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SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT
METRO RAIL PROJECT

PROJECT MANAGEMENT PLAN
FOR
MOS-1 CONSTRUCTION

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PROJECT MANAGEMENT PLAN
FOR
MOS-1 CONSTRUCTION

REVISION RECORD

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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

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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

1.0 PROJECT BACKGROUND AND SYSTEM DESCRIPTION

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)

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

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

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.

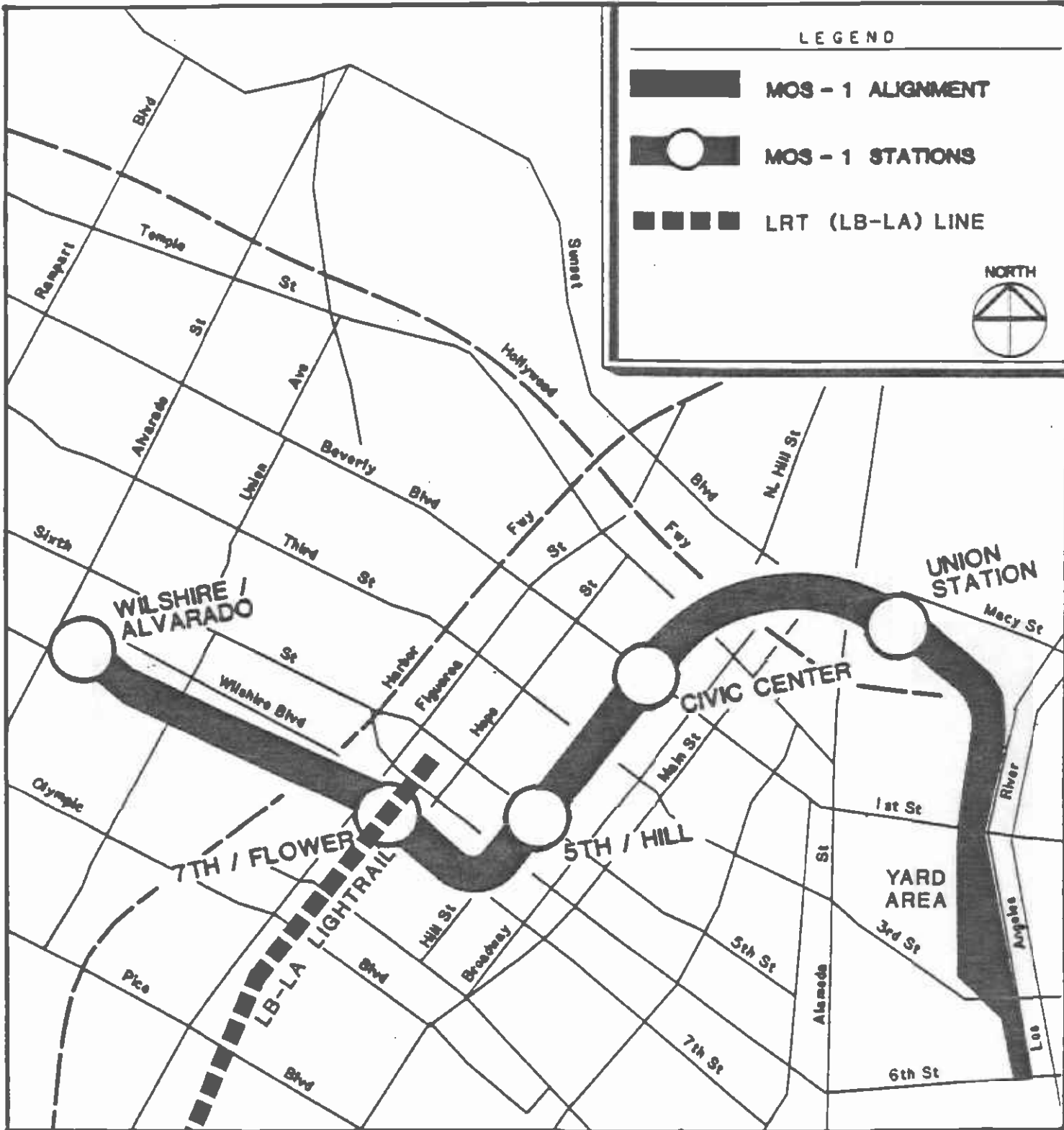
The mainline portion of MOS-1 will include three double crossovers. Two of the crossovers will be located at either end of Union Station, and one will be located at the east end of the Wilshire/Alvarado Station. The system will be integrated with the existing bus network and with the Long Beach-Los Angeles (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

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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

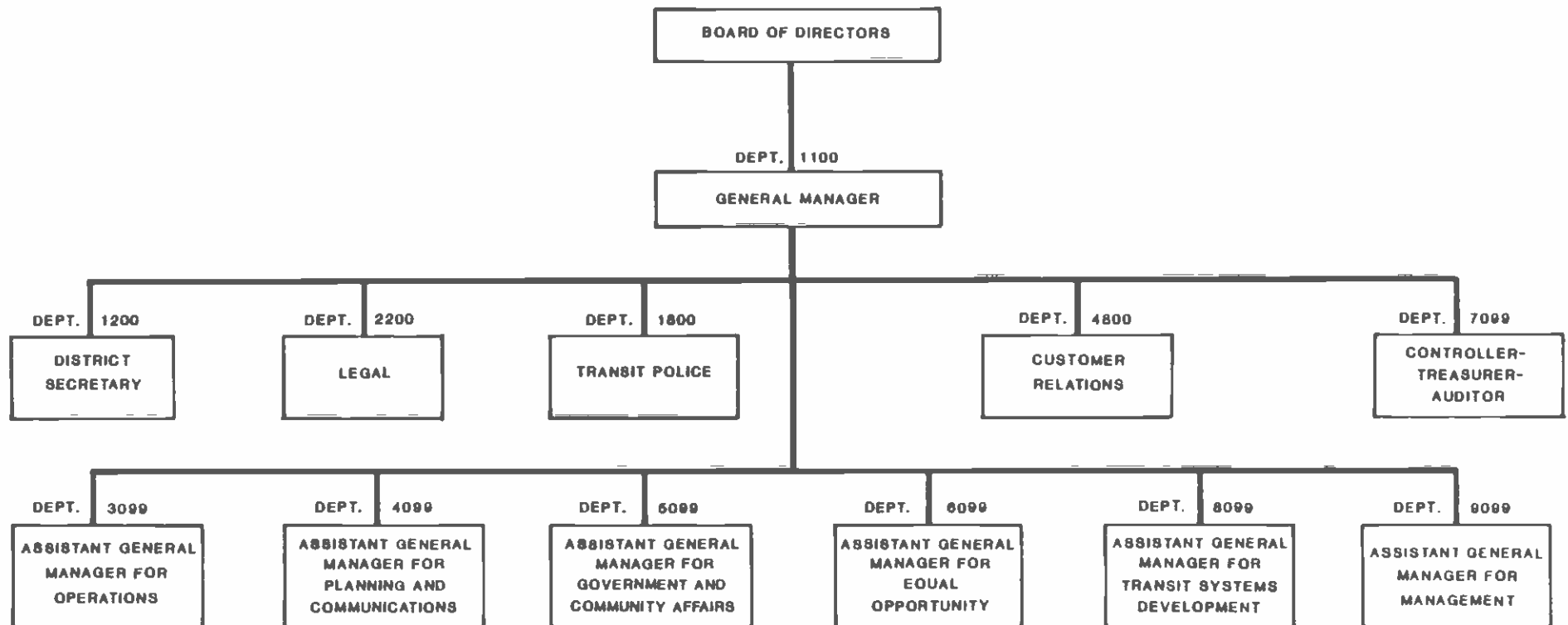
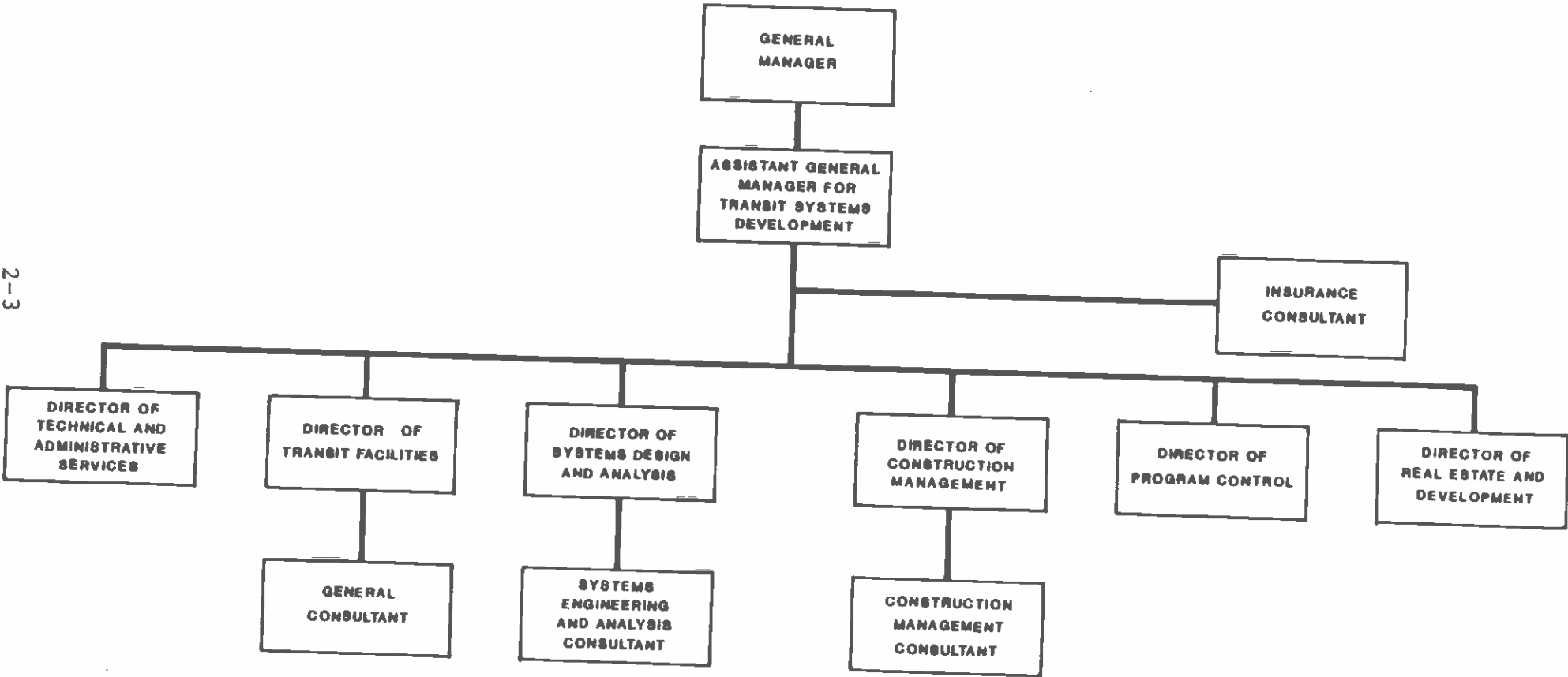


EXHIBIT 2-2
Organization of Metro Rail Core Project Team

2-3



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 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

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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:

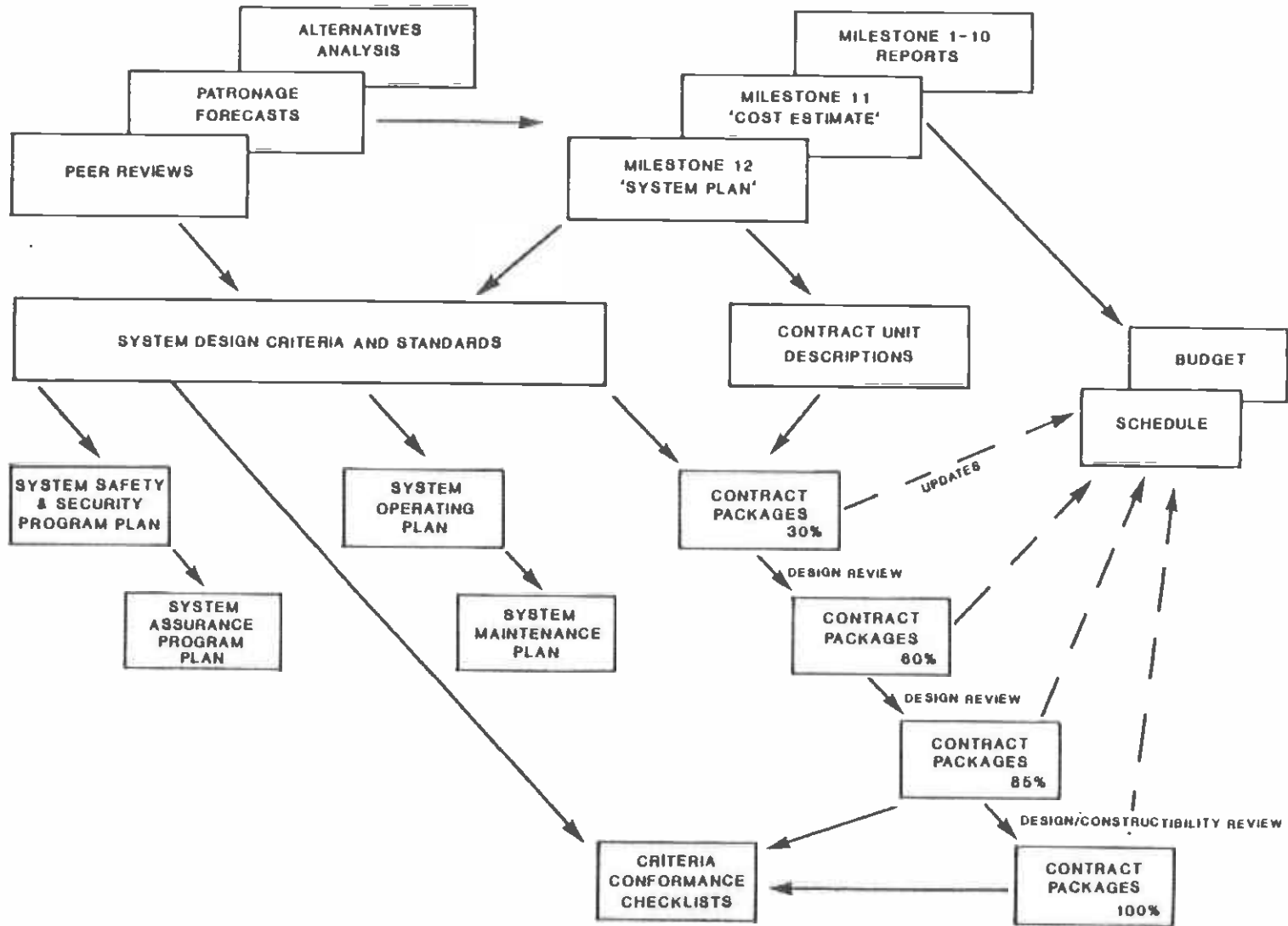
- The TSD Director of Transit Facilities is responsible for the design of all stations, tunnel segments, yard and shop facilities, and the specification of facility-related equipment, such as elevators, escalators, and ventilation fans. Facilities design documents are prepared by the GC's Facilities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

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

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

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.

