of Metro Rail construction. The process consists of five stages:

- Certification and approval of required real estate
- Appraisal of required interest
- Acquisition, either through settlement or eminent domain (condemnation)
- Relocation of occupants
- Property management, including demolition of improvements.

At the finish of construction, the disposition or development of excess property completes the real estate acquisition and management process.

The basic policies and procedures which regulate the real estate acquisition program for the Metro Rail Project are mandated by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. The Department of Transportation, Urban Mass Transportation Administration (UMTA), issued implementing regulations dated March 21, 1985, and subsequently revised April 28, 1986.[1] UMTA's regulations cover the appraisal and acquisition of real property, relocation services, moving payments and replacement housing payments, and other allowable expense payments mandated by the Uniform Act. On September 1, 1982, the SCRTD Board of Directors adopted the Metro Rail Project Milestone 5 Report, which documents SCRTD's policies and procedures for implementing a public real estate program that conforms to the requirements of the Uniform Act.[2]

On October 13, 1983, the SCRTD Board of Directors adopted a resolution amending the District rules and regulations and establishing a procedure for the expeditious acquisition of real property.[3] The Board report accompanying the resolution outlines the general procedures to be followed in acquiring real property. Detailed operating procedures have been developed to implement the general procedures.[4]

The October 13 Board Action, the adopted Milestone 5 Report, and the Real Estate and Development Operating Procedures establish the basic process for managing the Metro Rail real estate program. Following is a summary of the procedures involved in the real estate acquisition and management process.

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1 UMTA, "Land Acquisition and Relocation Assistance Under the UMTA Act of 1964 as Amended," C4530.1, March 21, 1985; and Final Rule, 39 Fed. Reg. 7000-7040, 27 Feb. 1986, effective 28 April 1986.

2 SCRTD Metro Rail Project, Milestone 5 Final Report, Right-of-Way Acquisition and Relocation Policies and Procedures, July 1982.

3 Amendment to Section 8.13, "Real Property," 13 Oct. 1983.

4 SCRTD, Real Estate and Development Detailed Operating Procedures, 1984.

4.1.1 Identification/Certification of Required Real Estate

Identification and certification of real estate required for MOS-1 is complete. Property Identification Plans (PIPs), developed by SCRTD's General Consultant (GC), identify every parcel affected by the Metro Rail alignment.[5] From the PIPs, preliminary title reports were obtained to ascertain the owner of record and a legal description of the parcel.

Detailed ROW requirements were identified by the GC and recommendations were developed. To support a recommended ROW requirement, the GC prepared a certification package containing detailed property plats and ROW maps, a legal description, and a Property Impact Statement. The recommendation and certification package were submitted to the Director of Transit Facilities. The Director of Transit Facilities reviewed the recommendation and certified the ROW requirement to the Director of Real Estate and Development.

The certification of required real estate was based on an analysis of:

- The adopted ROW selection criteria
- Design requirements
- Location of station or line segment
- Construction requirements
- Construction techniques
- Real estate cost and relocation impact.

Any revisions or modifications to the certification will be processed in the same manner as the original submittal.

Following receipt of the approved certification package from the Director of Transit Facilities, the Director of Real Estate and Development must obtain authorization from the SCRTD Board of Directors for acquisition of the required real estate.

4.1.2 Appraisal Program

All offers for acquisition of real estate will be based on the fair market value of the property as determined by an appraisal. Two independent appraisals will

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5 SCRTD Metro Rail Project, Property Identification Plans, various dates.

in general be obtained to establish the amount of just compensation. The following summarizes the basic process:

- The selection of independent fee appraisers will be based on qualifications and experience.

- The property owner will be notified in writing of Metro Rail Project requirements and the name(s) of the selected appraiser(s).

- The completed appraisal reports will be reviewed by the appraisal staff.

- The amount of just compensation will be recommended by the review appraiser. The recommendation will be submitted to the Chief Appraiser, the Director of Real Estate and Development, and the Assistant General Manager/TSD for concurrence. The General Manager will have final approval of just compensation.

- Just compensation amounts over certain limits require approval by UMTA. By letter dated March 21, 1985, UMTA granted the following waivers to its approval requirements:

  - UMTA review and approval will be required only for real estate appraisals in excess of $250,000.

  - UMTA concurrence will be required before the commencement of condemnation proceedings only when the offer is in excess of $250,000.

  - UMTA concurrence will be required whenever an administrative settlement for real estate acquisitions exceeds the UMTA-approved just compensation by $25,000.

  - Only one independent appraisal will be required for real estate acquisitions from governmental agencies.

  - Only one SCRTD staff appraisal or one independent appraisal will be required to establish fair market value for property disposition.

4.1.3 Acquisition Program

Every reasonable effort will be made to acquire real property required for the Metro Rail Project through negotiation. A Real Estate Specialist will be assigned to each parcel and will personally contact each property owner to explain the effect of the acquisition and to make an offer of just compensation. The procedures in general are as follows:

- The Real Estate Specialist will personally contact each property owner to offer the approved amount of just compensation.

- The written offer will be accompanied by a summary appraisal indicating the basis for the amount established as just compensation.

- The property owner will be given a relocation brochure which explains relocation benefits. Business owners will also be informed of their possible right to compensation for loss of goodwill and will be provided a copy of the pertinent portion of the California Eminent Domain Law relating to compensation for loss of goodwill.

- A reasonable amount of time will be given to the owner to consider the offer and to present information which may not have been considered during the appraisal.

- Once agreement is reached and the proper forms executed, the transfer of ownership will be completed through escrow.

- In those cases where the owner will not accept the original offer and it is feasible to increase the offer rather than filing for condemnation, an administrative settlement will be made. The administrative settlement will be based on consideration of all pertinent information including: (1) the appraiser's opinion of value; (2) the approved amount of just compensation; (3) recent court awards for similar types of property; (4) the estimate of trial cost; and (5) the opinion of legal counsel.

- If it is determined that a negotiated settlement cannot be reached, the SCRTD Board of Directors will be requested to authorize condemnation action. Upon approval by the Board, a condemnation attorney will be retained to file the condemnation suit.

- Negotiations will continue with the owner and the owner's attorney during the condemnation suit in an effort to reach settlement.

The average time to acquire a parcel through negotiations is 3 to 4 months. The average time to acquire possession of a parcel through condemnation is 5 to 6 months.

4.1.4 Relocation Assistance Program

The Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 provides for certain relocation payments in addition to the amount a person receives as just compensation for property. The Metro Rail relocation program has been designed to conform with the requirements of the Uniform Act. UMTA approved Metro Rail's relocation program report on October 18, 1983.[6]

Two relocation brochures have been developed which outline the relocation benefits available to residential and commercial displacees.[7] Key elements of the relocation assistance program include the following:

- SCRTD will use its own facilities, personnel, and services to implement its relocation and acquisition programs.
- SCRTD will present information and provide opportunity for discussion of relocation services and payments at public hearings, distribute relocation brochures and provide adequate notice of the relocation.
- A relocation advisory program will be established to provide the maximum assistance possible to all persons required to relocate because of the Metro Rail Project.
- Each displaced person will be provided written and verbal information that fully explains relocation services and eligibility requirements for replacement housing and moving expense

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6 SCRTD Metro Rail Project, Relocation Analysis Report, September 1983.

7 SCRTD, Real Estate and Development Department, Relocation Benefits: Tenants and Homeowners, and Relocation Benefits: Businesses and Non-Profit Organizations, no date.

payments. Each displaced business will be provided with equivalent information.

- No person eligible for relocation payment and lawfully occupying real property will be required to move from a dwelling or to move his or her business without receiving written notice at least 90 days in advance of the intended vacate date.

- Any applicant for a relocation payment who is aggrieved by SCRTD's determination as to eligibility for payment or the amount of the relocation payment may appeal that determination.

- Within a reasonable time prior to the issuance of a Notice to Vacate, SCRTD will assure itself that decent, safe, and sanitary replacement dwellings are available for displaced persons.

Revisions to the implementing regulation of the Uniform Act effective April 28, 1986, have been incorporated within the Real Estate and Development Detailed Operating Procedures.

4.1.5 Property Management

Properties acquired for the Metro Rail Project will be held for construction. Until the parcel is needed for construction, owners and tenants may remain in occupancy, paying rent to SCRTD. Leases entered into by occupants may be terminated upon 30-day notice. This provision will ensure the availability of the parcel as required by construction schedules.

4.2 JOINT DEVELOPMENT PROGRAM

Joint development policies and procedures adopted by the Board of Directors include procedures for negotiation with developers, formation of assessment districts, acquisition of land, and the use of land and property rights.[8]

The General Manager will carry out negotiations on joint development projects, obtaining authorization from the Board of Directors to complete negotiations and

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8 SCRTD Metro Rail Project, Milestone 6 Final Report, Land Use and Development Policies, January 1983; and SCRTD, Policies and Procedures for Implementing Joint Development, November 1983.

execute final agreements. An interdepartmental team designated by the General Manager will define for Board approval the negotiating position of the SCRTD on each particular joint development proposal. This team will meet periodically to coordinate interdepartmental efforts, formulate negotiating positions, and expedite the development process. This team will also coordinate negotiation strategies with affected local agencies. The Real Estate and Development Department will have the lead role in preparing and negotiating development agreements and for liaison with local agencies and will be supported by other departments, including the Legal Department, Planning and Communications Department, and Equal Opportunity Department.

Once a joint development/value capture agreement has been approved by the Board of Directors, the responsibility for administration and monitoring of the agreement will rest with the Director of Real Estate and Development. Any system design, schedule, or budget changes necessary to accommodate the provisions of joint development agreements will be subjected to the configuration management controls described in Chapter 8.0.

5.0 SYSTEMS PROCUREMENT MANAGEMENT

5.0 SYSTEMS PROCUREMENT MANAGEMENT

This chapter describes the general process to be used in the procurement of major systemwide equipment. For other equipment purchases, the procurement process will be similar, although the extent of some activities may vary according to the complexity and degree of standardization of the equipment.

The procurement process will be governed by procedures established by the SCRTD[1] and by the provisions of UMTA Circular 4220.1A. The following authorities have been established:

- TSD's Director of Systems Design and Analysis will be responsible for all technical aspects of the passenger vehicle and fare collection equipment procurements. He will be assisted by assigned staff and the SE&A consultant.

- TSD's Director of Construction Management will be responsible for all technical aspects of the procurement of train control, traction power, and communications equipment, and for equipment purchased for the various facility contracts. He will be assisted by assigned staff and the CM consultant.

- SCRTD's Director of Contracts, Procurement, and Material will be responsible for the contractual, pricing, and administrative aspects of all procurements.

5.1 ADVERTISEMENT

As the design process was completed for each type of equipment, a Bid Certification Checklist was prepared for that contract. This checklist identifies all actions that must be completed before the contract can be advertised and assigns responsibility for accomplishing each action to a specific individual. The checklist is prepared and

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1 Details on procurement procedures are contained in the SCRTD Office of Contracts, Procurement, and Materiel, Procedures Manual (no date).

closely monitored by TSD staff and reviewed at weekly status review meetings. All responsible parties are required to certify by signature that action items have been completed and that the package is ready for advertising.

For each equipment procurement, a list of potential bidders will be prepared. This list will include all manufacturers known to have the facilities and experience needed to provide high-quality equipment in compliance with specification requirements. All manufacturers on the list will be invited to bid on the procurement. In addition, the availability of bid documents will be advertised in such trade publications as Passenger Transport and Mass Transit, in minority and women-owned business trade publications, and in other media, including newspapers published and circulated in minority communities. These advertisements will be published before the bid documents are released to potential manufacturers. Formal procedures have been developed defining the steps to be taken in issuing and controlling bid documents.[2]

The bid documents will include a description of the contract scope, the form of contract to be awarded, and the requirements for the technical and the management portions of the proposal. They will also describe the process to be used in bidding, proposal evaluation, and award of the contract.

A pre-bid conference will be held to brief prospective manufacturers and explain the procurement requirements. Any pertinent changes to bid information resulting from the conference will be issued to all recorded holders of bid documents.

5.2 CONTRACTOR SELECTION

The selection of contractors for all major systems will take place by a negotiated procurement process or by a one-step competitive procurement process. Passenger vehicles, communications, and fare collection equipment will be acquired by a negotiated procurement process. For negotiated procurements, the SCRTD will issue specifications and contract documents which include a description of the factors to be considered in the proposal evaluation. The SCRTD may negotiate with any or all manufacturers and award a contract to the manufacturer whose proposal is

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2 See MRTC, Metro Rail Project Configuration Management Implementation Plan and Procedures Manual, Procedure E.6, "Contract Services Procedure," 27 May 1986.

considered most advantageous when price, technical features, and other factors are considered, as defined in the bid documents.

For all other systems and equipment (e.g., traction power, automatic train control, elevators, escalators), a one-step competitive procurement process will be used. In this process, proposers will simultaneously submit their technical and price proposals to the SCRTD. The evaluation process will be specified in advance in an evaluation plan and will treat the technical and price proposals separately. The evaluation of technical and price proposals will result in an award to the lowest price bidder who is fully responsive to the technical requirements and financially responsible.

Proposals for each procurement will be evaluated by a team of SCRTD and consultant staff knowledgeable and experienced in the design, manufacture, testing, and operation of the subject equipment. Members of the team will be designated by the Contracting Officer, with the approval of the General Manager. Technical representation on the team will be recommended by the TSD Director responsible for the procurement. The team will include members with experience in contracts and project management. The team will participate in any discussions with proposers, and will document the results of its efforts.