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.

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

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

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

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 SCRTD¹ 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

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

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 survey³ 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,

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

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 procedures¹ 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

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).

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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;

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.

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.

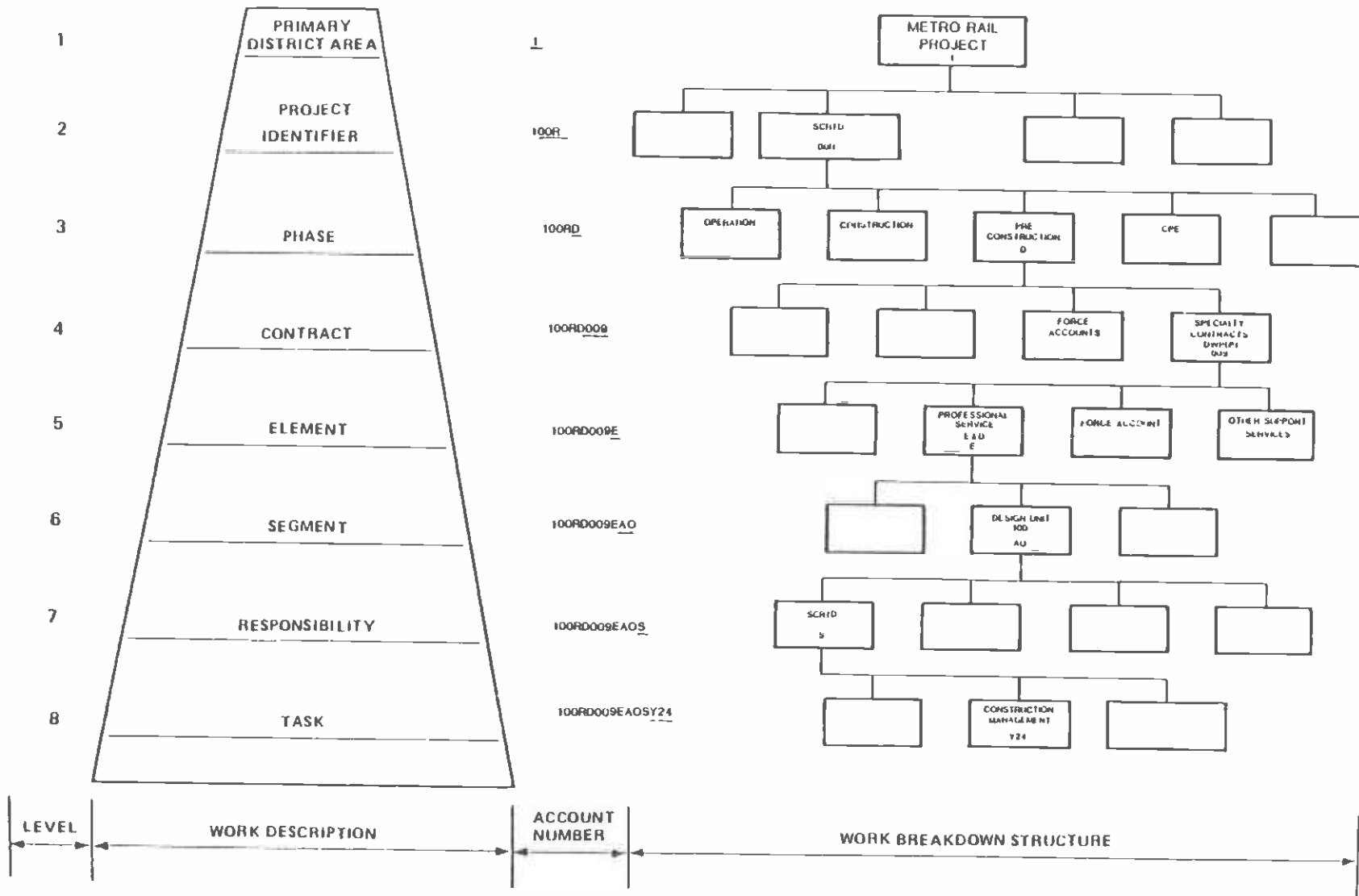
In conjunction with the project schedule, the budget has been used to develop obligation and cash flow plans. The obligation plan defines the amount of funds required in each year for awarding contracts, for SCRTD personnel and equipment requirements, for real estate acquisition, and so on. The obligation 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

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

7-3



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.

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:

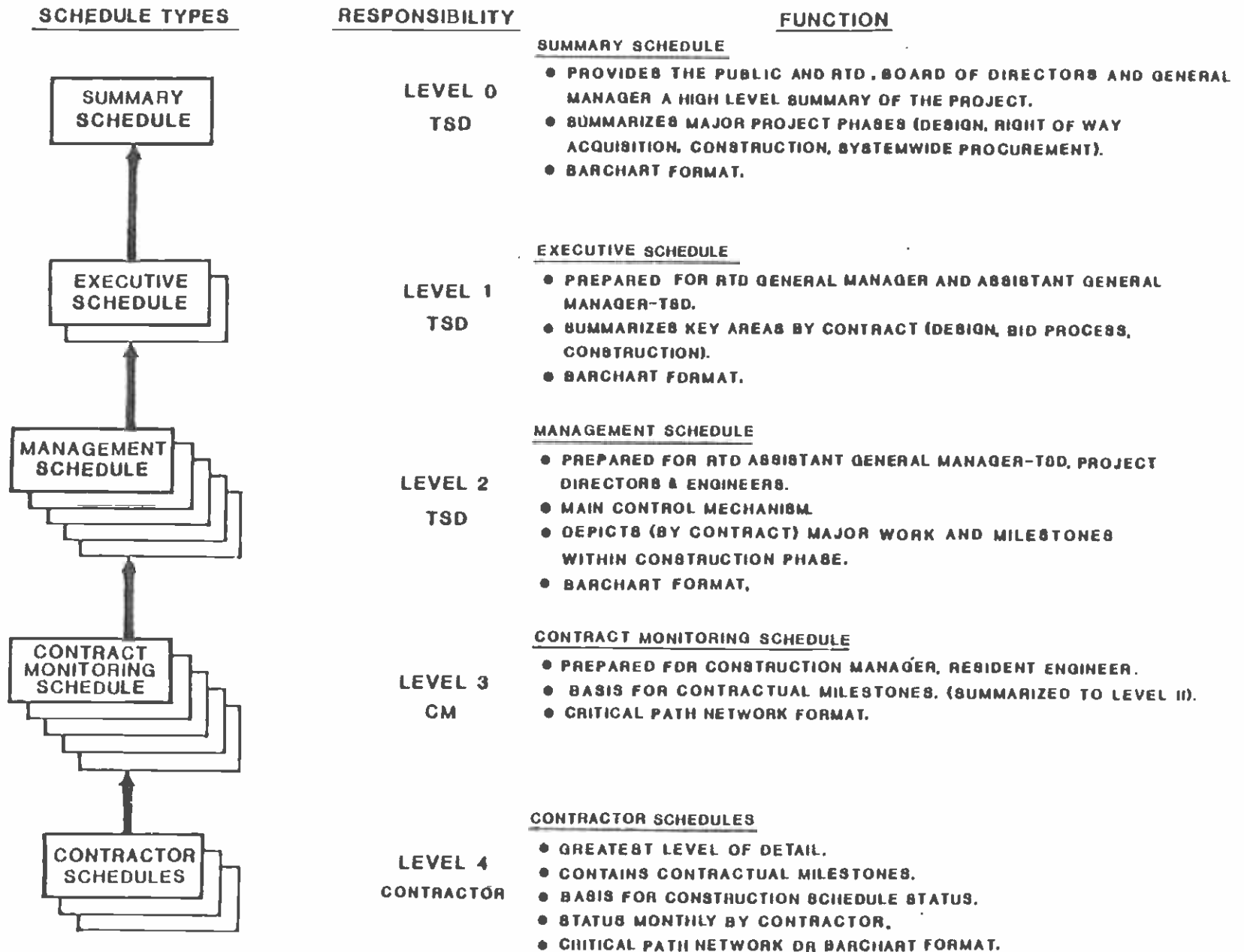
- Level 0 - Executive Schedule. This barchart schedule provides a high-level summary of major project phases but has insufficient detail for monitoring and control. It will be used for reporting to the SCRTD Board of Directors and the general public.
- Level 1 - Contract Schedule. This barchart schedule 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.

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

7-6



- 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.

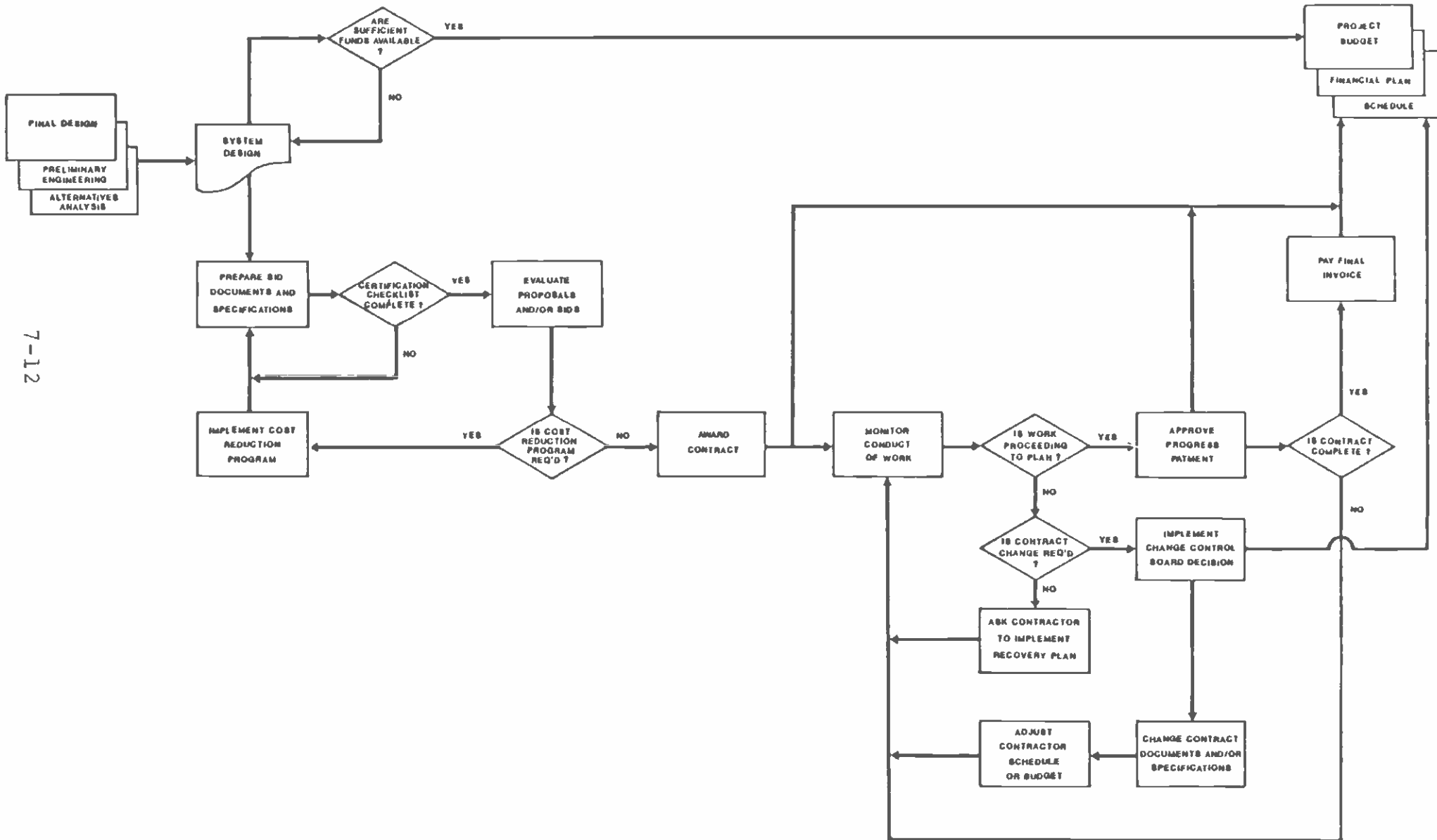
The program control process to be applied to each construction and procurement contract, and to activities conducted by the SCRTD and its consultants, is described below.

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



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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 TSD Directors of Transit Facilities, Systems Design and Analysis, Construction Management, Program Control, Technical and Administrative Services, and Real Estate and Development, and the SCRTD Director of Contracts, Procurement, and Materiel. 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.

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

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

- 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.

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 AND CLAIMS CONTROL

Because any change to baseline design documents or contract documents may preclude the attainment of project cost, schedule, and/or performance requirements, a formal system has been developed to evaluate and approve any changes to the design documents, contracts, and contract drawings. However, 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

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.

2 SCRTD Office of Contracts, Procurement, and Materiel, Procedures Manual, no date; SCRTD Rules and Regulations, Section 8 and 9 (Purchasing and Sales of District Property), 28 July 1983; 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.

Change Order procedures have been documented³ and cover such topics as:

- Class I and Class II Changes (Class I changes affect form, fit, function, cost, or schedule. Class II changes are routine changes, normally to improve the clarity of the project documentation.)
- Routine and 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.

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 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

3 PDCD, Metro Rail Project Control Procedures Manual, August 1986.

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, 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 a representative from SCRTD's Office of Contracts, Procurement, and Materiel will meet with the contractor to negotiate the cost of the Change Order. The representative from SCRTD's Office of Contracts, Procurement, and Materiel will prepare a summary of negotiations.
- The Change Order and the summary of negotiations will be transmitted for approval, depending on the dollar value of the Change Order, as follows:
 - Under \$10,000 - approval by the TSD Project Engineer
 - Between \$10,000 and \$25,000 - approval by the TSD Director of Construction Management
 - Between \$25,000 and \$50,000 - approval by the Contracting Officer's Representative and the Assistant General Manager/TSD
 - Between \$50,000 and \$100,000 - approval by the SCRTD General Manager
 - Over \$100,000 - approval by the SCRTD Board of Directors.
- 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.

MTA LIBRARY

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

Procedures⁴ 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.

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

⁴ SCRTD, Office of Contracts, Procurement, and Materiel, Procedures Manual, no date.

- 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.
- The SCRTD Contracting Officer's Representative will formally request claim details from the contractor.
- The contractor will prepare and submit the claim, which will be distributed to the TSD Directors of Construction Management, Transit Facilities, Systems Design and Analysis, and Program Control, to relevant consultants, and to the SCRTD Legal Department.
- 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 in accordance with the process described in the previous section.
- 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 Plan¹ 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.

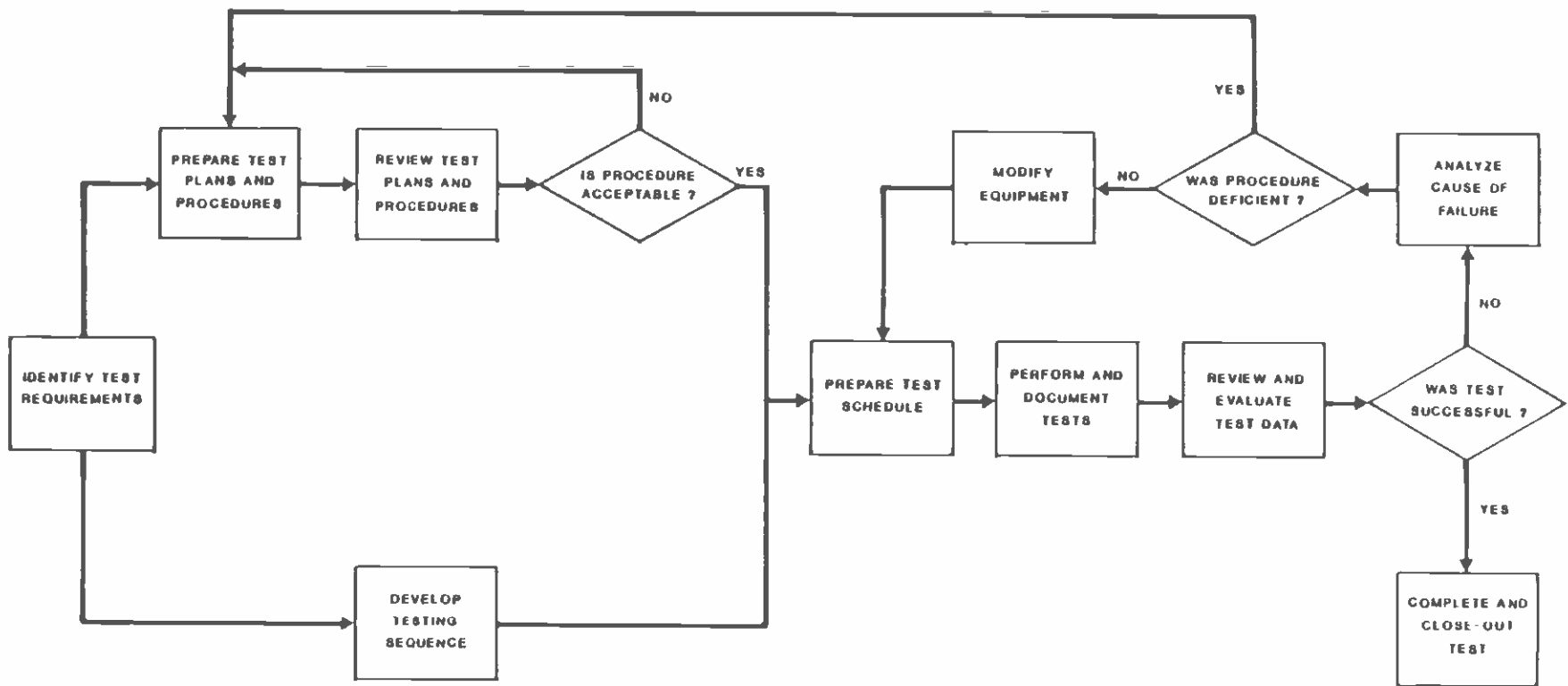
9.1 TEST PLANNING

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

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 Team² 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

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.

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

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

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 control⁵ manual. These plans will be implemented by the Resident Engineer.

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.

12.0 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

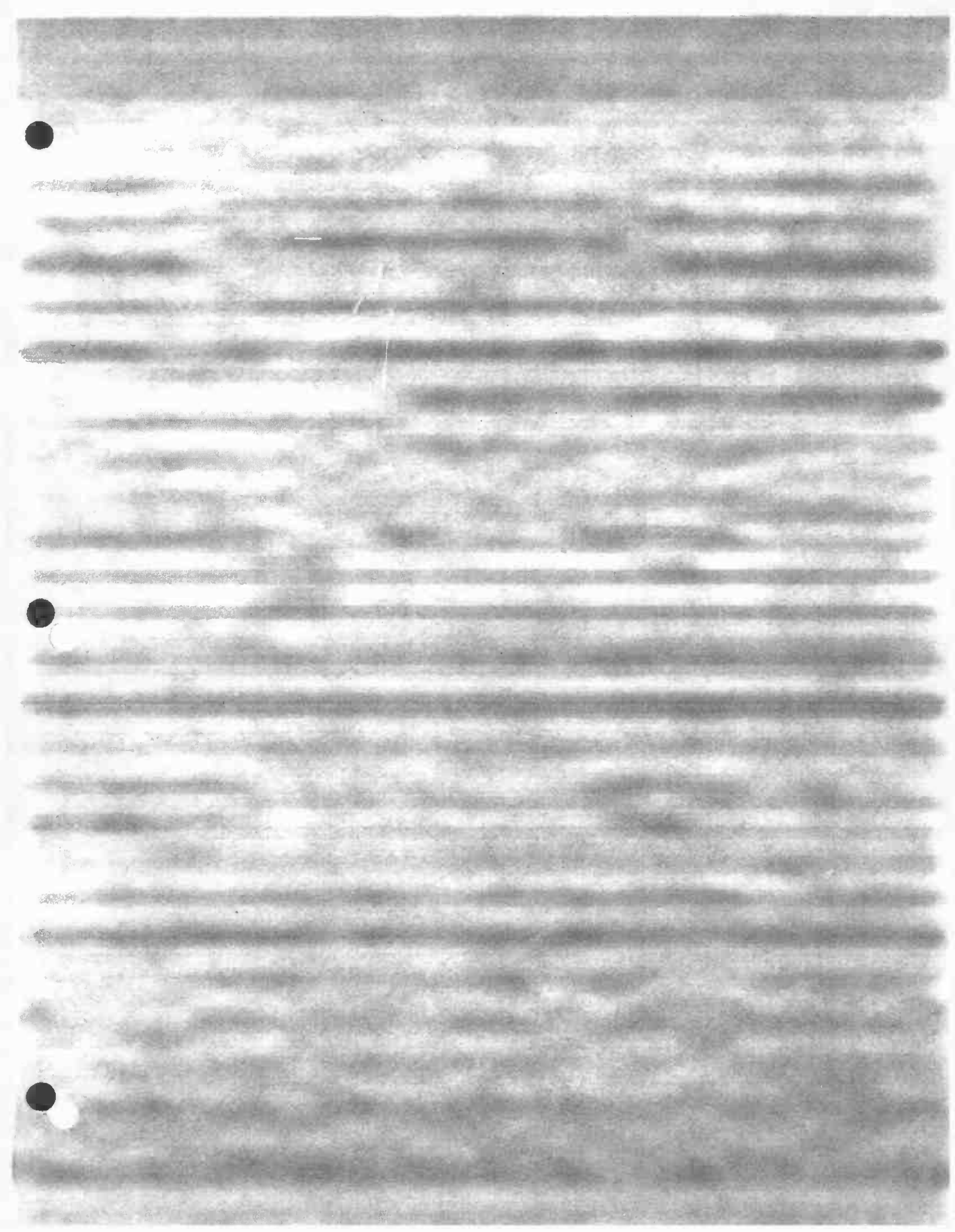
The Assistant General Manager/TSD is responsible for the maintenance of the Plan and for directing revisions to its contents when agreement has been reached with UMTA, and authorization has been given by the General Manager.

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.

13.0 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.

Subtask	Date	Page	of
Subject		Preparer	

15 SEP 86

PROGRAM CONTROLS SECTION OF
THE MANAGEMENT PLAN

EILEEN LOCKLAND	JEFF
JOEL SANBORG	TEAN
LESS ELLIOT	PAUL

REVIEWED ITEMS 2, 3, 4, 5 & AGREED
TO INCORPORATE JEFF'S SUGGESTIONS

PROGRAM CONTROL HAS NUMEROUS COMMENTS ON CHAPTER 7.0 BUT UNTIL THE KEY ISSUES CAN BE RESOLVED IT DOES NOT MAKE ANY SENSE TO DISCUSS THE NON-KEY ISSUES. GENERAL COMMENTS ARE LISTED FIRST:

1. I DO NOT SEE HOW PROGRAM CONTROL, DISTRICT ENGINEERING DEPARTMENTS, OR ANY LEVEL OF MANAGEMENT WILL USE THE INFORMATION IN CHAPTER 7.0 TO "CONTROL" ANYTHING. THE "WHO" AND ESPECIALLY "WHAT" ARE MISSING.

NO PROBLEM WILL PUT IN BUDGET SECTION

2. UNLESS IT WAS AN OVERSIGHT, ANY DISCUSS ON PROGRAM CONTROLS (THE DEPARTMENT OR THE FUNCTION) MUST ADDRESS THE ROLE OF ESTIMATING. THE CURRENT CHAPTER 7.0 OMITTS THE ROLE OF THIS FUNCTION.

3. EARLY PMP OUTLINES (PREPARED BY BAH, SDFA, OR PROGRAM CONTROL) CONTAINED A SECTION FOR REPORTING (WHAT, WHEN, AND TO WHOM). THE CURRENT CHAPTER 7.0 OMITTS THIS AREA.

NO PROBLEM WILL PUT IN SECTION 7.0

4. TWO KEY DOCUMENTS, THE FINANCIAL PLAN AND THE CUD, ARE NOT ADDRESSED IN THE NEW CHAPTER 7.0. BOTH DOCUMENTS ARE THE LYNCH PINS FOR OUR BASELINE MANAGEMENT AND INTEGRAL PARTS OF THE FULL FUNDING CONTRACT WITH UMTA.

5. THE ROLE OF STATUS (PROGRESS) REPORTING TO THE GRANTORS IS NOT ADDRESSED. THEY ALL HAVE INDICATED THIS IS IMPORTANT TO THEM.

6. EXHIBIT T-3, THE PROGRAM CONTROL PROCESS, IS AT BEST DIFFICULT TO READ AND AT THE WORST IS MISLEADING.

ON SECOND THOUGHT, IF THESE GENERAL COMMENTS CAN BE MUTUALLY RESOLVED EVERYTHING ELSE IS SECONDARY. I LOOK FORWARD TO OUR FRIDAY AFTERNOON WORK SESSION.

Jeff Christensen
9/9/86

CC: JOEL S.

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT

TO: JEFF FROM: TERRY DATE: 4 DEC 87

SUBJECT: PMP CHAPTER 7

ATTACHED ARE MY COMMENTS ON
CHAPTER 7 OF THE PROJECT MANAGEMENT
PLAN.

Terry Sherry

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.