5.3 CONTRACT AWARD

Before a contract is awarded, a pre-award survey[3] will be conducted by cognizant TSD and consultant staff to ensure that the prospective manufacturer has the personnel, facilities, procedures, financial resources, and experience necessary to complete the contract in a satisfactory manner. If the SCRTD finds that the prospective manufacturer is satisfactory, a contract will be prepared and executed. If not, the SCRTD will repeat the pre-award survey process with the next-ranked bidder until a satisfactory manufacturer is identified.

5.4 DESIGN CONTROL

During the manufacturing cycle, cognizant TSD and consultant staff will monitor and control equipment design by:

- Evaluating manufacturers' management plans,

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3 SCRTD Metro Rail Project, Quality Pre-Award Survey Manual, July 1984.

schedules, test plans and procedures, quality assurance plans, safety plans, and system assurance plans

- Participating in formal design reviews at the conceptual, preliminary, and final design stages. In addition, the SCRTD will evaluate design drawings and mock-ups to ensure compliance with specifications.

To provide the SCRTD with visibility over contractor progress and to ensure that work is consistent with SCRTD requirements, major equipment contractors will be required to submit Contract Data Requirements List (CDRL) items. The CDRL items include:

- Program management documents, such as quality assurance and manufacturing plans, schedules, test procedures, and progress reports

- Technical analyses, such as motor characteristic curves; stress analyses; reliability, maintainability, and safety analyses

- Configuration documentation, such as drawings, parts lists, and history books

- Maintenance and training manuals.

All CDRL items will be reviewed by cognizant TSD and consultant staff in a comprehensive and systematic manner for compliance with the specification requirements and approved or rejected.

5.5 FABRICATION/ASSEMBLY MONITORING

During the equipment fabrication and assembly cycle, the quality of components and of the final product will be monitored. For major equipment procurements, the CM consultant or the SE&A consultant, as appropriate, will place a Resident Inspector in the manufacturer's plant to monitor quality levels and schedule adherence. The Resident Inspector will be knowledgeable of the equipment and experienced in quality assurance and manufacturing techniques. He will pay close attention to initial production articles so that a high-quality standard is established for the equipment. To support the Resident Inspector, cognizant engineering and quality assurance personnel will periodically visit the manufacturing facility to witness tests and conduct spot checks on product quality. Monitoring will follow SCRTD quality assurance review procedures, the procedures specified in the quality assurance/quality control manuals of SCRTD

consultants, and other applicable manuals and plans. (See Chapter 11.0 for further discussion of the quality assurance program.)

5.6 CHANGES AND CLAIMS MANAGEMENT

All changes and claims on systems procurements will be managed by the processes outlined in Chapter 8.0 of this plan. Changes and claims will be managed by the SCRTD's Configuration Control Board, which will promptly review and approve or disapprove changes affecting systems designs, schedules, or budgets. Circumstances may arise during the manufacturing process which require an immediate change authorization to avoid delays or additional costs. In those circumstances, the Director of Systems Design and Analysis or the Director of Construction Management, as appropriate, will authorize the change. The Configuration Control Board will subsequently review the change and authorize the relevant design documents to be updated.

5.7 EQUIPMENT ACCEPTANCE

All equipment purchased for the Metro Rail Project will be thoroughly inspected before acceptance and appropriate acceptance tests will be performed. (See Chapter 9.0.) These inspections and tests will be performed by the TSD and consultant staff responsible for the procurement of the equipment. Defects will be documented and the manufacturer will be required to correct them before final payment is made.

5.8 WARRANTY ENFORCEMENT

All equipment purchased for the Metro Rail Project will have warranty periods consistent with those used in the transit industry. TSD and consultant staff responsible for the procurement will monitor the equipment during the warranty period. Failures which occur will be analyzed by the manufacturer and, when appropriate, design changes will be made. Failed equipment will be returned to the manufacturer for repair or replacement by personnel in the Office of Contracts, Procurement, and Materiel. If the SCRTD performs the warranty work, the associated costs will be segregated and the manufacturer will reimburse the SCRTD so that full value is obtained from the warranty provisions of the contracts.[4]

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4 SCRTD Metro Rail Project, Warranty Management Plan, March 1986.

6.0 CONSTRUCTION MANAGEMENT

6.0 CONSTRUCTION MANAGEMENT

The objectives of construction management on the Metro Rail Project are to complete the system on schedule, within budget, and in accordance with plans and specifications and local, state, and Federal requirements. In addition, a carefully planned safety program will be conscientiously carried out by all participants.

The TSD Director of Construction Management has overall responsibility for Metro Rail construction and is supported by assigned staff and the CM consultant.

Each phase of the construction management program is outlined in this chapter.

6.1 PRE-CONSTRUCTION PHASE

As the design process was completed for each construction project, a Bid Certification Checklist was prepared for that contract. This checklist identifies all actions that must be completed before the contract can be advertised and assigns responsibility for accomplishing each action to a specific individual. The checklist is prepared and closely monitored by TSD staff and reviewed at weekly status review meetings. All responsible parties are required to certify by signature that action items have been completed and that the package is ready for advertising.

All construction contracts will be competitively bid. The availability of bid documents will be advertised in local media, including local minority media, and in national trade publications, such as Engineering News Record and the Dodge Report, as applicable. In addition, an extensive list of potential bidders has been assembled. Notices will be sent to potential bidders concurrently with advertising. An Invitation to Bid will be distributed to all interested firms.

For each contract, a pre-bid meeting (including appropriate site visits) will be chaired by the Director of Construction Management to assist prospective bidders in fully understanding the nature and scope of the work and to clarify technical and administrative requirements. Addenda will be issued as necessary after the pre-bid conference.

Bid periods will range from 20 to 45 calendar days, depending on the nature and complexity of the contract. Bids will be publicly opened at the advertised time and date.

An SCRTD team will evaluate the bids. This team will be designated by the Contracting Officer with the approval of the SCRTD General Manager and will include cognizant TSD and consultant technical staff, contractual and legal specialists, and representatives of the Equal Opportunity Department. The team will prepare a recommendation for the SCRTD Board of Directors to approve and execute the contract. After receipt of payment and performance bonds and insurance certificates, the contract will be awarded by the Board of Directors. Any protests of award will be handled expeditiously in accordance with SCRTD procedures[1] and UMTA requirements.

The Director of Construction Management will schedule a pre-construction conference promptly after contract award. This conference will provide a forum for the SCRTD and the contractor to discuss administrative procedures and other items of mutual interest regarding the terms of the contract and its scope of work. It will also provide the SCRTD with the opportunity to reiterate actions that must be accomplished by the contractor prior to the start of work.

The Director of Construction Management will prepare the Notice to Proceed (NTP). The NTP will specify the work start date, total construction time, and interim milestone completion times.

6.2 CONSTRUCTION PHASE

Detailed procedures have been prepared by the CM consultant for the construction phase.[2] The CM consultant will place a Resident Engineer at each construction site. The Resident Engineer will be experienced in the construction of transit facilities. He will be the focal point for on-site construction management activities and the primary point of contact with the contractor during

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1 SCRTD, Office of Contracts, Procurement, and Materiel, Procedures Manual, no date.

2 These include Construction Operations Procedures Manual, Resident Engineer Manual (draft), Inspection Guidelines, Project Controls Procedures Manual, and Procurement Manual (draft).

the construction phase. The Resident Engineer will be supported by other CM consultant personnel and SCRTD personnel.

The primary functions of the Resident Engineer are to ensure that:

- All construction is accomplished in accordance with the contract documents and acceptable engineering and safety practices.
- All construction is completed on schedule and within budget.
- All changes and claims are properly documented and promptly processed, negotiated, and finalized.

After the NTP is issued, all correspondence and communications between the SCRTD and the contractor will be channeled through the Resident Engineer unless otherwise specified. The Resident Engineer will be responsible for maintaining complete contract files.

The SCRTD Community Relations staff and the Director of Construction Management, assisted by the CM consultant and contractor community relations personnel, will maintain contact with the public through briefings and interviews. The SCRTD News Bureau will provide the news media with project updates.

The Director of Construction Management will also manage the safety and security programs at construction sites, and will provide liaison with CAL-OSHA and between local law enforcement agencies and the SCRTD Transit Police. The Director will also ensure that agreements signed with unions are followed. The CM consultant and TSD staff will provide liaison with local utility companies and local agencies concerned about traffic problems that may arise.

The Resident Engineer will ensure that all contract deliverables (e.g., shop drawings, lists of subcontractors, project schedules, safety plans, quality assurance plans, inspection and test plans, change proposals and claims, progress payment requests) are properly documented and promptly processed.

The Resident Engineer will hold regular monthly job-site meetings with the contractor's representative to review work in progress, status of deliverables, problems, safety items, schedules of work, and other items pertinent to contractor performance. The Resident Engineer will

review the contractor's monthly progress reports and submit them to the Director of Construction Management, together with the minutes of the monthly job-site meeting.

The Resident Engineer will implement an inspection and testing program to verify that all work performed and all materials furnished are in conformance with contract requirements (see Chapter 9.0). When inspection and testing determine that materials or workmanship do not comply with specifications, the Resident Engineer will immediately notify the contractor in writing of the deficiency and require that corrective action be taken.

The Resident Engineer will ensure that measurement of, and payment for, work performance are in strict conformance with the specifications. The Resident Engineer will monitor the contractor's performance against the schedule and budget. Monthly progress estimates will be prepared by the Resident Engineer, compared to contractor invoices, and submitted to the Directors of Construction Management and Program Control for review, approval, and payment.

All changes during construction will be tightly controlled in accordance with established configuration management procedures. Programs have also been established for claims avoidance and expeditious processing and resolution of contractor claims on the Metro Rail Project. (See Chapter 8.0 for a discussion of change and claims control processes.) Circumstances may arise which require immediate authorization of a change to avoid unsafe conditions, delays, or additional costs. In those circumstances, the Director of Construction Management may authorize the change. The Configuration Control Board will subsequently review the change and authorize the relevant design documents to be updated.

6.3 POST-CONSTRUCTION PHASE

Upon notification from the contractor that all contract work has been completed, a final inspection will be conducted by the Resident Engineer and a team designated by the Director of Construction Management. The final inspection will confirm that the work has been completed in conformance with all contract requirements. Nonconformances will either be corrected by the contractor or be waived by the Director of Construction Management.

The Resident Engineer will deliver to the Director of Construction Management a complete set of record documents to reflect as-built conditions. The Director of Construc-

tion Management, prior to final acceptance of the contract, will ensure that:

- All required warranties and guarantees have been received.
- All operations and maintenance requirements (manuals, training, spare parts, etc.) satisfy the contract documents.
- Certificates of acceptance for work performed for utilities, agencies, railroads, and others have been received.
- The contractor has submitted an affidavit releasing the SCRTD from all claims and liens arising from the contract.

When these actions have been completed, final acceptance by the SCRTD will occur and the final contract payment will be made. The Director of Construction Management will recommend final acceptance of the facilities and a written acceptance will be transmitted to the contractor by the Director of Contracts, Procurement, and Materiel.

6.4 CONSTRUCTION SAFETY AND SECURITY

A construction safety and security manual has been developed that is specifically tailored for construction of the Metro Rail Project.[3] The construction safety and security manual has been prepared to ensure that contractors, while on work sites and in the conduct of construction contracts, comply with safe practices and the standards set forth in applicable local, state, and Federal codes, orders, and regulations. The manual establishes detailed compliance requirements to be followed by all contractors to protect employees, the public, facilities, and property during construction.

Safety is of primary importance and is the responsibility of personnel at all levels. A carefully planned safety program will be conscientiously carried out by all participants. Primary responsibility for ensuring implementation of, and compliance with, the safety program rests with the TSD Director of Construction Management.

The CM consultant will be responsible for day-to-day management of the project's safety and security program;

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3 Metro Rail Construction Safety and Security Manual, September 1986.

development and approval of project safety plans; and monitoring of the safety of construction activities and compliance with safety requirements. All contractors will have full responsibility for developing and implementing a contract-specific safety and security program consistent with the overall project safety and security program. All contractors will be required to comply with CAL-OSHA requirements and make CAL-OSHA records and reports available to the CM consultant.

The Director of Construction Management will oversee activities to ensure that work is performed safely and the project's safety, security, and sanitary requirements are maintained. Emergency response procedures have been developed as an integral part of the safety and security program. The District Insurance Administrator will coordinate with, and make recommendations to, the CM consultant concerning the design and implementation of special safety plans or corrective actions. In the event that methane gas, abandoned oil wells, hazardous wastes, or other extraordinary circumstances are encountered, applicable procedures will be followed. Liaison will be established between representatives of the SCRTD, District Insurance Administrator, and other personnel to identify and coordinate measures needed to resolve emergency situations and to ensure employee protection and accident prevention.

The following factors will be closely monitored by the Director of Construction Management in administering and enforcing the safety and security program:

- Acceptable policies, work practices, and standards are implemented to promote the goals of the safety and security program.
- Safety and health standards and Code regulations are applied.
- The recommendations of the City Independent Technical Review Committee are implemented.
- Environmental and quality control tests are periodically conducted.
- Standards for an effective pollution control program are maintained.
- Work is accomplished in the safest possible manner to prevent incidents or conditions that could lead to accident/injury.

- Compliance with CAL-OSHA Tunnel Safety Orders is maintained.
- Liaison is maintained with the Los Angeles Police and Fire Departments.
- Loss prevention surveys and activities are implemented.