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

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

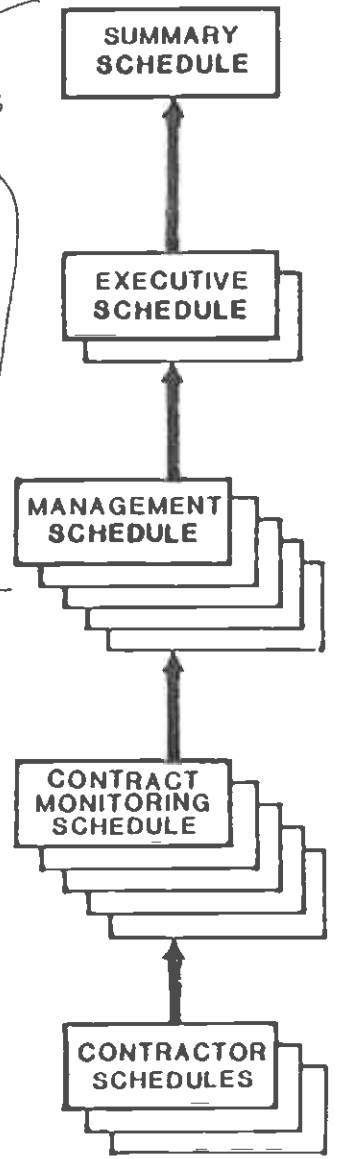
SCHEDULE TYPES

RESPONSIBILITY

FUNCTION

THE TITLES OF THE SCHEDULES DO NOT MATCH THE TITLES ON PAGE 7-5

7-6



LEVEL 0
TSD

SUMMARY SCHEDULE

- 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.

LEVEL 1
TSD

EXECUTIVE SCHEDULE

- PREPARED FOR RTD GENERAL MANAGER AND ASSISTANT GENERAL MANAGER-TSD.
- SUMMARIZES KEY AREAS BY CONTRACT (DESIGN, BID PROCESS, CONSTRUCTION).
- BARCHART FORMAT.

LEVEL 2
TSD

MANAGEMENT SCHEDULE

- 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.

LEVEL 3
CM

CONTRACT MONITORING SCHEDULE

- PREPARED FOR CONSTRUCTION MANAGER, RESIDENT ENGINEER.
- BASIS FOR CONTRACTUAL MILESTONES. (SUMMARIZED TO LEVEL II).
- CRITICAL PATH NETWORK FORMAT.

LEVEL 4
CONTRACTOR

CONTRACTOR SCHEDULES

- 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.

BY EACH CONTRACTOR

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

- 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

SHOULD MICHELLE OR SOMEONE UPDATE THIS BASED ON OUR NEW REPORT FORMAT.

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

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).

THIS SEEMS OUT
OF PLACE IN
PROGRAM CONTROL
SECTION. IF THIS
IS TO REMAIN, SHOULD
REDUCE TO VE

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.

DOES THIS WORK THIS WAY?

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.

BY WHOM?

IS THIS TRUE?

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.

IN TRUTH PROGRAM CONTROL HAS NO INPUT OR STROKES

DOES THIS HAPPEN

THE ACTUAL ROLE OF PROGRAM CONTROL IS EVEN LESS THAN THAT. WHAT THIS WRITE UP INFERS. SUGGEST THIS BE ELIMINATED. COM PROGRAM CONTROL WRITE UP.



7.0 PROGRAM CONTROL

A program control process has been established for the Metro Rail Project to ensure that the scope, budget, and schedule of the project are properly managed. The process has three cornerstones against which project performance will be measured:

- 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 will be described in this chapter together with a description of the program control process.

7.1 SCOPE OF THE WORK

The scope of construction 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 the construction activities has been segmented into a series of contract packages for which bid documents and specifications have been prepared. 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 the Metro Rail Project.

To provide a framework for management visibility and control of the construction activities, a Work Breakdown Structure (WBS) has been prepared (see Exhibit 7-1).¹ 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 a numbering system for uniquely identifying each element with an alphanumeric code which is used for accounting and for document filing.

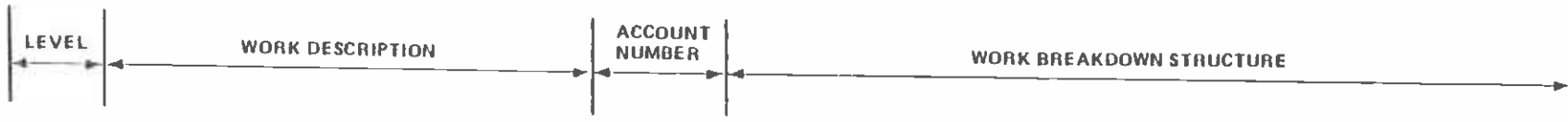
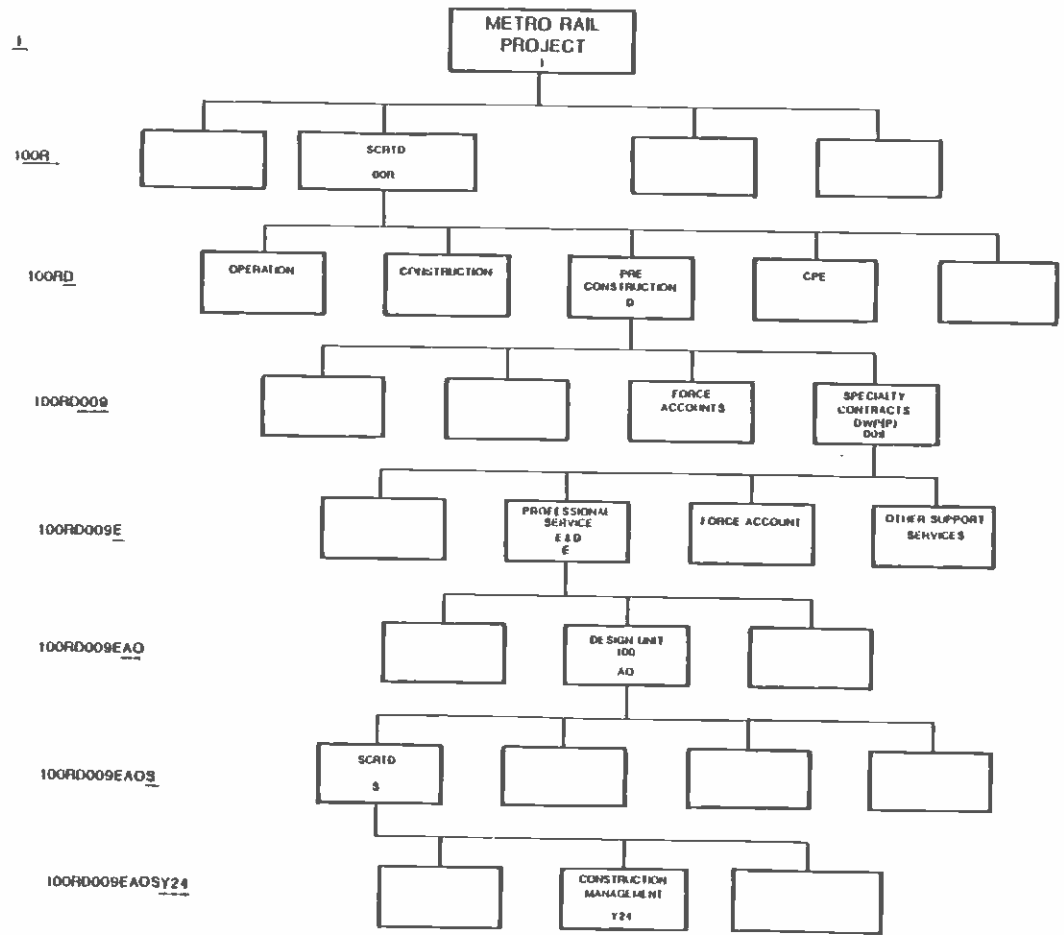
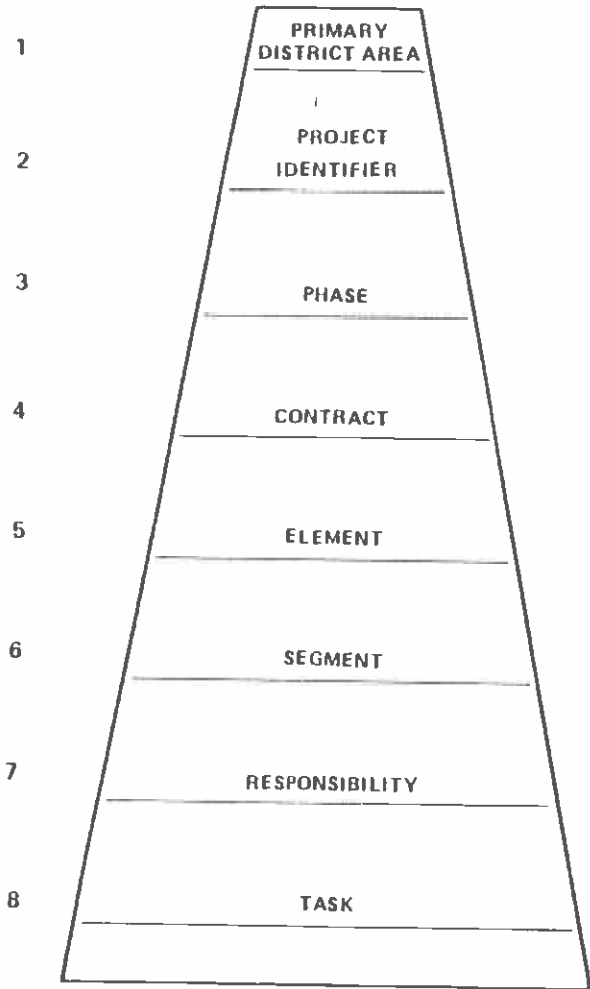
7.2 PROJECT BUDGET

A budget for the entire Metro Rail Project has been prepared. The 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 has also been included in the budget for unexpected events. The budget was a basis for the full funding contract with UMTA.

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

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

EXHIBIT 7-1 Work Breakdown Structure



requirements, and for real estate acquisition. The obligation plan conforms to the availability of funds from UMTA, the State of California, Los Angeles County, and the City of Los Angeles. The cash flow plans identify the amount of obligated funds to be expended in each month. Collectively, the project budget, the obligation plan, and the cash flow plan form the financial projections for the Metro Rail Project.

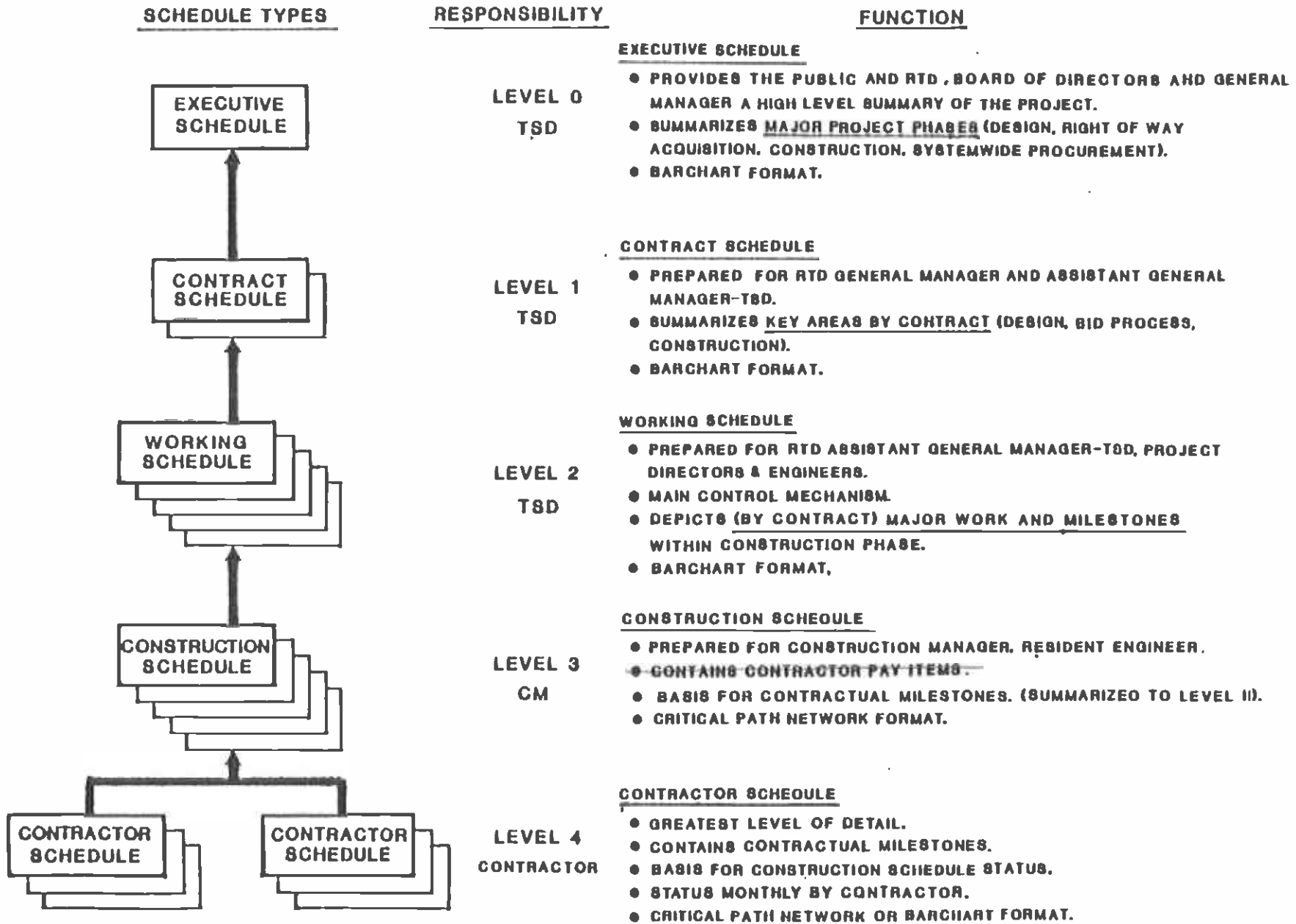
7.3 PROJECT SCHEDULE

To adequately plan and control the initiation and completion of events on the Metro Rail Project, detailed schedules have been prepared.² The schedule hierarchy, shown in Exhibit 7-2, has five levels:

- Level 0 is the executive schedule which provides a brief overview of project events 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 I is the contract schedule which presents, in the form of a bar chart, the major milestones for each construction contract on the project. It will be used for reporting progress to the SCRTD's General Manager.
- Level II is the working schedule which presents major milestones, ^{IN A BAR CHART FORMAT} and more detailed information on the critical path in the form of a precedence diagram. It will be used by the Assistant General Manager of TSD to monitor and control progress on the project.

2 SCRTD, Metro Rail MOS-1 Baseline Schedule, Rev. 4, July 1986.

EXHIB 2
The Schedule Hierarchy



X

- Level III is the construction management summary schedule which is used to measure, and report on, contractor progress.

- Level IV is a contract schedule showing the ~~lowest~~^{GREATEST} level of detail for each contract. Schedules are prepared and maintained by each contractor and submitted to the SCRTD for approval.

The SCRTD and its consultants will use the Level III and Level IV schedules for day-to-day monitoring of progress during Metro Rail construction. As circumstances on the project change, these detailed schedules will be updated and the Level O-II schedules will be modified accordingly. *WEAK SENTENCE*

7.4 PROGRAM CONTROL PROCESS

The program control process involves monitoring all work that is being conducted on the project, ^{ASSESSING STATUS} ~~measuring progress~~ against schedule and budget objectives, and taking appropriate management actions. ^{DUETO THE LARGE} The volume of information on the Metro Rail Project ~~will be large.~~ Accordingly, an automated program control computer program -- The Transit Automated Control System (TRACS)³ -- will be used to store, analyze, and report on cost and schedule performance. 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.

3 SCRTD Metro Rail Project, Transit Automated Control System,

X

- 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 Order: 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 provide reports to alert SCRTD management of cost and schedule problems. To properly control the entire Metro Rail Project, a rigorous program control process will be applied to all activities. Monthly cost, schedule, and ^{STATUS} ~~progress~~ ^{OF} data from each contract will be carefully analyzed by SCRTD and consultant staff. After review, the data will be entered into TRACS, which will integrate the new information into the existing data base for the project. In addition, monthly data from each construction contract will be consolidated by the CM consultant into an overall Monthly Construction Performance Report. This report will include:

- IS THAT RIGHT?

- Variances in the major milestones shown on the Level II schedule
- Construction status compared to the Level III schedule
- An outlook for the activities to be conducted on the project in the next month.

The Program Control ^{DEPARTMENT} ~~Office~~ within the TSD Department has been given a special, independent "watch dog" role on the project. Acting for the Assistant General Manager, 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 ^{DEPARTMENT} ~~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 of TSD and will involve senior TSD managers and consultant staff. The meetings will review ~~progress~~ ^{STATUS} on the project and address

?
WHAT DOES THIS MEAN?

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.

ADD
NOTHING

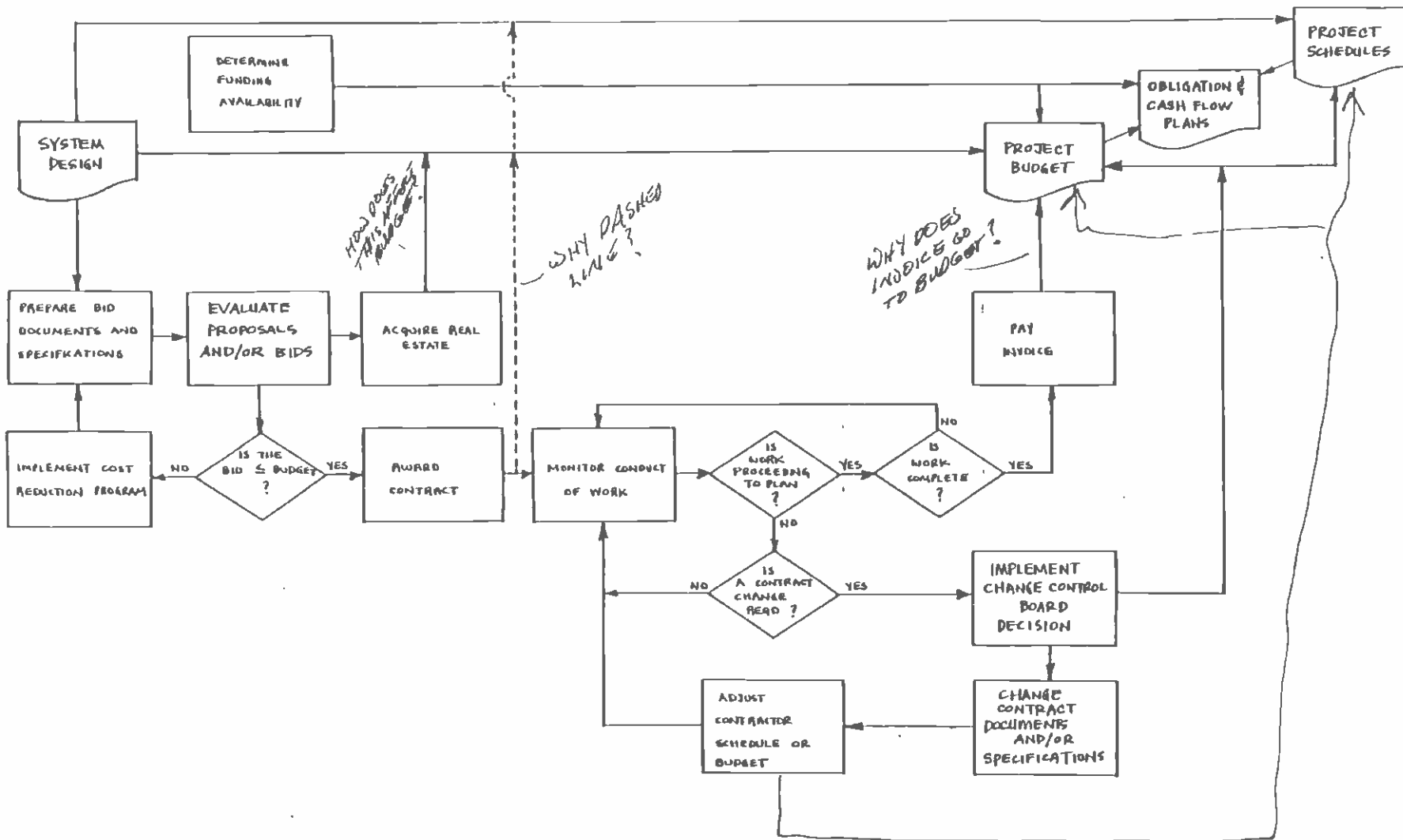
The program control process to be applied to each construction and procurement contract, and to activities conducted by the SCRTD and its consultants, is described below.

7.4.1 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, ^{STATUS} progress is ^{ASSESSED} 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, and configuration management (see Chapters 5.0, 6.0, and 8.0).

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 bidding. The Assistant General Manager of TSD will review and approve each contract package before it is released for advertising. In addition, he will conduct a weekly review of the status of each contract package to ensure their timely completion.

EXHIBIT 7-3
The Program Control Process



WHAT DOES THIS ADD ?

Proposals which are received for each contract will be kept in a secure place and an evaluation team will review each proposal for compliance with the design requirements.

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 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 of 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.

REAL ESTATE ACQUIRED

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~~ ^{WORK ACCOMPLISHED} on their contract
- 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 SCRTD and its consultants to verify their accuracy. If the work which 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 ^{DEPARTMENT} Office. If the invoice is not consistent, the contractor will be required to change it before payment is made. The Program Control ^{DEPARTMENT} Office will consolidate all monthly reports into a monthly project status report for the information of, and action by, SCRTD senior management.

MAY HAVE
NOTHING
TO DO WITH
INVOICE

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 implement a schedule recovery plan or the liquidated damages provisions of the contract will be invoked to recover costs incurred by the SCRTD as a result of the schedule slippage.

In the course of each contract, circumstances may arise which require a change to the contract documents. For such circumstances a change proposal will be prepared for review and approval by the Change Control Board (CCB). 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. The CCB decisions will be communicated to the contractor in writing so that the change can be implemented.

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 and either approved or denied. Claims which are approved 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, accept or reject the completed work, and close out the contract.

7.4.2 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 and analyzed 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 of TSD and the SCRTD General Manager before being adopted by the Board of Directors. After adoption by the Board, the project budget and financial plans will be updated. 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 and expenditures which will be reviewed by the Program Control Office, and the financial records of the project will be updated.

THIS DOES NOT ACCURATELY STATE WORK BY SCRTD PROGRAM CONTROL. WHAT IS MEANT BY DEPARTMENTS? PLURAL?

7.4.3 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 office responsible for managing the consulting will review each annual proposal and negotiate the annual cost in conjunction

NOT SPECIFIC VERY GENERAL

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 the cognizant technical personnel and by the Program Control ^{DEPARTMENT} Office and the financial records of the project will be correspondingly updated.

In total, these activities and tools will provide SCRTD management with the visibility required to control the project.

8.0 CONFIGURATION MANAGEMENT

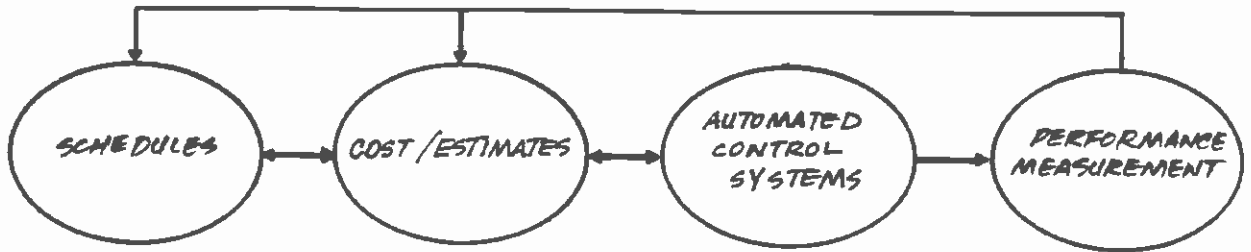
7.0 PROGRAM CONTROL

In today's environment of limited budgets and tight schedules, a fundamental management responsibility for design and construction programs is to insure that the status of all participants can be reported accurately and timely. Successful accomplishment of this responsibility is the result of a combined effort between the Southern California Rapid Transit District (RTD or District) and its contractors.

To provide this management capability for the Metro Rail Project, the Program Control department was delegated the responsibility to develop and maintain a system to monitor and forecast the status of the cost, schedule, and performance objectives of the Project. This system, described here in detail, supports an environment in which the design, procurement, construction, and control functions interact synergistically (see Exhibit 7-1). The Director of Program Control is responsible for these activities and is supported by Program Control personnel in the District, General Consultant ¹, and Construction Management Consultant ² offices.

PROGRAM CONTROL EXHIBIT 7-1

PROGRAM CONTROL SYSTEM



	SCHEDULES	COST/ESTIMATES	AUTOMATED CONTROL SYSTEMS	PERFORMANCE MEASUREMENT
<u>DATA</u>	<ul style="list-style-type: none"> • ACTIVITIES • DURATIONS • HOURS • LOGIC • CONTRACT CHANGES • CLAIMS 	<ul style="list-style-type: none"> • ESTIMATES • BUDGETS • ACTUAL COSTS <ul style="list-style-type: none"> - INVOICES - LABOR - EXPENSES/G&A • CONTRACT CHANGES • CLAIMS 	<ul style="list-style-type: none"> • ACTUAL COSTS <ul style="list-style-type: none"> - INVOICES - LABOR - EXPENSES/G&A • WBS • BUDGETS • CONTRACT CHANGES • CLAIMS 	<ul style="list-style-type: none"> • MEETINGS • REPORTS / COST SCHEDULES • TRACS
<u>INTERFACES</u>	<ul style="list-style-type: none"> • DISTRICT MANAGEMENT • ENGINEERING (DISTRICT AND GENERAL CONSULTANT) • CONSTRUCTION (DISTRICT AND CONSTRUCTION MANAGER) • REAL ESTATE • PROCUREMENT • COST ESTIMATING • COST CONTROL 	<ul style="list-style-type: none"> • DISTRICT MANAGEMENT • ENGINEERING (DISTRICT AND GENERAL CONSULTANT) • CONSTRUCTION (DISTRICT AND CONSTRUCTION MANAGER) • REAL ESTATE • PROCUREMENT • SCHEDULING • ACCOUNTING 	<ul style="list-style-type: none"> • PROCUREMENT • ACCOUNTING • PROGRAM CONTROL • CONSTRUCTION MANAGEMENT • GENERAL CONTRACTOR • REAL ESTATE 	<ul style="list-style-type: none"> • PROGRAM CONTROL • DISTRICT MANAGEMENT • CONSTRUCTION MANAGER • GENERAL CONSULTANT • REAL ESTATE • FUNDING AGENCIES
<u>REPORTS</u>	<ul style="list-style-type: none"> • EXECUTIVE SCHEDULE • DETAILED SCHEDULES • STATUS • ACTION LISTS • FINANCIAL PLAN • ANALYSIS 	<ul style="list-style-type: none"> • PROJECT COSTS <ul style="list-style-type: none"> - FINANCIAL PLAN - BUDGET - COST TO DATE - FORECAST • TRENDS • CHANGE HISTORY • ANALYSIS • STATUS 	<ul style="list-style-type: none"> • COSTS TO DATE • CHANGE HISTORY • COST REPORTS <ul style="list-style-type: none"> - BUDGET - CHANGE ORDERS - EXPENDITURES • STATUS • REAL ESTATE 	<ul style="list-style-type: none"> • VARIANCE ANALYSIS
<u>RESPONSIBILITY</u>	SCHEDULE SECTION OF PROGRAM CONTROL DEPARTMENT	COST/ESTIMATE SECTIONS OF THE PROGRAM CONTROL DEPARTMENT	SYSTEMS SECTION OF THE PROGRAM CONTROL DEPARTMENT	TECHNICAL MANAGERS