6.5 CONTINUATION OF WORK AGREEMENT

The SCRTD and the Los Angeles County Building and Construction Trades Council, AFL-CIO, have entered into a Continuation of Work Agreement for the Metro Rail Project.[4] This Agreement prohibits, during the term of the Metro Rail Project, all work stoppages, strikes, sympathy strikes, lockouts, and other forms of work disruption. The specific intent of the Agreement is to ensure that work on the Metro Rail Project proceeds in an orderly manner and without interruption due to labor disputes.

A Joint Labor Management Oversight Committee has been established consisting of four representatives selected by the SCRTD, including the Contracting Officer or his designee, and four representatives selected by the Los Angeles County Building and Construction Trades Council, AFL-CIO. The function of the Joint Labor Management Oversight Committee is to monitor the SCRTD's enforcement of compliance by all Metro Rail contractors with applicable Federal and state laws pertaining to wages, hours, benefits, health, and safety. The Committee recommends to the Contracting Officer or designee procedures to enforce compliance with prevailing state and Federal laws.

Any complaints which are made directly to the Joint Labor Management Oversight Committee are referred to the staff of the SCRTD for investigation and processing in accordance with Labor Code Section 1770, et seq., and applicable Federal prevailing law. Such complaints will be investigated and processed promptly.

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4 SCRTD and Los Angeles County Building and Construction Trades Council, AFL-CIO, Continuation of Work Agreement for the Metro Rail Project, June 28, 1984.

7.0 PROGRAM CONTROL

7.0 PROGRAM CONTROL

The Metro Rail Project will be managed and controlled according to the established scope of work, the budget, and the schedule. The Assistant General Manager/TSD is responsible for the overall management of the project. He is supported by the Directors of Systems Design and Analysis, Transit Facilities, and Construction Management, who have the responsibility for completing the various design, procurement, and construction activities on time and within budget. The Director of Program Control is responsible for monitoring progress on the project; maintaining schedules, budgets, and financial plans; and independently assessing and reporting on the status of the project.

A series of program control elements has been established to measure progress on the project. In addition, a program control process has been initiated to collect management information and, when appropriate, to allow corrective action to be taken. Each of these facets of program control is described in this chapter.

7.1 PROGRAM CONTROL ELEMENTS

Three cornerstones will be used to measure performance on the project:

- The bid documents, specifications, and annual work programs which define the scope of the work
- The project budget, which estimates the costs to be incurred
- The project schedules, which define when the work is to be completed.

Each of these cornerstones is subject to the configuration control procedures described in Chapter 8.0. These cornerstones are described in this section, as is the automated data system which will be used to monitor and report on project progress.

7.1.1 Scope of the Work

The scope of construction and procurement activities for the Metro Rail Project has been defined and refined during the preliminary engineering and final design phases of the project. The scope of these activities has been segmented into a series of contract packages for which bid

documents and specifications have been prepared. Complete descriptions of the various contracts are contained in the Contract Unit Description document,[1] which is maintained by the Program Control Office.

In addition to these contract packages, annual work programs will be implemented by the SCRTD and consultant staff. These annual work programs will be responsive to the prevailing needs of the project and will ensure that all procurement and construction activities are properly controlled and managed. Collectively, these contract packages and annual work programs define the scope of work for the construction of MOS-1.

To provide a framework for management visibility and control of project activities, a Work Breakdown Structure (WBS) has been prepared (see Exhibit 7-1).[2] The WBS provides a hierarchy for the work, dividing it into increasing levels of detail until sufficient definition of all activities is obtained for adequate management visibility. For each element in the WBS, a statement of work has been prepared and, as work is assigned, the responsibility for its completion will be identified. The WBS includes an alphanumeric numbering system that uniquely identifies each WBS element.

7.1.2 Project Budget

A baseline budget for the entire Metro Rail Project has been prepared. This budget is based on cost estimates for each procurement and construction contract, and also includes costs associated with consulting services, the SCRTD's internal expenditures, right-of-way acquisition, utility relocation, and insurance for the project. A contingency allowance is also included in the budget.

In conjunction with the project schedule, the budget has been used to develop obligation and cash flow plans. The obligation plan defines the amount of funds required in each year for awarding contracts, for SCRTD personnel and equipment requirements, for real estate acquisition, and so on. The obligation plan must reconcile with the annual availability of funds from outside funding agencies and from benefit assessments. The cash flow plan identifies the amount of obligated funds to be expended in each

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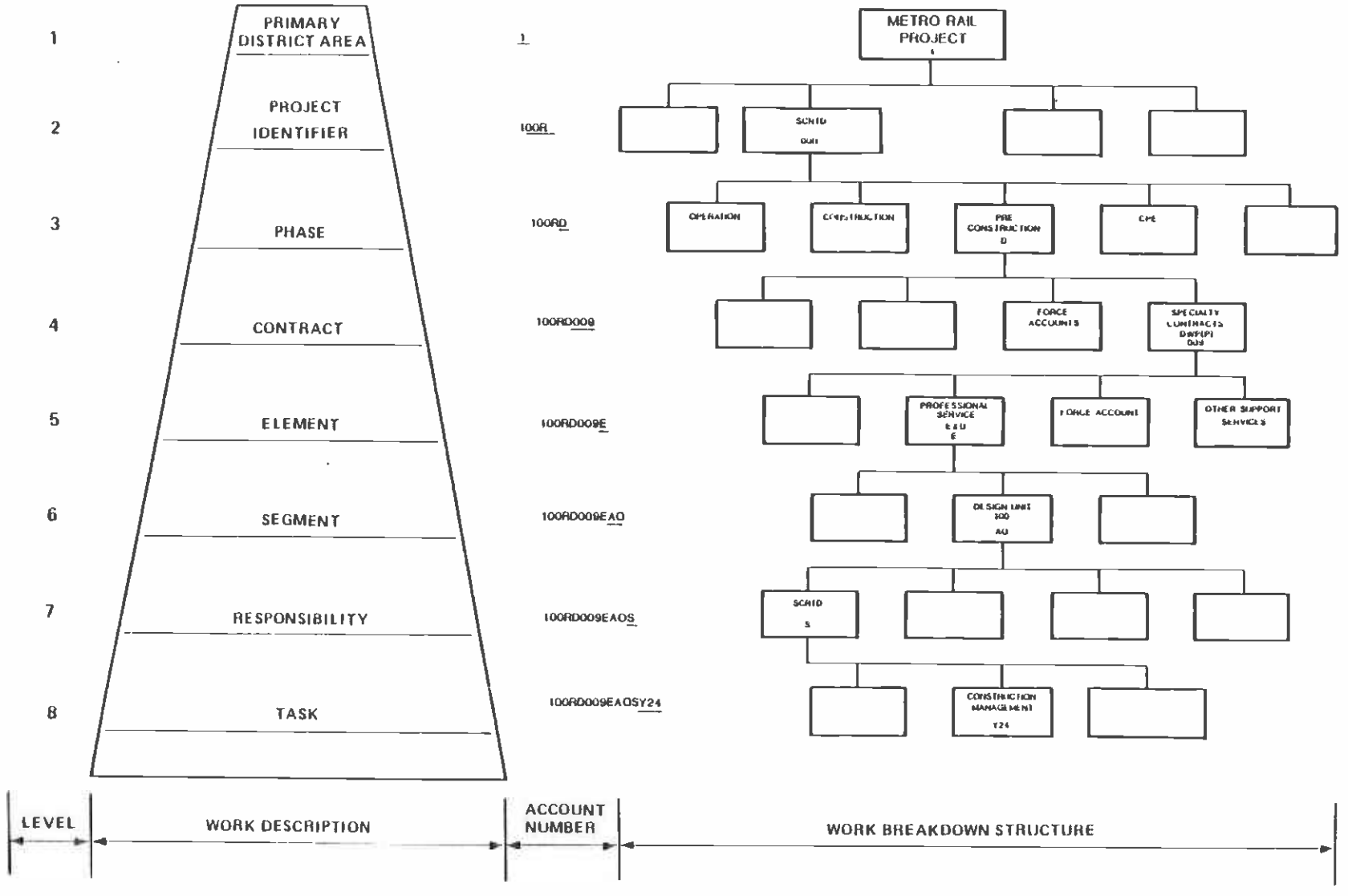
1 SCRTD Metro Rail Project, Contract Unit Descriptions: Minimum Operable Segment-1, July 1986.

2 SCRTD, Program Control Office, Work Breakdown Structure Manual, February 20, 1986.

EXHIBIT 7-1
Work Breakdown Structure



month. Collectively, the project budget, the obligation plan, and the cash flow plan form the Financial Plan for the Metro Rail Project.[3]

The Financial Plan is the key summary control document for cost management on the project. The Financial Plan outlines the project's baseline budgets, schedules, obligation plan, and cash flow plan against which cost performance is measured. This plan is distributed to SCRTD management and funding agencies, and appears in the project's monthly and quarterly status reports and in the Full Funding Contract between the SCRTD and UMTA. The Financial Plan is monitored daily and updated periodically to reflect revised cost estimates and actual cost history.

Estimates prepared at the 30, 60, 85, and 100 percent levels of design completion have provided increasingly refined assessments of the project's cost and have formed the basis for updating the Financial Plan. Immediately prior to each contract advertisement, the General Consultant will prepare an Engineer's Estimate for the contract. The Engineer's Estimates will be used in evaluating the cost proposals of bidders.

As contracts are awarded, Program Control will evaluate the successful bids against the baseline budgets and update the cost estimates in the Financial Plan. After contract award, project changes and claims will be analyzed by Program Control and revised cost estimates will be prepared and incorporated within the Financial Plan. In addition, the escalation rate used to prepare cost estimates will be analyzed monthly. Trends in the escalation index will provide an early warning indicator that will trigger revisions to cost estimates.

The Financial Plan will also be revised on the basis of Program Control's review of all purchase requisitions, invoices, and progress payments, and analysis of their fiscal and budget impact. Any potential drawdown on the contingency allowance will be noted by Program Control personnel in its analysis. The analysis and purchase documents will then be submitted to the Assistant General Manager/TSD for review and approval. Information from these documents will provide a basis for updating budgets and financial forecasts for the project.

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3 SCRTD, Metro Rail MOS-1 Financial Plan, September 1986.

7.1.3 Project Schedule

To adequately plan and control the initiation and completion of events on the Metro Rail Project, detailed schedules have been prepared.[4] The schedule hierarchy for the project contains five levels, 0 through 4 (see Exhibit 7-2). The top level (0) contains the least detail, while the lowest level (4) is the most detailed. To ensure schedule standardization, the top four levels of the schedule are derived from the same data base. Standardization for Level 4 is ensured by the use of scheduling specifications in all contracts.[5] A description of the schedule hierarchy follows:

- Level 0 - Executive Schedule. This barchart schedule provides a high-level summary of major project phases but has insufficient detail for monitoring and control. It will be used for reporting to the SCRTD Board of Directors and the general public.

- Level 1 - Contract Schedule. This barchart schedule summarizes the key areas by contract and is the source for the schedule information in the Financial Plan. The schedule is developed by establishing broad contract work scope definitions and developing durations based on these definitions. Following the development of lower level schedules, the Level 1 schedule will be reviewed to ensure that the durations and sequence of contracts remain valid.

- Level 2 - Working Schedule. This barchart schedule is the principal control schedule and is controlled by the procedures described in Chapter 8.0. It defines major contract milestones and provides information on the critical path in the form of a precedence diagram. After the Level 3 and Level 4 schedules are developed, the Level 2 schedule will be reviewed to confirm that the milestone dates remain valid.

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4 SCRTD, Metro Rail MOS-1 Baseline Schedule, Rev. 5, September 1986.

5 SCRTD, Metro Rail Project, Contract Bid Documents - General Conditions.

EXHIBIT 7-2
The Schedule Hierarchy

SCHEDULE TYPES	RESPONSIBILITY	FUNCTION
SUMMARY SCHEDULE	LEVEL 0 TSD	• PROVIDES THE PUBLIC AND RTD BOARD OF DIRECTORS AND GENERAL MANAGER A HIGH LEVEL SUMMARY OF THE PROJECT. • SUMMARIZES MAJOR PROJECT PHASES (DESIGN, RIGHT OF WAY ACQUISITION, CONSTRUCTION, SYSTEMWIDE PROCUREMENT). • BARCHART FORMAT.
EXECUTIVE SCHEDULE	LEVEL 1 TSD	• PREPARED FOR RTD GENERAL MANAGER AND ASSISTANT GENERAL MANAGER-TSD. • SUMMARIZES KEY AREAS BY CONTRACT (DESIGN, BID PROCESS, CONSTRUCTION). • BARCHART FORMAT.
MANAGEMENT SCHEDULE	LEVEL 2 TSD	• PREPARED FOR RTD ASSISTANT GENERAL MANAGER-TSD, PROJECT DIRECTORS & ENGINEERS. • MAIN CONTROL MECHANISM. • DEPICTS (BY CONTRACT) MAJOR WORK AND MILESTONES WITHIN CONSTRUCTION PHASE. • BARCHART FORMAT.
CONTRACT MONITORING SCHEDULE	LEVEL 3 CM	• PREPARED FOR CONSTRUCTION MANAGER, RESIDENT ENGINEER. • BASIS FOR CONTRACTUAL MILESTONES. (SUMMARIZED TO LEVEL II). • CRITICAL PATH NETWORK FORMAT.
CONTRACTOR SCHEDULES	LEVEL 4 CONTRACTOR	• GREATEST LEVEL OF DETAIL. • CONTAINS CONTRACTUAL MILESTONES. • BASIS FOR CONSTRUCTION SCHEDULE STATUS. • STATUS MONTHLY BY CONTRACTOR. • CRITICAL PATH NETWORK OR BARCHART FORMAT.

- Level 3 - Construction Schedule. This schedule is used to measure, and report on, progress on construction and procurement activities. The Level 3 schedule has been prepared to represent the most logical and probable plan for achieving contractual milestone dates. It will be revised following contract award to reflect SCRTD-approved Level 4 schedules.

- Level 4 - Contractor Schedules. These contract-specific schedules show the greatest level of detail. The Level 4 schedule will be used by each contractor to manage his contract and for reporting progress to the SCRTD and its consultants. The schedules will be prepared and maintained by each contractor and submitted to the SCRTD for approval.

The SCRTD and its consultants will use the Level 3 and Level 4 schedules to monitor status during the construction phase of the project. Schedule status will be reported each month to the Program Control Office, together with revised estimates of completion dates. If the revised completion dates significantly affect the baseline schedules, the contractor may be directed to institute a schedule recovery plan, or the project schedules may be changed to reflect the new conditions. Before that decision is made, the Program Control Office will analyze the situation and inform the Assistant General Manager/TSD of the available options.

Program Control will also forecast durations for remaining activities by assessing the scope of remaining work and identifying production rates, both actual and anticipated. By analyzing the current actual progress of each contract and developing forecasts for the duration of work remaining, the completion date for each contract and the project will be forecast. Any changes to project schedules that will affect milestones on the Level 2 schedule will be submitted to the Configuration Control Board for review and approval.

7.1.4 Transit Automated Control System

The volume of information on the Metro Rail Project will be large. Accordingly, an automated program control computer program -- Transit Automated Control System (TRACS) -- will be used to store, analyze, and report on cost and schedule performance. TRACS will:

- Provide all levels of management with timely, accurate, and relevant information

- Provide a mechanism for budget definition and funding allocation and their updating and monitoring

- Improve status reporting and forecasting of project costs and schedules by integrating budget, schedule, cost, and other relevant data in a timely and meaningful way

- Provide a means for tracking information on the status of procurements, real estate acquisitions, and Change Orders during their processing cycles

- Meet the reporting requirements of funding agencies

- Enhance progress payment methods and compile timely and objective progress and "projection to complete" information.

TRACS combines all basic project information into a common data base involving 10 subsystems:

- Budgeting: Initiates, updates, and monitors budget information, reflecting contractual obligations, pending change orders, contractor progress payments, and material purchases.

- Funding: Initiates, updates, and records the status of project funding, and links funds to the various components of work.

- Task Detailing: Permits the specification of labor and material resources for each task.

- Procurement: Establishes and monitors procurement information from the initial requisition to receipt of goods or services. This subsystem includes a vendor history file.

- Real Estate: Details and reports on the status of real estate appraisals, acquisition, relocations, rentals, and related legal services.

- Change Orders: Tracks Change Orders through their processing cycle and updates budgets to reflect the impact of pending and approved changes.

- Progress Payments: Records progress payments and compares the work completed against the invoiced amount.

- Scheduling Interface: Stores schedule information and allows integration of cost, schedule, and status reporting.

- System Reporting: Generates user-created reports from the TRACS data base through a report generator called IMAGINE.

- System Maintenance: Enables the system administrator to identify valid codes for updating data in the TRACS.

TRACS will be used to support management decisions in the program control process and will provide the reports necessary for effective project management. TRACS will be particularly useful in supporting the analysis of the expected impacts of Change Orders and providing the most current estimates of the project's total cost and expected completion date.

7.1.5 Project Status Reporting

Project control consists of monitoring events and activities, analyzing data, and taking corrective action when appropriate. Various reports will continue to be available to assist in this process. During the construction phase, each contractor will submit to TSD and its consultants a monthly report providing cost, schedule, and progress information. The data from these contractor reports will be consolidated by the CM consultant into a Monthly Construction Performance Report which includes:

- Milestone Exception Analysis Report, identifying Level 2 schedule milestones which are slipping, assessing the effect on other activities, and recommending the corrective actions to be implemented

- Construction Schedule Status Report, showing the project status against the Level 3 schedule

- Target Milestone Report, showing the status of all Level 2 schedule milestones, including the original duration, start date, and completion date, as well as the current duration, start date, and completion date

- Thirty Day Window Report, identifying all Level 3 schedule activities currently in progress or scheduled to start within the next 30 days

- Cost Status Report, highlighting variances to project budgets, including the impact of changes and claims

- Summary Contract Status Report, showing the work accomplished during the reporting period and highlighting problem areas and proposed solutions.

This consolidated report will be submitted to the Assistant General Manager/TSD and to the Directors of Construction Management and Program Control for review and analysis and authorization of the proposed actions to be taken by the CM consultant. The Program Control Office will then update the Level 0, Level 1, and Level 2 schedules and the appropriate TRACS files.

The TSD Program Control Office will prepare monthly and quarterly reports for UMTA and other funding agencies. These reports will advise these agencies of the current project status, including:

- A status report for activities shown on the Level 1 schedule

- A discussion of major accomplishments since the last report, and identification of actual or anticipated problems that could lead to schedule delays

- An analysis of critical path activities and a discussion of corrective actions being taken

- A discussion of areas of concern, highlighting critical and potentially critical activities

- Summaries of the cost status of the project.

Finally, the Program Control Office will also prepare internal monthly cost reports, including updates to the Financial Plan, the obligation plan, the cash flow plan, and the grant status.

7.2 PROGRAM CONTROL PROCESS

The program control elements previously discussed provide the information necessary to manage, control, and direct the Metro Rail Project. The program control process will compare the data in the monthly contractor and consultant reports against the cornerstone budget, schedule, and scope of work documents. It will identify variances between expected and actual events so that action can be

taken by TSD management. Each Director within TSD has the responsibility and authority to assess the prevailing circumstances and take corrective action.

However, the Program Control Office within the TSD Department has been given a special, independent "watch dog" role on the project. Acting for the Assistant General Manager/TSD, the Director of Program Control will be responsible for independently reviewing cost and schedule performance on all activities and for ensuring that the scope of work is properly managed.

The Program Control Office also maintains the Management Information Center (MIC), wherein all project information is displayed and continuously updated. Weekly project review meetings will be held in the MIC. The meetings will be chaired by the Assistant General Manager/TSD and will involve senior TSD managers and consultant staff. The meetings will review progress on the project and address current problems and issues. Minutes of each meeting will be taken and actions assigned to resolve outstanding problems and keep the Metro Rail Project on schedule and within budget.

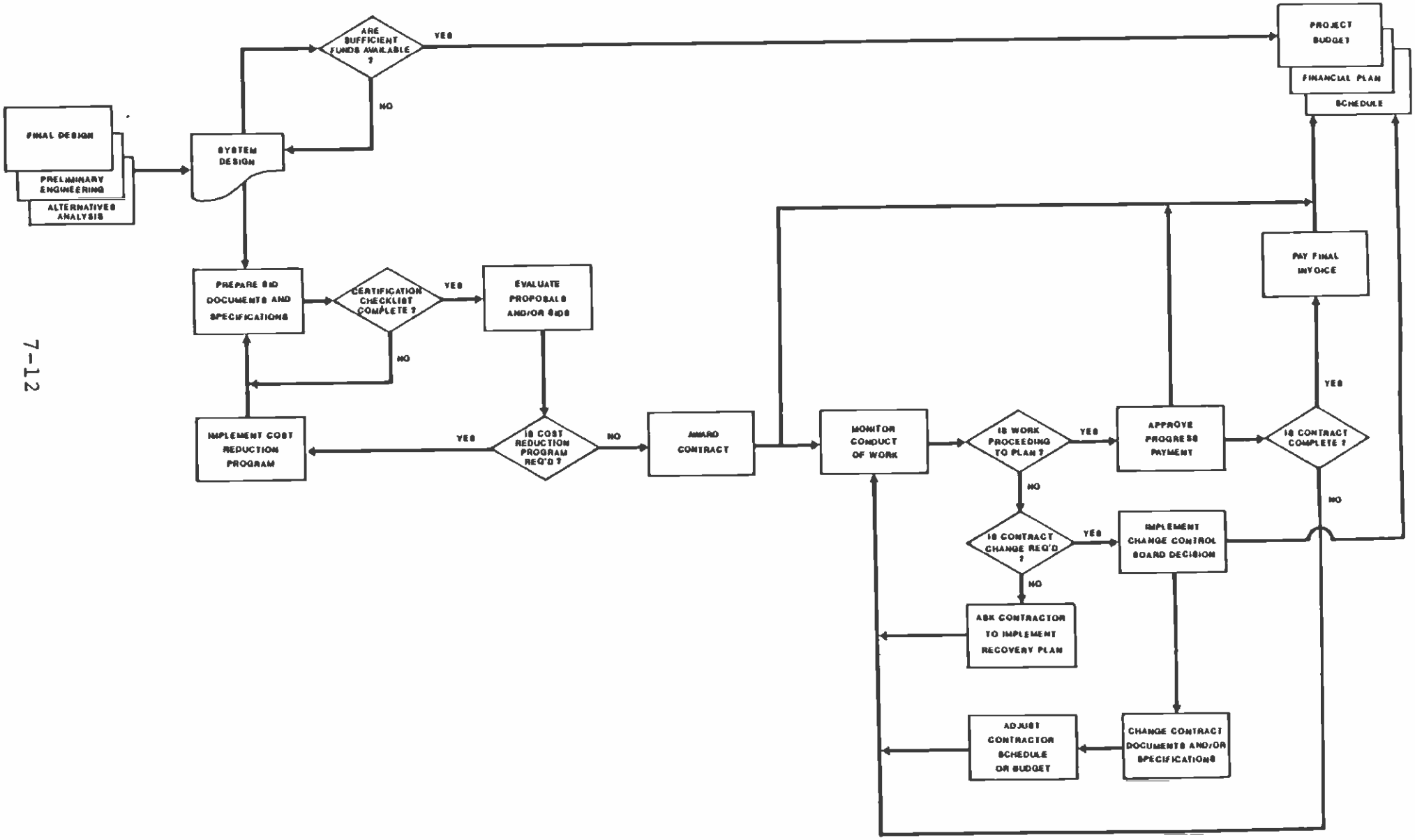
The program control process to be applied to each construction and procurement contract, and to activities conducted by the SCRTD and its consultants, is described below.

7.2.1 Construction and Procurement Contracts

The program control process for construction and procurement contracts is schematically shown in Exhibit 7-3. The process uses the bid documents and specifications, the project budget, and the project schedule as the fundamental documents by which the work is defined, from which changes are authorized, and against which progress is measured. To ensure that the project is completed on time and within budget, the process includes control points at which comparisons will be made between planned and actual events. Deviations from the project plans will be measured and appropriate management action will be taken. The control process includes many of the activities described elsewhere in this plan, particularly those involved in systems procurement management, construction management, configuration management, and quality assurance/control (see Chapters 5.0, 6.0, 8.0, and 11.0).

The process will begin with the assembly of the drawings, documents, and specifications which define each contract package. For each package, a checklist will be prepared describing all the actions which must be completed before the contract can be released for advertising and

EXHIBIT 7-3
The Program Control Process for Construction
and Procurement Contracts



bidding. The Assistant General Manager/TSD and cognizant Directors of TSD will review and approve each contract package before it is released for advertising. In addition, a weekly review will be conducted on the status of each contract package to ensure its timely completion.

Bids or proposals which are received for each contract will be kept in a secure place, and an evaluation team will review each bid or proposal for compliance with design requirements. (See Chapters 5.0 and 6.0.) Nonconforming proposals will be rejected, and the price quotations for satisfactory proposals will be evaluated to determine the lowest responsive and responsible bidders. If the price quotations significantly exceed the budget, the SCRTD may implement a cost reduction program, change the contract documents and specifications, and readvertise the contract. The decision to implement a cost reduction program will depend on the size of the budget variance and the anticipated cost of the cost reduction program and the readvertising process. If the price quotations are acceptable, contracts will be awarded and real estate acquired, and the project budget, obligation, and cash flow plans will be updated. Variances between the awarded contract value and the budget estimate will result in an increase or decrease in the budget contingency allowance.

After contract award, the SCRTD and its consultants will monitor the performance of the work on each contract. The monitoring process will include inspection of work in process, review of the detailed drawings and design documents for compliance with the contract requirements, and acceptance of completed work. Each contract will require that the contractor submit a monthly report describing:

- Progress of the work
- Problems impacting progress
- Cost and schedule status
- Changes to the expected cost at completion or the expected completion date.

In addition, the contractor will submit a monthly invoice for work which has been completed, including any milestones which have been achieved. The monthly progress reports and invoices will be reviewed by the cognizant TSD and consultant staff (see Chapters 5.0 and 6.0 for their responsibilities) to verify their accuracy. The work completed will be verified by on-site reports from Resident Inspectors and Engineers and compared against the applicable schedules. If the work that has been completed is

consistent with the invoice, payment will be approved and the financial records for the project will be updated by the Program Control Office. If the invoice is not consistent, the contractor will be required to change it before payment is made.