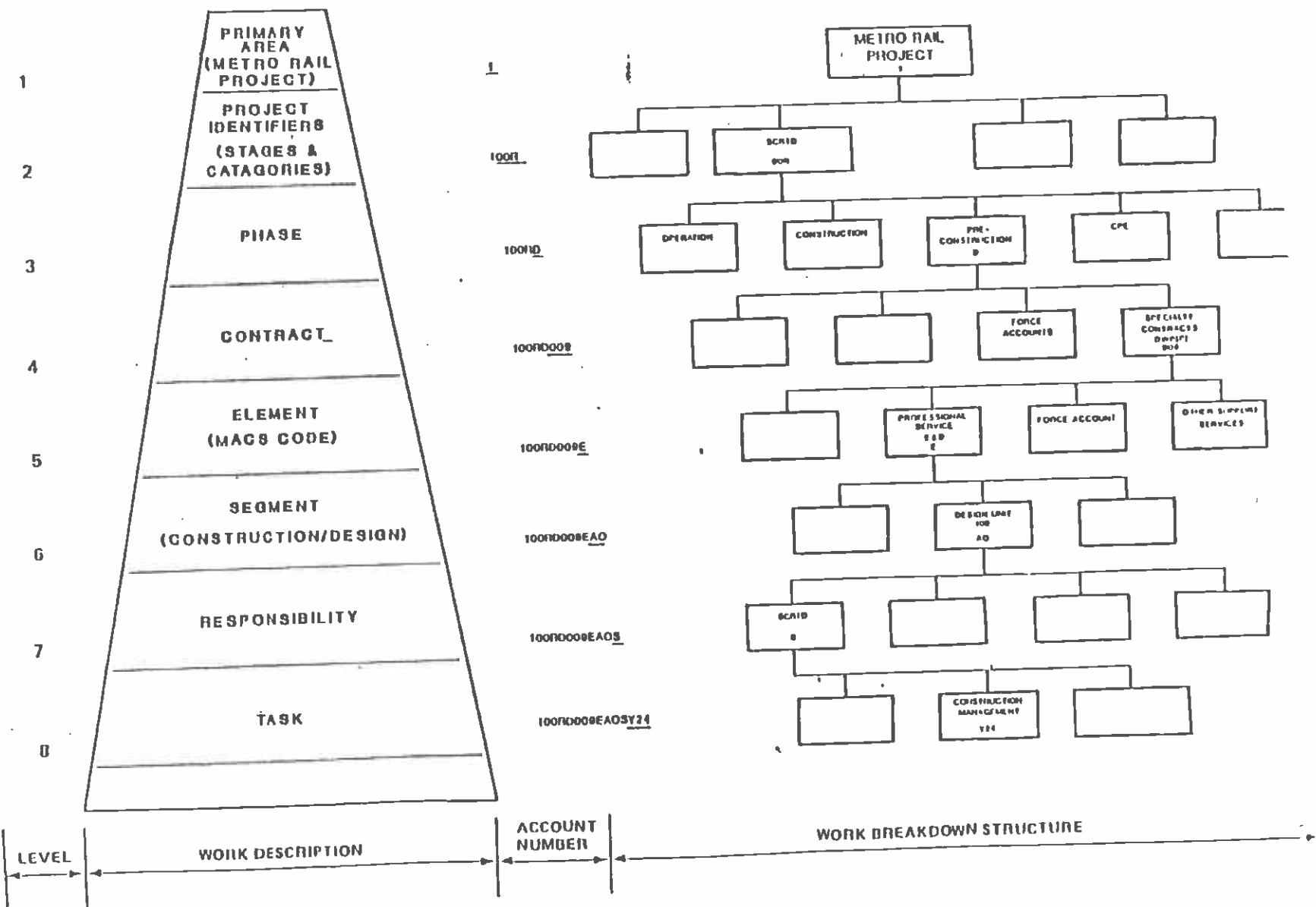
Program Control is the focal point for collecting, disseminating, and controlling all cost, schedule, systems, and estimating information. Program Control serves as the internal "watch dog" to assist the District and consultant management in controlling the Project. Program Control also provides independent assessments of reports and Project status submitted by consultants and contractors, recommendations for alternative courses of action, and feedback on implementation of any such actions.

1. MRTC Project Control Procedures Manual, 4/16/84
2. PDCD Project Control Procedures Manual, 8/12/86

The AGM/TSD provides overall policy direction to the Director of Program Control. The Director of Program Control, in turn, provides daily direction and guidance to the Program Control Managers in the District and the Program Control staffs in the General Consultant and the Construction Management Consultant offices. In addition, the Director of Program Control conducts bi-weekly Program Control staff meetings to discuss activities of the consultant staffs and to resolve outstanding Program Control

EXHIBIT 7-2

Southern California Rapid Transit District
Work Breakdown Structure



APR 1966

issues.

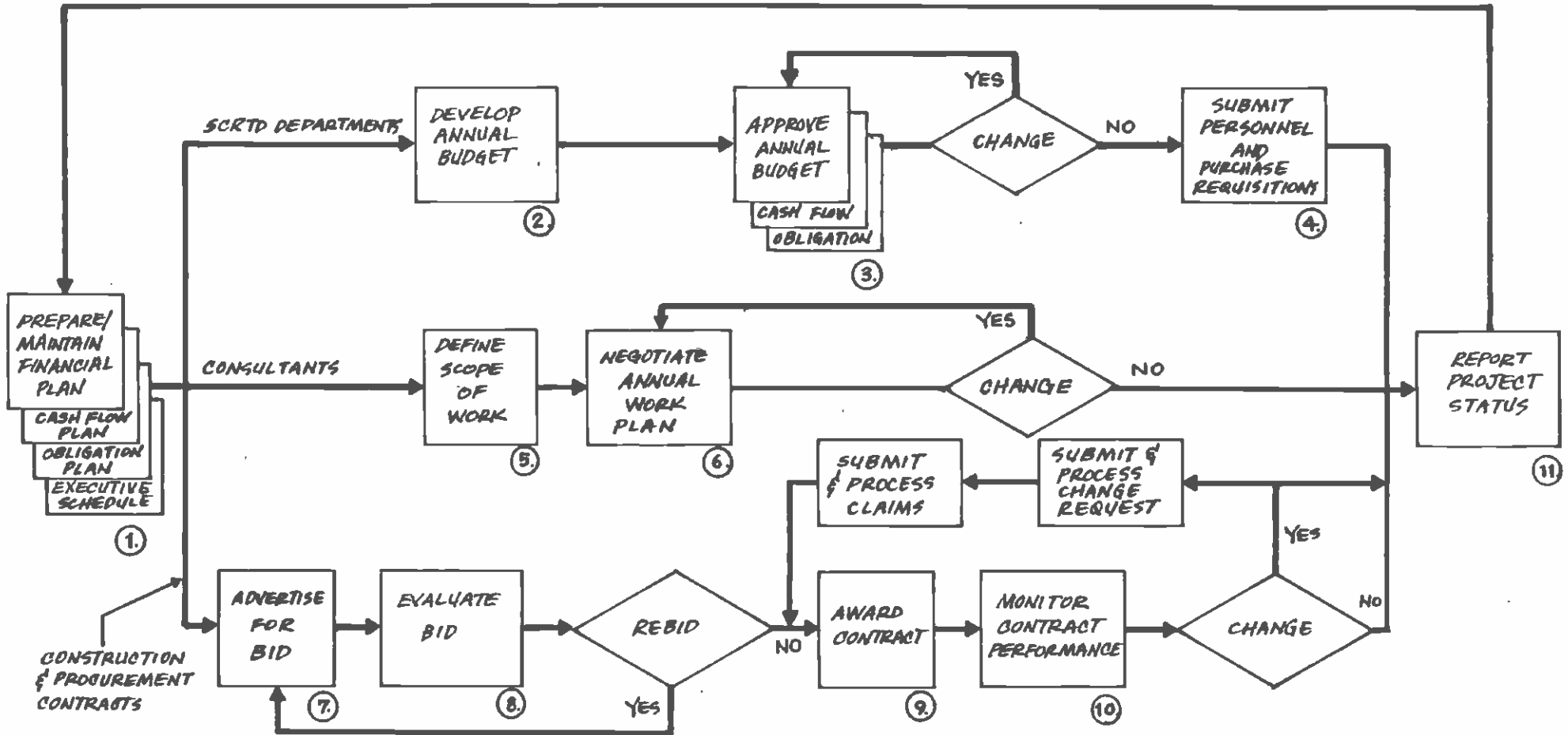
A key element in the Program Control system is the standardized approach for management to effectively plan, monitor, and control the Project. Standardization is provided through the use of a Work Breakdown Structure (WBS)³. The WBS lays the foundation for a comprehensive Project plan through the use of a hierarchical system that subdivides the Project into manageable units of work. These units of work are assigned to project managers who further define the level of detail necessary for proper Project control (see Exhibit 7-2).

3. WBS Dictionary and Manual, 2/20/86

This chapter also addresses the closed-loop process for controlling the Project's budget and schedule. Control is continually exercised by individuals responsible for each segment of the Project to prevent deviations to the planned costs or schedules (see Exhibit 7-3).

The work flow is divided between the following three groups: RTD, consultants, and construction and procurement contractors. As Exhibit 7-3 shows, the work flow is closed-loop with control

CLOSED-LOOP WORK FLOW



exercised at several points. An explanation of these controls is presented below:

1. The control process begins with Program Control developing cost baselines from estimates generated from GC design packages and schedule baselines generated from preconstruction schedules developed by the CM. These baselines have been integrated into the Project Financial Plan, the single governing document defining the performance objectives of the Project. The Financial Plan contains base and escalated cost information and advertise, notice to proceed, and completion dates for construction/procurement contracts. (Complete descriptions of the construction contracts are contained in the Contract Unit Description document, which is kept current and distributed by Program Control). The Financial Plan also includes costs associated with Professional Services Contracts, the District's internal costs, Right-of-Way, Owner Controlled Insurance, and Contingency. The cost information in the Financial Plan was the basis for the budgets approved in the Full Funding Contract with UMTA. This information was also used to develop Project obligation and cash flow plans. The obligation plan defines the amount of funds required in each year for awarding contracts, for agency staff and equipment requirements, for real estate

acquisition, and so on. This plan must reconcile with the annual availability for funds from various grantors and benefit assessments. The cash flow plans identify, for the District Treasurer, the amount of obligated funds that will be expended in each month.

2. Within RTD, the departmental requirements (staffing plans, equipment needs, and professional services) and objectives for support of the Project are identified during development of each fiscal year budget. This process usually begins in January, six months before the start of the new fiscal year. The budgets submitted by each District department are collated and analyzed by Program Control for the AGM/TSD. The AGM/TSD maintains control over the Metro Rail elements of the District budget by approving the package before it is submitted to the General Manager.

3. The proposed budget for each fiscal year is reviewed and approved by the General Manager, prior to being submitted to the Board of Directors. Board adoption normally occurs in June. After adoption, Program Control incorporates Board directed changes into the cash flow and obligation plans.

4. The annual budget is implemented through the use of requisitions to acquire new personnel, equipment, or professional services. All purchase requisitions are reviewed by Program Control for conformance to the budget prior to AGM/TSD approval. Accounting summarizes District timecards into a monthly report of manhour expenditures by department. This report, plus a review of invoiced expenditures, is also summarized into a monthly report, and is used by Program Control to show status against approved budgets.

5. During the last quarter of the contract year, each major consultant is given a scope of work required by the District for the next annual work plan. The consultants submit an annual work plan proposal, with a work schedule, staffing plan, staffing plan justification, and the proposed cost for labor, overhead, other direct expenditures, and fees. The department responsible for managing each consultant reviews the proposed plan against the available budget guidelines approved in the District budget, and provides a recommendation and basis for negotiations.

6. Following the submittal and negotiation of the consultant proposals, the next annual work plans and budgets are approved by the AGM/TSD and submitted to the Board for concurrence.

7. Numerous points of control exist for construction and procurement contracts. Prior to advertising, control is exercised through a Bid Certification Checklist, prepared by Program Control under the direction of the project manager for each contract. The Checklist states actions and responsibilities to insure that a contract can be released for advertising. Weekly meetings are conducted by the AGM/TSD to review the status of each item on the checklist with the assigned project manager. All construction and procurement purchase requisitions are reviewed by Program Control and the AGM/TSD and approved by the Board of Directors prior to advertising.

8. The bid evaluation process provides another control point for District project managers. Bid review and award criteria are prepared by the Director of OCPM, with input from other District Directors. A District review team reviews each bid against these criteria for technical responsiveness, compliance with contract terms, and consistency with the Engineer's Estimate. The review team may recommend rebidding if the bids are not responsive to these criteria or the Estimate.

9. Following contract award, each contractor submits a detailed (Level IV) schedule of his plan to accomplish the work.

This schedule must comply with contractually specified milestones. Specification 01310, networks, and Specification 01311, bar charts, contain the process by which a contractor will submit his schedule. ⁴ The RE and the District's project manager review these schedules and request changes until they are satisfied that the methods, timing, and activity durations comply with contractually specified milestones. The schedule is then summarized and entered into the Program Control schedule system as the baseline for that contract.

4. Contract bid documents - General Conditions

10. Once a contract has been awarded, numerous control points exist in the construction process where the CM and the District can implement corrective actions. The more significant actions are listed below.

- o Direct changes - if project conditions change, for whatever reason, the District has the right to direct a change to the contractor, for which the contractor will submit a change proposal.

- o Direct work acceleration - The AGM/TSD can direct work acceleration if contractor performance proves insufficient to meet contractual milestones. The District determines performance from monthly status reports and schedule updates by the contractor, trend analyses prepared by the field staff, and weekly review meetings in the Management Information Center (MIC).

- o Approve progress payments - The RE will agree, based on daily field reports, on a monthly progress assessment as a basis for monthly progress payments. The progress payment including retention, will be reviewed and approved by the CM, the Director of Construction, and the contract administrator. The project engineer will approve, based on design and manufacturing status reports, invoices for payment of design and procurement contracts.

- o Approve change and claim requests - no changes to the construction or procurement contract baseline documents can be made without a change request approval by the Configuration Control Board (CCB). Change orders are

then negotiated by District representatives.

- o Assess liquidated damages - the construction and procurement contract documents include daily liquidated damage amounts which are assessed if the contractor fails to meet a liquidated damage milestone (identified in the Special Conditions).

- o Payments retention - a portion of the monthly progress payments are routinely withheld until fifty percent progress is achieved, after which retentions are released at the discretion of the AGM/TSD. Payment can also be withheld for failure of a contractor to submit a monthly schedule update.

The above control tools are secondary action items. The primary control lies in the daily working relationship the REs and their office staffs develop with the Contractor and his staff.

11. The grantors and District and CM management will be routinely informed on the current Project status through monthly reports, review meetings, and daily inspection reports. For construction contracts, this process begins with daily assessments of work in place and labor and equipment usage from CM field inspectors. The assessments are reviewed and approved by the RE in month-end progress review meetings with the contractor. Progress payments are determined at these meetings. The cost engineers and schedulers review field operations to insure coordination of information in status reports and that the MIC contains an accurate and thorough representation of current conditions. The RE and schedulers also review the contractor's monthly schedule update for compliance with the baseline plan.

The CM staff works with RTD Program Control and project managers to prepare information for the weekly Project status meetings in the MIC. The AGM/TSD chairs these meetings and reviews progress and problems presented by the RTD project managers. RTD, CM, and GC staffs are represented at these meetings to provide a full discussion of issues. All new and outstanding actions are tracked in a log which contains the name of the individuals responsible for the actions, a planned completion date, and relevant comments.

All contractors will prepare monthly progress assessment and forecast reports. These reports will be delivered to the RTD Director of Construction or Director of Systems Design and Analysis, as appropriate, and to Program Control. This information and monthly reports from the GC, SEA Consultant, and CM become part of the monthly and quarterly status reports prepared by Program Control. Section 7.5 addresses the type of information in these reports.

The reports prepared by RTD, the GC, the SEA Consultant, and the CM highlight areas of concern and recommend corrective action. The reporting of concerns and their potential trends are the responsibility of everyone assigned to the Project. Once identified, the problems are discussed at the weekly reviews with the District's Directors, and actions are taken by the appropriate Director or the AGM/TSD, depending on the nature of the problem. Program Control monitors the corrective action to assess its effectiveness, and reports the results to the involved Director and the AGM/TSD. If the corrective action is successful, the Project remains on schedule and within budget. If corrective action cannot affect the deviation, forecasts are produced identifying costs and schedule impact.

In summary, the primary functions of Program Control are to plan, organize, monitor, and control the Project to a successful completion.

7.1 SCHEDULE MANAGEMENT - INTRODUCTION

The timely accomplishment of activities on the Metro Rail Project requires the identification and control of events at many levels of management and supervision. To fulfill this requirement, and to assure a disciplined approach by management, identification of activities and contract milestones in the development of an integrated Metro Rail Project schedule is essential. All schedules are developed to provide the visibility and detail required at a specific level of management to control the Project. In addition, Project schedules contain milestones which portray significant controllable events.

7.1.1 PURPOSE

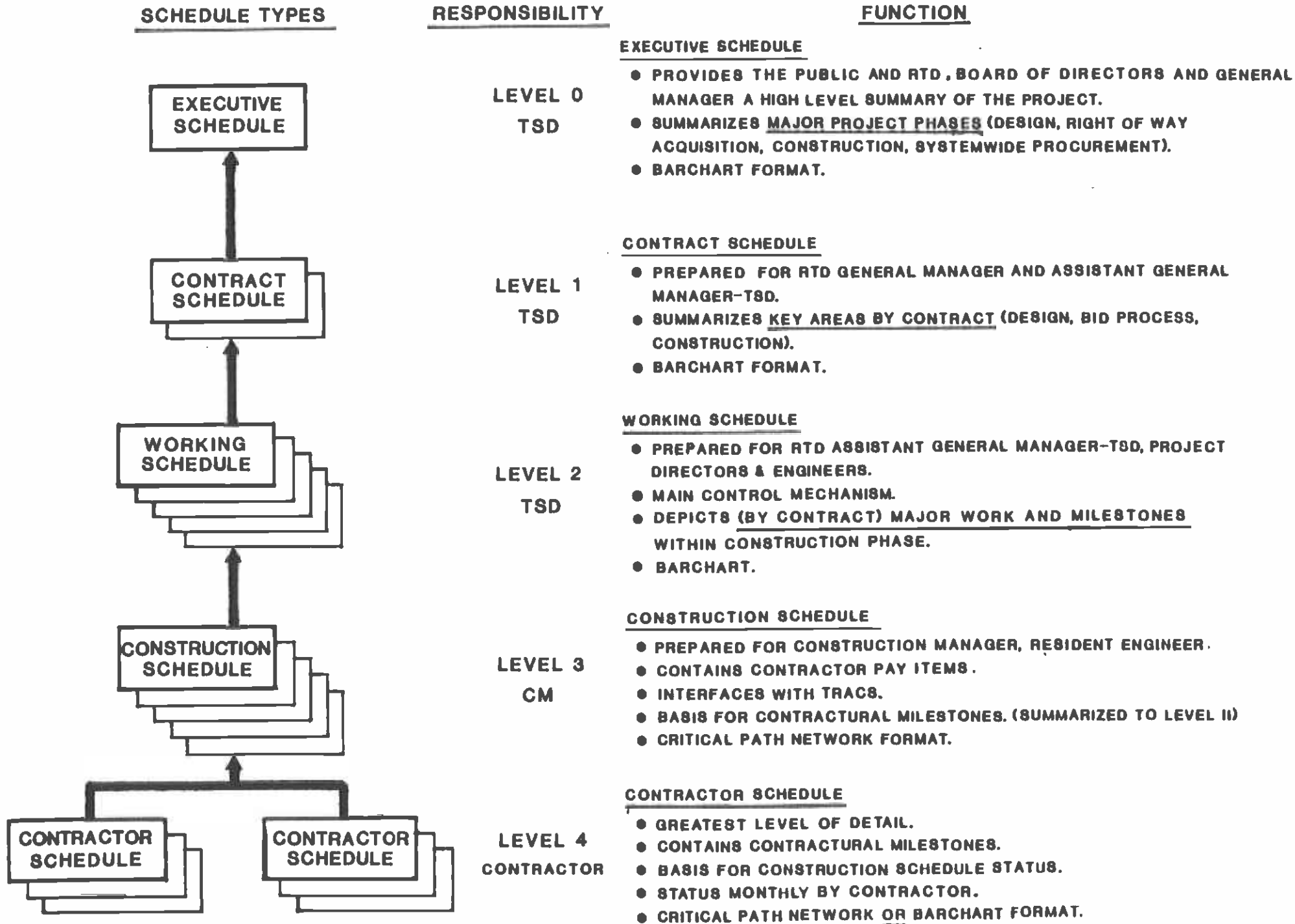
The complexity (long duration, large dollar value, and numerous funding agencies) of the Metro Rail Project requires a responsive, integrated, and formally controlled schedule management system. This system, and the role of Project participants in developing and maintaining Project schedules, is the subject of this section.

7.1.2 RESPONSIBILITIES

The AGM/TSD has final approval authority for the Project schedule. This authority is delegated, on a daily basis, to the Director of Program Control. The Director assigns responsibilities

SCHEDULE HIERARCHY

EXHIBIT 7-4



and commits the resources of the District and consultant scheduling staffs.

The schedule hierarchy for the Project contains five levels, 0 through IV (see Exhibit 7-4). The top level (0) contains the least detail, while the lowest level (IV) is the most detailed. To insure schedule standardization, the top four levels of the schedule are derived from the same data base. Standardization for Level IV is insured by the use of scheduling specifications (01310 for networks and 01311 for bar charts) in all contracts.

The responsibilities for schedule maintenance are divided among the three primary organizations involved with design, construction, and management of the Metro Rail Project: RTD, MRTC, and PDCD. The functions of these organizations in schedule management are described below.

7.1.2.1 RTD

The RTD Program Control department is responsible for establishing and maintaining the Metro Rail Project schedules. Consultants, under the direction of Program Control, assist with scheduling requirements of the Project. Specific responsibilities of the Program Control department are presented below:

- o Prepares and maintains the following schedules (see Exhibit 7-4):

- Level 0, Executive Schedule
This barchart schedule summarizes the major Project phases and provides a high level summary of the Project. The milestone dates for this schedule are provided by the AGM/TSD and General Manager. This schedule provides the public and RTD Board of Directors a summary of the MOS-1 Project.

 - Level 1, Contract Schedule
This barchart schedule is prepared for the General Manager and AGM/TSD. It 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. Input is received from the Project Directors, as well as the AGM/TSD. After the lower level schedules are developed, a review of the Level I schedule is made to confirm that the durations and sequence of the contracts are still valid.

 - Level II, Working Schedule
This barchart schedule is prepared for the AGM/TSD, Project Directors, and engineers. This document is the principal control schedule and is the baseline document controlled by the procedures described in Chapter 8.0. Input is received from the CM to establish sequence and construction methodology. The contract milestones are defined and monitored throughout the construction phase. Deviations are analyzed by Project Control and corrective action is recommended to District and Consultant Management. After the Level III and IV schedules are developed, the Level II schedule is reviewed to confirm that the milestone dates are valid.
- o Reviews design schedules submitted by MRTC and construction

schedules submitted by PDCD. All schedules submitted by the General Consultant and Construction Manager are reviewed by the RTD scheduling staff to insure they support established milestones and reflect the current contractual and Project requirements. After review, the schedules are submitted to the AGM/TSD for approval, and issued to project managers and consultants.

- o Reviews periodic reports submitted by MRTC and PDCD. All schedule progress reports submitted by the General Consultant and Construction Manager are reviewed for contractual and Project requirements. Data contained in these reports are verified and analyzed to assess current trends and forecasts. A monthly summary of this analysis is forwarded to the AGM/TSD.
- o Issues monthly and quarterly status reports to District departments and outside funding agencies. These reports reflect current information from the General Contractor, Construction Manager, and the District. The reports summarize the schedule status of the Project, identify areas of concern, and recommend corrective action. (See Section 7.5).
- o Provides all schedule information and milestone dates for the District. This includes contract milestone dates for advertising, notice to proceed (NTP), and contract completion for all construction/procurement contracts.

These milestone dates serve as the basis for schedule status and assessment of liquidated damages.

- o Maintains the MIC. This room provides a central location for material reflecting the current Project status. It contains charts showing status of contracts, schedules, and real estate acquisitions. The charts, schedules, and reports contained in the MIC allow management to see the current status of the Project. This data is statused and updated on a regular basis, and is an integral part of Project review meetings.

- o Prepares and coordinates special scheduling studies. During the course of the Project, occasions will arise which require indepth studies and analysis. These studies include the following:
 - Schedule and impact assessment of special designs
 - Impacts of scope of work changes
 - Development of work around schedules
 - Impact of procurement and contractor schedule variances.

Such special scheduling studies will be performed by the schedule section of the Program Control department or CM staff, with input from District project managers and Construction Management staff.

- o Coordinates and chairs Change Control Board (CCB) when schedule issues are discussed. This board reviews potential changes to the Contract Unit Descriptions (CUD) document or to the Level II schedule. CUD and schedule issues are

submitted to the AGM/TSD for approval. Upon approval, items are then reflected in an updated Level II schedule or CUD and distributed to District and consultant staffs. The Project is then monitored and controlled against these updated documents.

7.1.2.2 MRTC

MRTC performs the following schedule functions:

- o Prepares and submits system design schedules. Working with the Systems Design Engineering department of the District, MRTC defines the scope of work and develops systems design schedules. These schedules are used by project managers to assess design status and by the CM to identify design impact on construction schedules.
- o Participates in the CCB meetings when schedule issues are discussed. Also, submits scope of work changes and identifies design impacts on schedule or cost.
- o Prepares special scheduling studies which include the following:
 - Design estimate schedules
 - Design option impacts
 - Design review schedules

These studies are used to aid the District and the CM in allocating resources for design reviews and assessing impacts of design changes.