If the work is not proceeding on schedule, the SCRTD and its consultants will meet with the responsible contractor to discuss the problem. The contractor will be asked to explain the reasons for the schedule slippage, and will be directed to implement a schedule recovery plan. If the schedule slippage is sustained, the Contracting Officer will inform the contractor, in writing, that the SCRTD is concerned about his performance and the effect of the slippage on other Metro Rail contracts. In addition, the contractor will be reminded about the liquidated damages provisions in the contract. Those provisions will be invoked to recover costs incurred by the SCRTD as a result of the schedule slippage, if the relevant milestones are not achieved. When schedule slippage on a contract cannot be rectified, the Assistant General Manager/TSD will direct that other contract schedules and milestones be adjusted to mitigate the cost to the overall Metro Rail Project.

In the course of each contract, circumstances may arise which require a change to the contract documents. For such circumstances, a Change Request will be prepared for review and approval by the SCRTD's Configuration Control Board (CCB) (see Chapter 8.0). CCB approval will result in a change to the contract documents and an update of the project budget, schedule, and obligation and cash flow plans. CCB decisions will be communicated to the contractor in writing.

Similarly, circumstances may arise which cause the contractor to file a claim for a contract change. Such claims will be investigated by the SCRTD and its consultants. Claims which are approved by the SCRTD will result in a contract change. Those which are denied may result in further dialogue with the contractor and either resolution or litigation.

Finally, when the equipment manufacture or facility construction is complete, the SCRTD and its consultants will perform a final inspection and accept or reject the completed work (see Chapters 5.0 and 6.0).

7.2.2 Work Conducted by SCRTD Departments

Annual work programs will be implemented by SCRTD departments to meet the needs of the project. The annual objectives for each SCRTD department will be identified during the development of each fiscal year budget. The costs associated with achieving those objectives will be estimated by each department and collated by the Program Control Office within the TSD Department. The proposed fiscal year budget for Metro Rail Project will be reviewed and approved by the Assistant General Manager/TSD and the SCRTD General Manager before being adopted by the Board of Directors. After adoption by the Board, the project budget and Financial Plan will be updated.

Financial control over the annual work programs will be exercised by the review and approval of requisitions for additional staff, equipment, professional services, and travel. In addition, each SCRTD department will prepare a monthly report accounting for progress which will be reviewed by the Program Control Office, and the Financial Plan will be updated to account for costs which have been incurred.

7.2.3 Work Conducted by Consultants

The consultants employed on the project will be given a statement of work for each fiscal year. The consultants will submit an annual proposal, responsive to the statement of work, and a work schedule, staffing plan, and cost estimate. The TSD Director responsible for managing the consultant will review each annual proposal and negotiate the annual cost in conjunction with a Contracting Officer's Representative. Following approval of the annual work program, the consultant will conduct the work and submit monthly reports accounting for progress and expenditures. The monthly reports will be reviewed by cognizant TSD technical personnel and by the Program Control Office for compliance with the contract scope of services and the consultant's schedule. Biweekly meetings will be held with each consultant to review progress on their contract and to allow coordination among TSD, consultant, and contractor activities. If the consultant is not performing satisfactorily, verbal and written notices will be given by the cognizant TSD Director. Consistent failure to perform may result in the consultant's being directed to remove errant staff members from the Metro Rail Project.

8.0 CONFIGURATION MANAGEMENT

8.0 CONFIGURATION MANAGEMENT

The SCRTD has established rigorous configuration management procedures to ensure that the Metro Rail Project progresses along its predetermined path and that any change to that path receives proper levels of management and technical review. These procedures were applied during the design phase and will continue during the construction phase of the project.

The configuration management process includes document control procedures, design review procedures, and change control and claims procedures. All are intended to ensure that project objectives are met by exerting control over design progression; by precluding unauthorized changes to established designs, plans, schedules, and/or budgets; by ensuring that the impact of any proposed change is thoroughly assessed and understood before a change is authorized; and by providing clear audit trails of all changes.

Overall responsibility for the configuration management process resides within the TSD Department. Authority for approving any change affecting established designs, schedules, and/or budgets rests with the SCRTD Configuration Control Board (CCB). The CCB is chaired by the Assistant General Manager/TSD. It includes as members the SCRTD Director of Contracts, Procurement, and Materiel, the TSD Directors of Transit Facilities, Systems Design and Analysis, Construction Management, Program Control, Technical and Administrative Services, and Real Estate and Development. The CCB also includes, as ex officio members, the TSD Project Engineer and the consultant Resident Engineer cognizant of the change under consideration.

Assistance in configuration management activities is provided by the GC and the CM consultants, acting under the direction of their respective TSD functional Directors and under the procedures established by TSD to guide and control the configuration management process.

During the design phase of the project, the GC has been responsible for document control and for assisting the CCB by processing changes to baseline design documents. During the construction phase of the project, responsibility for accomplishing these functions will shift

to the Change Control Section of the CM consultant. As each contract is awarded, the CM consultant will assume responsibility for change and claims processing and document control, including receipt and control of contractors' shop and working drawings and all CDRL items. Because of the likely frequency and volume of drawing changes, the GC will retain physical possession of original drawings and baseline design documents. Changes to these drawings and documents will be made by the GC only at the direction of the CM consultant's Change Control Section, acting to implement the decisions of the SCRTD's CCB, and controlled by the formal process specified in the following pages of this chapter.

8.1 DOCUMENT RECORD-KEEPING SYSTEM

Configuration accountability and maintenance of historical records of the project's design are an integral part of configuration management. Consequently, an effective document control system is essential.

In addition to maintenance of project files of drawings, documents, and correspondence, the document control function includes maintaining a library of technical documents, codes, standards, specifications, criteria, and other information essential to project development.

During the design phase of the Metro Rail Project, a Document Control Center at the GC offices has been specifically assigned the tasks of receipt, storage, and retrieval of various project documents and the preparation and distribution of reports. The specific responsibilities of the GC's Document Control Center have been:

- Correspondence control
- Document control
- Drawing control/drawing requests
- Technical library
- Status reports.

After contracts are awarded, the focus of document control will shift to the CM consultant, who will utilize an automated Document and Material Control System (DMCS). All contract documents and drawings, including those for the vehicle and fare collection procurements, will be tracked by DMCS. DMCS contains seven separate systems. Each system is a variation of the basic DMCS program and is developed to handle a specific document type, such as shop drawings and correspondence. Following is a description of the seven DMCS systems:

- Design Package System enables tracking of the review cycle of constructibility packages, design

criteria, standard and directive drawings, and program documents and special studies.

- Correspondence Index System provides for the indexing, cross referencing, and sorting of information by document type (correspondence, interoffice memoranda, meeting minutes, and library reference materials).

- Equipment Status System provides for the status-ing of critical fabrication milestones and the delivery/shipping status of equipment and materials. Schedule, forecast, and actual dates are provided in the system for each milestone to allow for complete status reporting during all stages of fabrication and delivery.

- Contract Document Index System provides for the indexing of contract documents and document revisions by contract. Upon award of each contract, each document/drawing issued with the contract is entered into the system. As Change Orders are issued and drawings are revised, the data base is updated to show the latest revision level of each document.

- Shop Drawing Review System provides for the tracking of shop drawing submittals through the review and approval cycle and back to the contractor.

- Maintenance System provides for the set-up and changing of contract numbers and their description in DMCS.

- System Information System supplies information about DMCS, such as lists of current users.

Each of the DMCS systems provides several report selections. At the conclusion of the Metro Rail Project, DMCS will provide the SCRTD with organized files for all contract documentation.

The official Metro Rail construction contract files are maintained in the Office of Contracts, Procurement and Materiel (OCPM). Working files for each of these contracts are maintained in the TSD Department and in the designated Resident Engineer's office(s).

The Resident Engineer (RE) is responsible for a timely transmission of all contractual information to OCPM with

copies to TSD. Any contractually-related information generated by TSD is similarly forwarded to OCPM and the RE.

The OCPM conducts regular weekly audits of the three sets of files to ensure that all are complete and up-to-date.

8.2 BASELINE DESIGN CONTROL

Documents containing data and requirements necessary for design, construction, procurement, and operation of the system are defined as baseline documents. They include:

- Project schedules, budget, and Financial Plan
- System Design Criteria and Standards (vols. I-V)
- Standard and directive drawings
- System Operating Plan
- System Maintenance Plan
- System Safety and Security Program Plan
- System Assurance Program Plan
- Design Directives
- Contract Unit Descriptions Book
- Contract Specifications Books (Conformed).

These baseline design documents are under the positive control of the Change Order process described in Section 8.5. The management of project budgets, schedules, and the Financial Plan is the responsibility of the TSD Office of Program Control; Chapter 7.0 provides further information on the development and control of these documents. The development of the remaining documents, except for conformed Contract Specifications Books, is described in Chapter 3.0.

The development of Metro Rail Contract Specifications Books is a detailed and comprehensive process. An effective design review process is essential to the control of design progression and, as such, is an integral part of project configuration management.

Design reviews are conducted to evaluate and compare specification development progress against the baseline requirements and to allow reassessment of these baselines as design matures. The formal design review process ensures that all project participants are given the opportunity to assess conformance to requirements in their areas of interest. This process also ensures that changes to the baseline documents resulting from design reviews are recorded and the appropriate change action is

initiated. If the design is considered acceptable at the design review milestone and is in full compliance with baseline requirements, formal changes are not required.

Design review packages consisting of the specifications and drawings are distributed to all program participants. Each reviewer of the contract documents submits comments using a standard Design Review Comment Sheet. Copies of all design review comments are forwarded to the GC and are sorted. Each comment is individually addressed and resolved. The cognizant design manager ensures that the reviewer concurs with the action taken in response to the reviewer's comment.

Formal design review meetings are held after all comments are compiled. Action item lists are maintained to track all unresolved issues. Each review package, along with comments, responses, actions, and minutes, is then filed by the GC as part of the historical record of the project.

Upon completion of the contract documents, the design becomes baselined and subject to formal change control as described in Section 8.5.

8.3 BID DOCUMENT CONTROL

The GC's Contract Services Section is organized to control and document the sale and distribution of all bid and related documents for the Metro Rail Project. The Contract Services Section is responsible for:

- Establishing a uniform process for the assembly and printing of bid and related documents
- Providing a timely and responsive process for the distribution and sale of all bid and related documents, including advance notice to bidders, bid packages and other information available to bidders, addenda, and information letters
- Providing positive control of the distribution and identification of specific bid document copies
- Establishing historical records and documentation of the assembly, printing, distribution, and sale of bid and related documents
- Operating and maintaining a Plan Room to be open to prospective bidders during the bid phase of the project.

The GC's Contract Services Section is responsible for maintaining all files, logs, lists, and other appropriate records required to document the processing of bid packages and related documents, including records of receipts and disbursements.

Specific procedures have been developed to manage:[1]

- The assembly of bid document packages
- Final modification of drawings prior to submittal to contract services
- Printing of bid documents
- Development of distribution list for bid documents
- Distribution of advance notice to bidders
- Distribution of bid and related documents
- Sale of bid and related documents
- Transmittal of addenda and information letters
- Plan Room operation.

As noted previously, the GC's Contract Services Section is responsible for control of all contract documents until contract award. After that time, changes to the contracts will be processed under the management of the CM consultant's Change Control Section.

8.4 CONTRACTOR DESIGN CONTROL

To ensure that contractor designs for major systems procurements adhere to all established design criteria and standards, incremental design reviews will be conducted by the SCRTD. The following design reviews are prescribed in the contract specifications for major systems elements:

- Conceptual design review
- Preliminary design review
- Final design review
- Mock-up review
- First article configuration inspection.

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1 MRTC, Metro Rail Project Configuration Management Implementation Plan and Procedures Manual, Procedure No. E.6, "Contract Services Procedures," 27 May 1986.

These reviews will be conducted to evaluate the progress and technical adequacy of the design and its compatibility with the performance requirements of the contract. Prior to each review, the contractor will submit a data package that includes CDRL and other items required for the review. Minutes of the review meetings will be distributed by the TSD Project Engineer.

- Conceptual Design Review (CDR). The CDR will usually be held no later than 60 days after Notice to Proceed. The CDR will be conducted at or near SCRTD facilities and is intended to:

  - Identify the contractor's management team
  - Identify subcontractors
  - Include design concepts for major systems hardware proposed by the contractor and subcontractors
  - Acquaint the contractor and subcontractors with SCRTD's operating, maintenance, safety, and system assurance philosophies.

- Preliminary Design Review (PDR). The PDR will be conducted prior to detail design to evaluate the progress and technical adequacy of the selected design approach and its compatibility with contractual performance requirements and interfaces. The review will be conducted on mutually agreeable dates at the contractor's facilities. Major subsuppliers will also be present.

  Design data covering each subsystem will be submitted prior to the PDR and will be at a level of detail consistent with the preliminary stages of design. Each data submittal will contain functional and interface descriptions, applicable engineering calculations, and schematic, layout, and general arrangement drawings. Specific data requirements are identified in each contract specification.

- Final Design Review (FDR). The FDR will be conducted incrementally when detail design is essentially complete and production drawings are ready for release. The FDR will confirm that the detail design will satisfy design requirements and establish the exact interface relationships between the system and other items of equipment

or facilities that are SCRTD-furnished. The reviews will be held on mutually agreeable dates at the contractor's facility.

- Mock-Up Review. When each required mock-up is complete, a design review will be held. The purpose of this review is to verify that the hardware represented in each mock-up meets requirements, is safe and maintainable, and includes proper human factors engineering.

- First Article Configuration Inspection (FACI). The FACI will take place at the point of assembly, whether at the subcontractor's or contractor's facility, after completion of acceptance tests on first production hardware. The FACI will verify that production hardware complies with production drawings as agreed upon during the FDR.

  Thirty days prior to each FACI, data that include the latest drawings, specifications, and quality documentation required for adequate checkout of the equipment under inspection, and an indentured list of drawings, will be submitted to the SCRTD.

8.5 CHANGE ORDER CONTROL

Because any change to baseline design documents or contract documents may preclude the attainment of project cost, schedule, and/or performance requirements, a specific set of delegations has been developed to evaluate and approve any changes to the contract documents. Because of the potential volume and the minor nature of a large percentage of the changes, the change control process balances the efficiency of the process with the proper amount of management control. The change control process described herein is consistent with SCRTD's procurement procedures and also provides for expeditious processing.[2]

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2 SCRTD Office of Contracts, Procurement, and Materiel, Procedures Manual; SCRTD Rules and Regulations, Section 8 and 9 (Purchasing and Sales of District Property), 28 July 1983 (as amended); Policy Implementation Procedure - John Dyer to Board of Directors, 4 February 1982; SCRTD Administrative Procedures for Consultant Contract Negotiations, 3 January 1983; all as amended by the Response to Draft Report on the Certification Review of the SCRTD, 6 June 1986.

The CCB will function to control changes that:

- Affect project cost or schedule
- Cause construction or procurements to deviate from approved baseline drawings and specifications
- Alter functional and operational characteristics of a system
- Impact warranties or system reliability.

The SCRTD Board of Directors has delegated the General Manager authority to approve specified Metro Rail contract amendments increasing the aggregate contract price up to five (5) percent or $99,999 for an individual amendment.

The General Manager has delegated all contract amendment authority for the Metro Rail contracts to the Director of OCPM. Primary responsibility for all procurement and contract administration activities is also assigned to the Director, OCPM. As designated Contracting Officer for the District, he is authorized to appoint such Contract Administrators and Contracting Officer's Representatives as he deems necessary to carry out his responsibilities. All such delegations are in writing, signed personally by the Director, OCPM and clearly specify the duties and functions delegated as well as the contract for which the delegation applies. The Director closely monitors the activities of these representatives and conducts such performance reviews and audits as necessary to assure compliance with SCRTD rules and regulations. Specific levels of delegation are as follows:

Contract Amendment Value	Delegated Authority Specified Metro Rail Contracts
Up to $ 10,000	TSD Project Engineer
From $ 10,000 Up to $ 25,000	TSD Director of Construction Management
From $ 25,000 Up to $ 50,000	Contracting Officer's Representative and AGM/TSD
From $ 50,000 Up to $100,000	Director, OCPM

Change Order procedures have been documented[3] and cover such topics as:

- Class I and Class II Changes. Class I changes are those in excess of $100,000 which generally affect form, fit, function, cost, or schedule. Class II changes are those less than $100,000, generally are routine, and do not affect form, fit, or function. If a Class II Change Order potentially has a Class I impact, it must be identified by the Project Engineer for further processing in accordance with the procedures below.
- Emergency Changes
- SCRTD vs. Field-Initiated Changes
- Change Request Approval Authority
- Change Control Responsibilities and Authority
- Unilateral Change Orders
- Change Order Documentation.

Formal approval must be obtained for any deviation from the baseline documents identified in Section 8.2. Any changes to the baseline documents will be carefully prepared to provide a clear picture of the current baseline and a clear audit trail of all changes to the original baseline. Some prospective changes can be expected to be mutually interactive with other changes, with other facets of the project's efforts and schedules, with system testing, and with operations and maintenance. Accordingly, the SCRTD's configuration management program will identify, account, evaluate, approve, and control the implementation of necessary changes to the baseline.

8.5.1 Class I Changes

The following description provides an example of the process to control a routine Class I change, originated by a contractor in the field. Reference should be made to the Metro Rail Project Control Procedures Manual for the process to be followed for emergency and Class II changes

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3 PDCD, Metro Rail Project Control Procedures Manual.

and for changes initiated by the SCRTD or consultants. The general process for Class I changes will be as follows:

- The contractor's Project Manager proposes a change to the CM consultant's Resident Engineer. The Resident Engineer will develop a Change Request package which includes the Change Request form, a finding-of-fact statement, and copies of relevant correspondence.

- The CM consultant's Change Control Section will add an estimate of cost and schedule implications to the Change Request package. Following approval by the CM consultant's Deputy Construction Manager-Operations, the package will be transmitted to the TSD Director of Construction Management.

- The TSD Directors of Construction Management, Program Control, and Transit Facilities or Systems Design and Analysis, as appropriate, as well as the Director of OCPM, will review the package. The Director of Construction Management will resolve any internal SCRTD concerns about the package. He will also obtain approval from SCRTD's Contracting Officer's Representative to continue the change process.

- If the package is approved by the SCRTD, the contractor will be requested to submit a formal change proposal.

- The contractor will prepare a Field Change File, which will expand the Change Request package to include the contractor's proposed cost and schedule estimates.

- The Change Control Section will distribute the Field Change File to the TSD Directors of Construction Management, Program Control, and Transit Facilities or Systems Design and Analysis, as appropriate, for review and comment. The Director of Construction Management will resolve any internal comments.

- A complete Change Request package will then be prepared by the Change Control Section for CM consultant's Construction Configuration Control Board (CCCB), which will have the responsibility for recommending changes to the SCRTD.

- Upon approval by the CCCB, the Change Request package will be transmitted to SCRTD's CCB for approval.

- If approved by the CCB, the Change Request package will be returned to the Change Control Section for processing. A copy will be sent to the TSD Program Control Office for input into TRACS.

- The Change Control Section will prepare a Change Order instructing the GC to change the relevant drawings and specifications, and to provide reproducible copies of the revised versions to the Change Control Section. Copies of revised drawings and specifications will be transmitted to the contractor and the TSD Project Engineer. The Change Control Section will refine the cost and schedule impacts based on the final changes to drawings and specifications.

- A negotiating team consisting of the Resident Engineer, the TSD Director of Construction Management, and the Contracting Officer's Representative from SCRTD's OCPM will meet with the contractor to negotiate the cost of the Change Order. The Contracting Officer or the Contracting Officer's Representative from the OCPM will chair the negotiating team and will prepare a summary of negotiations.

- After approval by the proper level of SCRTD authority, the SCRTD Legal Department will review and approve the Change Order. The Change Order will then be presented to the Board of Directors for review and approval.

- The approved Change Order will be returned through the TSD Director of Construction Management to the Change Control Section. A copy will be sent to the TSD Program Control Office for input into TRACS.

- The Change Control Section will advise the Resident Engineer to give the contractor Notice to Proceed, and will provide Program Control with this information.

8.5.2 Class II Changes

Class II Changes are those which generally do not affect form, fit, or function. Where a Class II Change appears to impact the above, it must be identified by the Project Engineer and forwarded for further processing. The TSD Director of Construction Management will make all final decisions on whether or not a Class II Change Order has a Class I impact. If a Class II Change Order has a Class I impact, it must follow the procedure described in Section 8.5.1 above.

All Class II Change Orders not having any Class I impacts will be handled as follows:

- The contractor's Project Manager proposes a change to the CM consultant's Resident Engineer. The Resident Engineer will develop a Change Request package which includes the Change Request form, a finding-of-fact statement, and copies of relevant correspondence.

- The CM consultant's Change Control Section will add an estimate of cost and schedule implications to the Change Request package. Following approval by the CM consultant's Deputy Construction Manager-Operations, the package will be transmitted to the Contracting Officer's Representative and the Director of Construction Management. The Director of Construction Management will resolve any internal SCRTD concerns about the package. He will also obtain approval from the Contracting Officer's Representative to continue the change process.

- If the package is approved by the SCRTD, the contractor will be requested to submit a formal change proposal.

- A complete Change Request package will then be prepared by the CM's Change Control Section, which will have the responsibility for recommending changes to the SCRTD.

- All Change Requests leading to Change Orders not exceeding $50,000 in total shall be processed as field change orders, shall be fully documented, negotiated by those with delegated authority to act, and shall be documented through the Change Control process as described below.

- All Change Orders exceeding $50,000 shall, in addition to the above, proceed through the Change Control Board and steps described below.

- Negotiations of Change Orders shall be conducted in accordance with District procedures and the delegation of authority issued by the Contracting Officer.

- All approved Change Request packages will be returned to the Change Control Section for processing. A copy will be sent to the TSD Program Control Office for input into TRACS.

- The Change Control Section will prepare a Change Order instructing the GC to change the relevant drawings and specifications, and to provide reproducible copies of the revised versions to the Change Control Section. Copies of revised drawings and specifications will be transmitted to the contractor and the TSD Project Engineer. The Change Control Section will refine the cost and schedule impacts based on the final changes to drawings and specifications.

- Prior to approval by the proper level of SCRTD authority, the SCRTD Legal Department will approve the Change Order.

- The approved Change Order will be returned through the TSD Director of Construction Management to the Change Control Section. A copy will be sent to the TSD Program Control Office for input into TRACS.

- The Change Control Section will advise the Resident Engineer to give the contractor Notice to Proceed, and will provide Program Control with this information.

8.5.3 Other Change Orders

Two other categories of change orders shall be processed by the Resident Engineer subject to subsequent ratification rather than by prior approval as required for Class I and Class II changes. These include:

- Emergency Change Orders The Resident Engineer has the duty to act in any situation which is determined to endanger lives or property, or which threatens the immediate cessation of work on the contract. In these circumstances, the RE

shall order immediate changes to be made at the work site under the emergency clause of the contract, and shall notify the AGM/TSD, and the Director of OCPM using the most expeditious communications method available. Subsequent to such notification, the circumstances which required the emergency change shall be fully documented, a price proposal solicited from the contractor covering the cost of the changed work, and a change order processed, all in accordance with Section 8.5.1 or Section 8.5.2, hereof, whichever is applicable.

- Unilateral Change Orders Unilateral Change Orders under the Force Account clause of the contract may be issued at the various levels of delegated authority provided for herein only upon reaching an impasse in the negotiations process. All unilateral Change Orders shall be classified as claims and processed in accordance with section 8.6 hereof.

8.6 CLAIMS CONTROL

Procedures[4] have also been developed to manage claims. A claim is a written demand by a contractor for contract adjustment (money and/or time extension) based on alleged differences in conditions or performance requirements not included in the contract documents. The reason for claims include:

- Disagreements in interpretation of drawings and/or specifications
- Alleged defective drawings and/or specifications
- Directed or constructive changes in method or manner of the performance of work
- Alleged differing site conditions
- Changes in SCRTD-furnished facilities, equipment, materials, services, site, etc.
- Directed or constructive acceleration of work
- Alleged interferences or delays caused by another Metro Rail contractor or subcontractor.

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4 SCRTD, Office of Contracts, Procurement, and Materiel, Procedures Manual.

The most significant factor in the control and avoidance of potential claims by Metro Rail contractors is the need for continuing alertness by project personnel to conditions that may give rise to claims. The SCRTD will train staff to handle claims and will also require:

- Thorough familiarization with contract documents, including terms, conditions, drawings, specifications, and standards
- Clear and distinct contract packages
- Thorough and consistent contract administration
- Good communications and professional working relationships with contractors
- Timely response to correspondence and problems
- Judicious avoidance of interfering with a contractor's planning and performance of work
- Proper preparation and maintenance of documentation.

Claims procedures for the Metro Rail Project are consistent with SCRTD procurement procedures and balance the rapid response needed for claims avoidance with necessary management controls. A summary description of these procedures follows:

- As soon as an SCRTD Project Engineer or a Resident Engineer becomes aware of an unusual situation that could give rise to a claim, the matter will be documented and all available information obtained. The contractor will submit a Notice of a Claim, advising of his intention to file a claim to the Resident Engineer, who will transmit this information to the Project Engineer and the Contracting Officer.
- The SCRTD Contracting Officer's Representative will formally request claim details from the contractor.
- The contractor will prepare and submit the claim to the Resident Engineer, which will be distributed to the Project Engineer. Further distribution will be made by the Project Engineer to the Contracting Officer, TSD Directors of Construction Management, Transit

Facilities, Systems Design and Analysis, and Program Control, to relevant consultants, and to the SCRTD Legal Department.

- The Resident Engineer will prepare a statement of findings and recommendations to be included with the claim submitted by the contractor.

- The SCRTD Contracting Officer's Representative will meet with cognizant representatives of the above organizations and evaluate the merits of the claim. The Contracting Officer's Representative will prepare disposition instructions.

- If the contractor concurs with SCRTD's evaluation and disposition instructions, the claim will either be withdrawn or will be submitted for processing as a Change Order.

- If the contractor disagrees with SCRTD's decision, he may appeal to the SCRTD Claims Appeals Board.

- If the Claims Appeals Board approves the claim, a Change Order will be prepared and the standard Change Order procedure will be followed.

- If the Claims Appeals Board rejects the claim and the contractor remains unsatisfied, the matter will be settled in accordance with contractual dispute clauses.

9.0 TEST MANAGEMENT

9.0 TEST MANAGEMENT

During construction, procurement, and start-up activities on the Metro Rail Project, a comprehensive test program will be implemented to ensure that:

- Equipment, material, facilities, and software conform to contractual requirements
- Equipment, facilities, software, and personnel function effectively together to provide safe and dependable service.

Because testing is a complex and vitally important element in preparing the Metro Rail system for service, the SCRTD has adopted a standardized approach to conduct, monitor, and coordinate the testing of Metro Rail elements. All program participants will work actively and cooperatively toward successful completion of the Metro Rail testing program under the overall management of the TSD Director of Systems Design and Analysis.

A detailed Test Program Plan[1] has been prepared for the Metro Rail Project. The plan reflects the process shown in Exhibit 9-1 and will govern contractual, materials, system integration, and pre-revenue operations testing, as discussed in the following pages of this chapter.

9.1 TEST PLANNING

Test planning was initiated during the final design phase of the Metro Rail Project and will continue during facilities construction, equipment procurement, and initial system operations. A Test Program Plan (TPP) has been prepared to:

- Establish the process for conducting, monitoring, and coordinating the test program
- Delineate the test organization and specify its authority and responsibilities

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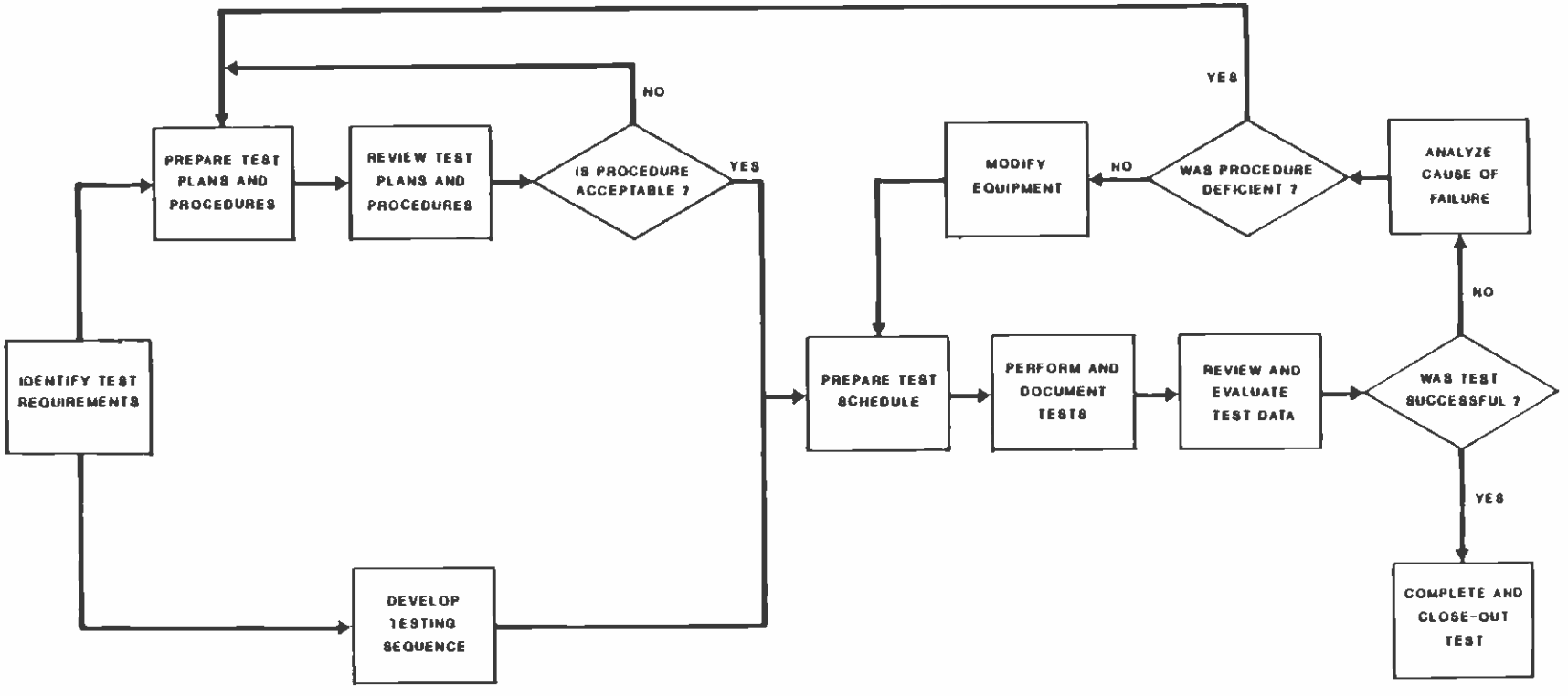
1 SCRTD Metro Rail Project, Test Program Plan, Draft, June 1986.

EXHIBIT 9-1
Test Management Process



- Describe the administrative requirements of the test program.

The TPP was developed to ensure that management and technical resources are applied in a coherent and organized manner to achieve the Metro Rail test program objectives. The test program includes the following elements:

- Identification and Definition of Test Requirements. Contract specifications define those tests necessary to ensure that equipment meets performance requirements. In addition to contractually required tests, system integration tests will be identified and performed to ensure that necessary compatibility has been achieved among all elements of the system.

- Establishment of Test Program Administration System. Administration of the test program will be a major undertaking and will be managed using a computerized system to monitor, control, document, and report on program status. A test numbering system will be established to assist in the administration and retrieval of testing documents.

- Development of Testing Sequence and Schedules. The test schedule will conform to, and support, the overall project schedule. The initial schedule established in test planning will be updated regularly during the subsequent phases of the project.

The test program will be administered by a test management team established within the Systems Engineering and Analysis Section of the TSD Systems Design and Analysis Office. A Test Engineer will manage the test program with assistance from consultants and TSD staff.

9.2 CONTRACTUAL TESTING

Contractual testing on the Metro Rail Project will begin during the construction phase and continue through pre-revenue operations. The following categories of contractual tests will be conducted on the Metro Rail Project:

- Design Qualification Tests will be conducted by the contractor at the component/subsystem level during contractor engineering to demonstrate compliance to specification.

- Production Verification/Construction Inspection Tests will be conducted by the contractor at the component/subsystem level during production/ construction to ensure the product is in accordance with design and/or workmanship standards.

- Installation Verification Tests will be conducted by the contractor at the subsystem level to ensure proper installation.

- Acceptance Tests will be conducted by the cognizant TSD and consultant staff at the subsystem level to verify that performance of all delivered equipment is in compliance with specification.

- Demonstration Tests will be conducted by the cognizant TSD and consultant staff in the pre-revenue and revenue operations phases to demonstrate the reliability of the system equipment. An Incident Evaluation Committee, chaired by the Supervising Engineer, Systems Safety and Assurance, will evaluate the relevance of all failures to the reliability demonstration test program and require corrective action to be taken.

Contractors will be responsible for preparing plans and procedures for tests they are contractually responsible for performing. The contractor will submit the test plans and procedures to TSD for review and approval. Cognizant TSD and consultant staff will ensure that an adequate review is conducted and will authorize the contractor to proceed with the test. Test results and reports will also be promptly reviewed by TSD and consultant staff and written approval or rejection provided to the contractor. TSD and consultant staff will develop plans, procedures, and reports for acceptance and demonstration tests. Tests will be scheduled, conducted, and documented in accordance with the approved schedules, plans, and procedures and will be monitored by TSD and consultant personnel. Formal reports on the status of the test program will be issued monthly to Metro Rail Project management.

9.3 MATERIALS TESTING

Requirements for testing of materials are defined in the contract documents for construction materials and for materials required to fabricate equipment. In addition, testing of products for which fabricators have submitted Material Certificates or Certificates of Compliance will be conducted on a random basis or when the validity of the

materials/products or documentation are questionable. Contract-specific inspection and test plans will identify the products/materials which most likely require testing.

9.4 SYSTEM INTEGRATION TESTING

The system integration testing will be conducted upon completion of the contractual acceptance tests. The system integration testing will be performed to demonstrate the ability of various subsystems and facilities to perform together as a system. The system integration testing will be performed by the TSD staff with support from consultants. The Test Engineer will provide overall guidance and direction to the engineers administering the specific contract for the performance of tests determined necessary by TSD.

Each test will be documented in a formal test report, prepared by the TSD and consultant staff who conducted the test. Tests which affect system safety will be reviewed independently by the Metro Rail Safety Certification Review Team[2] to ensure that potential hazards are identified and resolved. During system integration testing, equipment suppliers will be required to participate in tests of their equipment so that problems can be expeditiously investigated and corrected. Changes to equipment resulting from systems integration testing will be subjected to the configuration management procedures outlined in Chapter 8.0.

9.5 PRE-REVENUE OPERATIONS

During the construction phase, the SCRTD will recruit and train personnel to operate and maintain the Metro Rail system. For several months prior to revenue service, the SCRTD will simulate service to test whether all elements, including personnel, can function safely and efficiently together. Pre-revenue operations will verify the competence of these personnel and ensure a smooth transition from construction through testing to revenue service. Pre-revenue operations will verify, through documented demonstrations:

- The ability of Metro Rail to coordinate plans, rules, procedures, equipment, facilities, and personnel to sustain reliable and safe normal revenue service

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2 SCRTD Metro Rail Project, Safety Certification Plan, May 1986.

- The ability of Metro Rail and outside agencies to coordinate plans, rules, procedures, equipment, facilities, and personnel to provide safety for employees, passengers, and property during abnormal/emergency operations.

10.0 VALUE ENGINEERING

10.0 VALUE ENGINEERING

A value engineering program has been established and implemented on the Metro Rail Project. Value engineering involves an organized and rigorous analysis of system functions and requirements to ensure that functions are provided and requirements met at the lowest capital and life-cycle costs. Value engineering has been applied during the design phase to all aspects of the Metro Rail system design, including facilities, equipment, operating strategies, and maintenance planning. The program will continue during the construction phase of the project.

The TSD Director of Transit Facilities and the TSD Director of Systems Design and Analysis are responsible for evaluation and administration of value engineering activities in their respective areas. These directors are supported by qualified consulting firms who provide independent analysis on an as-needed basis.

10.1 VALUE ENGINEERING DURING THE DESIGN PHASE

To achieve maximum benefits, value engineering has been applied throughout the design effort. Typically, the investigations and analyses have been performed at the 60 percent level of final design. At that point, designs and specifications were sufficiently advanced to permit accurate cost analyses of alternative methods, arrangements and materials, particularly for the architectural, civil, and structural elements.

For fixed facilities, four design units were selected for value engineering analysis:

- 7th/Flower Station
- Wilshire/Alvarado Station and tunnel segment
- Civic Center Station and tunnel segment
- 5th/Hill Station and tunnel segment.

These design units are representative of other portions of the MOS-1 system and the results of the value engineering studies were applied to other MOS-1 units.

Value engineering has also been applied to the design of equipment that will be procured for the project. For

example, there have been investigations of:

- The brakes and coupler arrangements for the passenger vehicle
- The functions to be provided by the Supervisory Control and Data Acquisition System
- The design of the fare collection system.

These investigations of the fixed facilities and equipment have resulted in significant cost savings.

10.2 VALUE ENGINEERING DURING THE CONSTRUCTION PHASE

To achieve cost reductions during the construction phase, each contract will contain a cost reduction incentive clause. The clause will enable the contractor to share the savings from cost reduction suggestions with the SCRTD. The contractor will be required to submit suggestions describing the proposed alternative and estimating the cost savings. The SCRTD will evaluate these suggestions to ensure that service life, quality, economy of operation, ease of maintenance, and safety standards are not impaired. If the suggestion has merit, a change proposal will be prepared and processed according to the procedures described in Chapter 8.0.

11.0 QUALITY ASSURANCE/CONTROL

11.0 QUALITY ASSURANCE/CONTROL

The Metro Rail quality assurance program is designed to ensure that components, tunnels, systems, and facilities are designed, procured, and constructed in accordance with established criteria and quality standards. The program provides controls for all facets of the Metro Rail Project:

- Design
- Equipment procurement
- Construction
- System acceptance testing
- Initial system operations.

The controls applied to each of these are described in this chapter. The TSD Director of Systems Design and Analysis is responsible for managing the quality assurance program for passenger vehicles and fare collection equipment. The TSD Director of Construction Management is responsible for managing the quality assurance program for remaining equipment and for all facilities.

11.1 DESIGN

During the design process, quality assurance was addressed through the following activities to ensure that the Metro Rail system achieves its dependability and quality objectives.

11.1.1 SCRTD Design Reviews

Design reviews were conducted to evaluate and compare design progress against the applicable System Design Criteria and Standards (see Chapter 3.0) and to allow reassessment of these requirements as the design matured. Formal design reviews were conducted on all contract packages at the following stages:

- A Preliminary Design Review, conducted at approximately 30 percent of design maturity
- An In-Progress Design Review, conducted at approximately 60 percent of design maturity
- A Prefinal Design Review, conducted at approximately 85 percent of design maturity

- A Final Design Review of all completed design drawings and specifications.

11.1.2 Safety, Security, and System Assurance Requirements

The safety, security, and systems assurance functions maintain independence from the design and engineering groups to ensure unbiased critiques of designs and specifications. The safety, security, and systems assurance staff have prepared systems assurance requirements for each specification. These requirements are clearly identified in each system specification,[1] and guidelines have been prepared for use by systems contractors in developing safety and system assurance analyses. The guideline requirements are incorporated by reference in appropriate specifications.[2]

11.1.3 Value Engineering Reviews

During final design, value engineering reviews were conducted on major elements of the Metro Rail system to enhance the cost-effectiveness of the project (see Chapter 10.0). Quality assurance personnel participated in the value engineering analyses to ensure that design changes would not compromise system quality. During the construction phase of the project, quality assurance personnel will review any cost-reduction proposals submitted by contractors.

11.1.4 Constructibility/Claims Avoidance Reviews

During final design, constructibility and claims avoidance reviews were conducted on the tunnels, stations, and other Metro Rail facility plans and specifications to identify potential problems. Drawings and specifications were reviewed by the CM consultant and TSD quality assurance staff with respect to constructibility and inspectability, and for sensitivity to construction problems and delays.

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1 See, e.g., SCRTD Metro Rail Project, Procurement Specification Book, Contract No. A650: Passenger Vehicle (October 1985), Chapter 8, "Technical Provisions," Section 19, "Systems Assurance Program."

2 SCRTD Metro Rail Project, Guidelines for the Preparation of Safety and System Assurance Analyses, SCRTD 5-001, August 1985.

11.1.5 Configuration Management

The configuration management practices described in Chapter 8.0 have been established to ensure the integrity of all project baseline documents, and to ensure that design changes are made in accordance with established procedures. All design changes will be reviewed by quality assurance personnel.

11.2 EQUIPMENT PROCUREMENT

The Metro Rail Project staff will monitor the performance of each manufacturer. This monitoring will address such issues as technical compliance, schedule adherence, product quality, and testing. The equipment to be procured for the Metro Rail system varies in terms of quantity and complexity. Some items will be specially manufactured, while other equipment will be standard "off-the-shelf" items. The quality controls to be applied to each procurement will be determined by the cost of the procurement, the complexity of the equipment, the degree of standardization, and the quality history of the manufacturer(s). All quality assurance programs will consist of the elements described in the following sections.

11.2.1 Pre-Award Survey

Before a major equipment contract is awarded, TSD quality assurance staff, with support from consultants, will review the selected manufacturer's quality assurance capabilities. These quality assurance capabilities include quality planning, control, coordination, and audit and analysis activities during the design, procurement, fabrication, assembly, and delivery phases of the contract. The quality pre-award surveys will be conducted in two steps:[3]

- A review of the manufacturer's quality assurance plans, procedures, and organization
- A verification of the manufacturer's quality history and capabilities through plant visits and interviews with previous customers.

11.2.2 In-Process Inspections

In-process inspections will be conducted to ensure that the manufacturer's quality procedures are acceptable

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3 See SCRTD Metro Rail Project, Quality Pre-Award Survey Manual, July 1984.

and effective, that the SCRTD's quality standards are enforced, and that the contractor's quality assurance program is being implemented. The in-process inspections will employ a Resident Inspector for major or critical procurements. The inspections will be performed according to written checklists, and a log book will be maintained for each procurement. The inspections will usually be performed by an examination of sample parts rather than a widespread inspection of all components. Particular attention will be paid to first production articles.

In addition, source inspections will be conducted on the major subsystems supplied by subcontractors on each procurement. Inspection results will be documented and filed for reference.

11.2.3 Quality Audits

Periodically, for each major procurement, a quality audit will be performed to verify, by physical examination of hardware and relevant documents, that the manufacturer is conforming to the applicable quality procedures and standards.[4] These audits will be conducted by the SCRTD with assistance from consultant quality assurance personnel, and will be independent from the in-process inspection activities of the Resident Inspector.

The audits will be conducted in accordance with an overall audit plan and will use quality assurance checklists prepared specifically for each procurement. Written reports will be prepared after each audit, and the findings will be discussed with the manufacturer's management so that corrective action may be taken. Follow-up visits will be scheduled as necessary to verify that corrective actions are being implemented.

11.2.4 Final Inspections

When the equipment procured for the Metro Rail Project has been completely assembled and tested, the SCRTD will perform a thorough final inspection of the hardware and any associated software. These final inspections may be performed at the manufacturer's location, at SCRTD facilities, or at both locations. Any identified defects will be corrected by the manufacturer. As required by applicable procurement specifications, contractors will be required to provide drawings showing the as-built

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4 See SCRTD Metro Rail Project, Quality Assurance Review Guidelines, June 1985.

configuration of equipment; complete sets of operating and maintenance manuals; and history books for selected equipment.

11.2.5 Receiving and Storage

The SCRTD will establish strict procedures for the receipt and storage of all spare parts and material procured for Metro Rail. Receiving inspections will be conducted on all incoming material and supplies. Once spare parts are delivered and accepted, the material will be securely stored and issued in accordance with SCRTD procurement procedures.

All capital assets procured by the SCRTD are controlled and managed in accordance with UMTA and Office of Management and Budget requirements. The SCRTD's automated materials management system provides the capabilities for receiving, inventory accounting and forecasting, and more advanced materials management functions.

11.3 CONSTRUCTION

Metro Rail Project staff will monitor all construction activities. Continuing quality assurance reviews and formal audits will be conducted to ensure that all construction and installation activities are accomplished in accordance with approved quality assurance/quality control procedures. This monitoring will address such issues as technical compliance, schedule adherence, product quality, and material testing. A Resident Engineer, supported by the CM consultant's quality assurance personnel, will be assigned to each construction contract to provide on-site quality inspections and liaison between the contractor and the SCRTD. The construction quality assurance program will consist of the activities described below.

11.3.1 Inspection and Test Plans

Inspection and test plans for each specific construction contract will be developed in accordance with requirements specified in the CM consultant's quality assurance/quality control[5] manual. These plans will be implemented by the Resident Engineer.

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5 See PDCD, Metro Rail Project QA/QC Procedures Manual, September 1985.

11.3.2 In-Process Inspections

Resident Engineers will be deployed to ensure that construction quality control procedures are in place and effective, and to ensure that quality standards are acceptable. The Resident Engineers' activities will include:

- Verifying the contractor's material certifications and samples
- Inspecting materials and equipment delivered to the job sites by the contractor or furnished by the SCRTD
- Performing inspections of specially furnished equipment and fabricated construction materials
- Inspecting construction and installation work in progress
- Documenting the results of inspections and tests
- Supervising construction operations and field testing of construction materials
- Directing and supervising the sampling of construction materials, such as soil borings.

When the materials and workmanship do not conform with the specifications, the Resident Engineer will immediately notify the contractor in writing to correct the deficiencies.

11.3.3 Quality Surveillance and Audits

Surveillance of all construction activities will be performed by TSD construction management staff and by the CM consultant's quality assurance personnel. Random tests, as described in Section 9.3, will be used by quality assurance personnel to verify materials meet with specification requirements. In addition, for each construction contract, a periodic quality audit will be performed by TSD and consultant staff to verify, by physical examination of hardware and relevant documents, that the contractor is complying with applicable quality procedures and standards.

These audits will be independent of the Resident Engineer's activities. They will be conducted in accordance with the CM consultant's quality assurance/quality control manual. An overall audit plan and checklists specifically prepared for each contract will be used. Written reports will be prepared after each audit, and the

findings will be discussed with the contractor so that corrective action may be taken. Follow-up surveillance and quality audits will be used to confirm that corrective action has been taken and is effective.

11.3.4 Final Inspections

When construction activities, including any necessary documentation, have been completed, the TSD Director of Construction Management will designate an acceptance team to perform a final inspection. The team will include TSD personnel, the Resident Engineer, and other CM consultant personnel. Any identified defects will be documented, and the contractor will be required to take corrective action. After defects have been corrected, the team will recommend that the SCRTD accept the facilities and/or equipment. As required by the applicable construction contracts, the SCRTD will review and accept as-built drawings, contractor-procured or contractor-developed operating and maintenance manuals, and construction records.

11.4 INITIAL SYSTEM OPERATIONS

During the first year of Metro Rail operations, equipment performance or reliability problems are expected to occur. These problems will be identified by operations and maintenance personnel and will require engineering investigations, possible redesigns, and subsequent retrofits by the manufacturer. Applicable warranties will be enforced and revised designs and retrofits will be monitored for conformance to the established Metro Rail criteria and quality control standards.

Reliability demonstration tests will be conducted for critical system equipment, such as the passenger vehicles and communications system. The reliability of the critical equipment will be measured against success/failure criteria. If the equipment fails the test, the contractor will redesign the component until it performs dependably.

12. MAINTENANCE OF THE PLAN

12.0 MAINTENANCE OF THE PLAN

This Project Management Plan may be revised at the initiative of either the SCRTD or UMTA. The need for such revisions will be discussed at the quarterly review meetings between SCRTD and UMTA. After agreement on the intent and scope of the revisions, the Plan will be updated using the procedures described in this chapter.

12.1 RESPONSIBILITY FOR UPDATING THE PLAN

The Assistant General Manager/TSD is responsible for the maintenance of the Plan and for directing revisions to its contents when agreement has been reached with UMTA, and authorization has been given by the General Manager.

12.2 THE UPDATING PROCEDURE

At least seven days prior to the quarterly review meetings, either the SCRTD or UMTA will inform the other party in writing of any proposed revisions to the Plan and the reasons for them. The proposed revisions will be discussed at the meeting and mutual agreement reached on their intent and scope. This agreement will be recorded in the minutes of the review meeting and will form the basis for initiating changes to the Plan.

After the agreement is reached, the Assistant General Manager/TSD will authorize the cognizant TSD Directors to implement the changes and to revise the text of the Plan. The revisions will be documented on the Revision Record provided at the front of the Plan. Revised pages will then be distributed to all recorded holders of the Plan according to configuration management procedures.

13. REFERENCE DOCUMENTS

13.0 REFERENCE DOCUMENTS

This chapter provides a listing of the documents which support the Project Management Plan.

13.1 ENVIRONMENTAL REPORTS

- SCRTD, Alternatives Analysis/Environmental Impact Statement/Report, April 1980.
- SCRTD, Final Environmental Impact Statement, Los Angeles Rail Rapid Transit Project: Metro Rail, December 1983.
- SCRTD, Environmental Assessment: Los Angeles Rail Rapid Transit Project, Union Station to Wilshire/Alvarado, August 1984.
- SCRTD, Comments and Responses on the Environmental Assessment for the Los Angeles Rail Rapid Transit Project, Union Station to Wilshire/Alvarado, October 1984.
- UMTA, Re-Evaluation of Environmental Record, June 1986.

13.2 SYSTEM DESIGN DOCUMENTS

- SCRTD Metro Rail Project, System Design Criteria and Standards, 1983.
- SCRTD Metro Rail Project, System Operating Plan, September 1986.
- SCRTD Metro Rail Project, System Maintenance Plan, Draft, June 1986.
- SCRTD Metro Rail Project, System Safety and Security Program Plan, January 1985.
- SCRTD Metro Rail Project, System Assurance Program Plan, February 1986.
- SCRTD Metro Rail Project, Contract Unit Descriptions: Minimum Operable Segment-1, July 1986.

- SCRTD Metro Rail Project, Guidelines for the Preparation of Safety and System Assurance Analyses, SCRTD 5-001, August 1985.

- SCRTD Metro Rail Project, Procurement Specifications for:

  - Passenger Vehicle
  - Automatic Train Control
  - Communications
  - Traction Power
  - Fare Collection

13.3 CONFIGURATION MANAGEMENT DOCUMENTS

- MRTC, Metro Rail Project Configuration Management Implementation Plan and Procedures Manual, December 1983

13.4 REAL ESTATE DOCUMENTS

- UMTA, Land Acquisition and Relocation Assistance Under the UMTA Act of 1964, as amended, March 1985.

- UMTA, Final Rule, 39 Federal Regulations 7000-7040, February 1986.

- SCRTD Metro Rail Project, Milestone 5 Final Report, Right of Way Acquisition and Relocation Policies and Procedures, July 1982.

- SCRTD, Real Estate and Development Detailed Operating Procedures, 1984.

- SCRTD Metro Rail Project, Property Identification Plans, various dates.

- SCRTD Metro Rail Project, Relocation Analysis Report, September 1983.

- SCRTD, Real Estate and Development Department, Relocation Benefits: Tenants and Home-owners, no date.

- SCRTD, Real Estate and Development Department, Relocation Benefits: Businesses and Non-Profit Organizations, no date.

- SCRTD Metro Rail Project, Milestone 6 Final Report, Land Use and Development Policies, January 1983.

- SCRTD, Policies and Procedures for Implementing Joint Development, November 1983.

13.5 PROCUREMENT DOCUMENTS

- SCRTD, Office of Contracts, Procurement, and Materiel, Procedures Manual, no date.
- SCRTD Metro Rail Project, Warranty Management Plan, March 1986.
- PDCD, Procurement Manual, draft

13.6 QUALITY ASSURANCE DOCUMENTS

- SCRTD Metro Rail Project, Quality Pre-Award Survey Manual, July 1984.
- SCRTD Metro Rail Project, Quality Assurance Review Guidelines, June 1985.
- PDCD, Metro Rail Project QA/QC Procedures Manual, September 1985.

13.7 CONSTRUCTION MANAGEMENT DOCUMENTS

- PDCD, Construction Operations Procedures Manual, draft.
- PDCD, Resident Engineer Manual, draft.
- PDCD, Inspection Guidelines
- PDCD, Project Controls Procedures Manual
- PDCD, Metro Rail Construction Safety and Security Manual, September 1986
- SCRTD and Los Angeles County Building and Construction Trades Council, AFL-CIO, Continuation of Work Agreement for the Metro Rail Project, June 1984.

13.8 PROGRAM CONTROL DOCUMENTS

- SCRTD, Program Control Office, Work Breakdown Structure Manual, February 1986.
- SCRTD, Metro Rail MOS-1 Financial Plan, September 1986.
- SCRTD, Metro Rail MOS-1 Baseline Schedule, Rev. 5, September 1985.

- SCRTD, Program Control TRACS System Manual, draft, September 1985.

- SCRTD, Program Control Procedures Manual, no date.

13.9 TESTING DOCUMENTS

- SCRTD Metro Rail Project, Safety Certification Plan, May 1986.

- SCRTD Metro Rail Project, Test Program Plan, draft, June 1986.