- o Issues the monthly Metro Rail Progress Report. This report includes status of the design schedule, highlights of the month, work planned for the succeeding month, and

identification of problem areas with recommendations. This report provides information for the monthly and quarterly reports issued by the District to the various funding agencies.

7.1.2.3 PDCD

PDCD performs the following scheduling functions:

- o Reviews and comments on design schedules. Current information is continually supplied by the District and the General Consultant. This information is reviewed and analyzed by PDCD to assess its impact on construction schedule activities and methodology. Areas of concern are identified and corrective action recommended to maintain current construction schedule milestones.

- o Reviews the contractor's Level IV schedule for compliance with contract requirements and reasonableness. Recommendations are made for approval or changing the schedule to meet the program objectives.

- o Develops and maintains a Level III construction/procurement schedule, which includes details for each contract. Upon award of each contract, the Level III schedule is updated using the data from the contractor's approved Level IV schedule. The updated schedule reflects the current plan

for meeting project milestones.

- o Prepares special scheduling studies which include the following:
 - Impact analysis of design changes
 - Analysis of equipment delivery and contract schedule variances.

These studies become the basis for corrective action recommendations made to District management.

- o Participates in the CCB meetings when schedule issues are discussed. Also, identifies scope of work changes and construction impacts, which are the basis for management action.
- o Prepares monthly status reports monitoring the schedule performance of the construction/procurement contracts. These reports are the basis for development of monthly and quarterly reports submitted by the District to the various funding agencies.

7.1.3 SCHEDULE HIERARCHY

Five levels of schedules are used for control of the Metro Rail Project (see Exhibit 7-5). These schedules range from general work functions at the executive level (Level 0) to detailed tasks at the contractor level (Level IV). The standardization of these schedules

SCHEDULE HIERARCHY

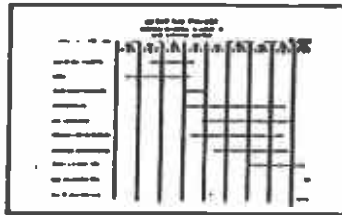
EXHIBIT 7-5

SCHEDULE LEVEL OF DETAIL

RESPONSIBILITY

FUNCTION

0

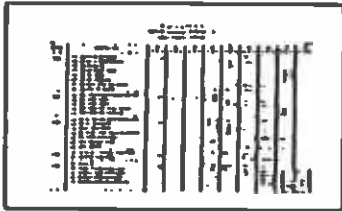


TSD

EXECUTIVE SCHEDULE

- 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.

I

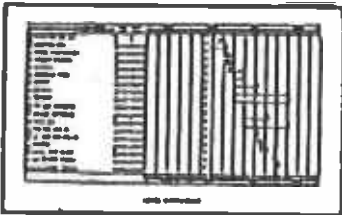


TSD

CONTRACT SCHEDULE

- PREPARED FOR RTD GENERAL MANAGER AND ASSISTANT GENERAL MANAGER-TSD.
- SUMMARIZES KEY AREAS BY CONTRACT (DESIGN, BID PROCESS, CONSTRUCTION).
- BARCHART FORMAT.

II



TSD

WORKING SCHEDULE

- PREPARED FOR RTD ASSISTANT GENERAL MANAGER-TSD, PROJECT DIRECTORS & ENGINEERS.
- MAIN CONTROL MECHANISM.
- DEPICTS (BY CONTRACT) MAJOR WORK AND MILESTONES WITHIN CONSTRUCTION PHASE.
- BARCHART.

III



CM

CONSTRUCTION SCHEDULE

- PREPARED FOR CONSTRUCTION MANAGER, RESIDENT ENGINEER.
- CONTAINS CONTRACTOR PAY ITEMS.
- INTERFACES WITH TRACS.
- BASIS FOR CONTRACTURAL MILESTONES. (SUMMARIZED TO LEVEL II)
- CRITICAL PATH NETWORK FORMAT.

IV



CONTRACTOR

CONTRACTOR SCHEDULE

- GREATEST LEVEL OF DETAIL.
- CONTAINS CONTRACTURAL MILESTONES.
- BASIS FOR CONSTRUCTION SCHEDULE STATUS.
- STATUS MONTHLY BY CONTRACTOR.
- CRITICAL PATH NETWORK OR BARCHART FORMAT.

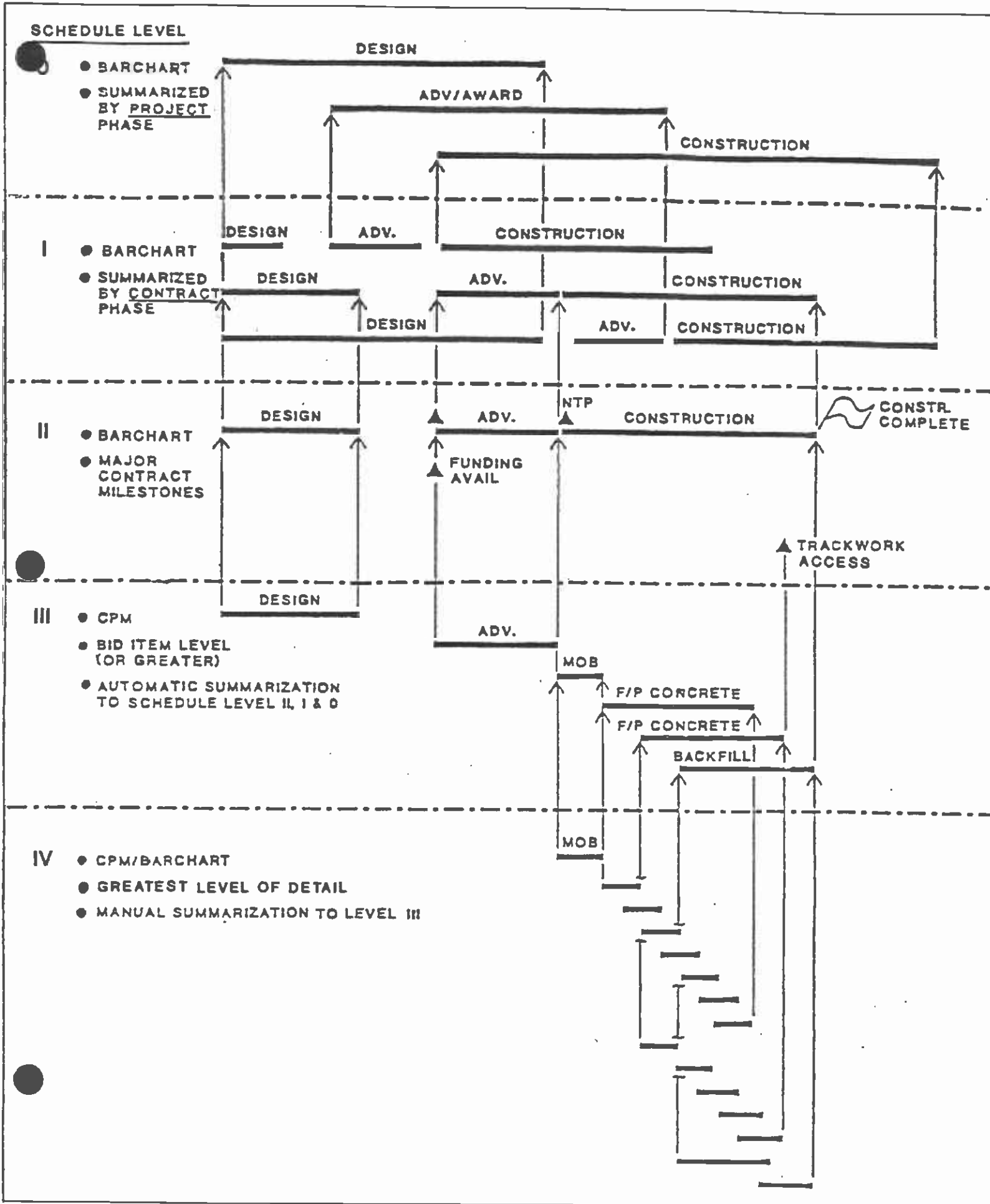
is insured by a "roll up" technique, whereby each level of schedule is rolled up into the next level (see Exhibit 7-6).

Scope definition, activities, duration, and logic become more detailed during the process of developing the lower level schedules. As a result, the lower level schedules may impact the sequence and durations of activities in the higher level schedules. This is the principal of the "rolling wave". Lower level schedules are developed based on the targets and milestones identified in the higher level schedule; however, due to more detailed information being available at the lower level schedule, the targets and milestones of the higher level schedules may have to be adjusted.

The impact of the "rolling wave" is especially evident in the Level III schedule. This schedule is developed by the CM to represent a logical and probable plan for achieving contractual milestone dates. After contract award, the contractor submits a Level IV schedule showing his detailed activities, durations, and logic. The Level IV schedule may differ significantly from the established Level III schedule. PDCD reviews and suggests needed changes to the Level IV schedule. When the Level IV schedule is approved by the District, PDCD summarizes the schedule into a revised Level III schedule.

Monitoring begins with the contractor reporting his status on the Level IV schedule, the lowest level, and PDCD and the District rolling the data into the higher schedule levels until it reaches Level 0, the highest level. With this roll up technique, consistency and accuracy is always maintained within each level of the schedule.

SCHEDULE ROLL UP RELATIONSHIPS EXHIBIT 7-6



RTD and its consultants will use the Level III and Level IV schedules to monitor status during the construction phase of the Project. Schedule status will be reported each month to the Program Control department, together with revised completion dates. If the revised completion dates affect the baseline completion dates, the contractor may be directed by the CM 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 department will analyze the situation and inform the AGM/TSD of the available options. Changes to the Project schedules affecting Level II schedule milestones will be reviewed and approved by the CCB.

7.1.4 SCHEDULE CONTROL

During the life of the Project, the Program Control department will continually monitor the status of design, procurement, and construction. The status of work completed is provided by the contractor and verified by the RE on the construction manager's staff. Program Control, with input from the RE, forecasts 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 is forecasted.

The forecasted end dates are compared with the current approved schedules and deviations are identified. The impact of the deviations are analyzed by Program Control and recommendations are presented to the RE. These recommendations are thoroughly reviewed with the RE and, when appropriate, the contractor is directed to take corrective action to regain schedule. If corrective action cannot maintain the schedule, the impact of the deviation on other contracts and the total Project is assessed. The entire schedule is then updated after approval by the CCB and becomes the current working schedule. Status is then monitored against the updated schedule.

7.2 ESTIMATING - INTRODUCTION

MTA LIBRARY

Estimates have been prepared at various stages of design. This process has been the basis for updating the Financial Plan, and has provided District management with an increasingly refined assessment of the Project's cost. Just prior to bid opening, the 100% design estimates will be upgraded by Program Control to Engineer's Estimates. The contracting officer then evaluates the bids against the Engineer's Estimate. Program Control evaluates the successful bid against the baseline budget in the Financial Plan and updates the Financial Plan. After contract award, Estimating continues to play an important roll in the control process by providing estimates and analyses of Project changes and claims. These changes and claims will result in an update to the Project budget and appear as a forecast in the Transit Automated Control System (TRACS), and the Financial Plan.

7.2.1 PURPOSE

Estimates provide the initial basis for all Project costs. They establish the baselines from which cost performance can be measured. As estimates are updated, contracts awarded, and changes and claims approved, the latest contract values are compared to the Project's baseline budgets. A variance analysis explaining any differences, required, is prepared and presented to District management. Updated Project costs then appear in TRACS and revisions to the Project Financial Plan.

7.2.2 RESPONSIBILITIES

The responsibility for estimate preparation, review, and analysis lies with the Program Control staffs in the District, General Consultant, and Construction Management Consultant offices. These organizations and their functions are described below.

7.2.2.1 RTD

The Program Control department provides the following estimating functions:

- o Reviews and reconciles estimates submitted by the General Consultant and the Construction Management Consultant. The reconciled contract values result in an update to the contract budgets in the Financial Plan. The appropriate SDA or Facilities project manager is notified and kept current on Project costs. This process fine tunes contract specifications and plans and eliminates future claims.
- o Prepares, with input from the utility relocation project manager, check estimates on the utility relocation work. These estimates assist the utility project manager in evaluating estimates submitted by the utility companies and provides the basis for updating costs in the Financial Plan.
- o Prepares Engineer's Estimates on selected contracts designed in-house and on all demolition contracts.
- o Maintains the estimating schedule. This schedule depicts the estimating and specification activities of the General Consultant and the estimate review activities of the Construction Management Consultant. Program Control uses this schedule to coordinate the work of both consultant organizations. This schedule also provides District management with an "early warning" indicator of when specifications may become critical to advertising a contract. If a slip in schedule is required for a contract, it would come before the SCCB for action. The action taken would appear in TRACS and in updates to the Financial Plan.

- o Maintains escalation indices. Engineering News Record publishes regional escalation indices. Program Control monitors this publication's index for the Los Angeles region, and compares the published escalation rate in this index to the escalation rate used in the Financial Plan. Program Control's monthly analysis is presented to the AGM/TSD for review. Trends in this index provide an "early warning" indicator that will trigger changes to Project budgets in TRACS and the Financial Plan.

- o Reviews all estimates associated with Project changes and claims. Initially, the review comments are used to assist the CCB in determining the disposition of the change or claim. After CCB approval, this analysis is used by the contracting officer to negotiate the change or claim with the contractor. After the change or claim is negotiated, the budget and forecasts are updated in TRACS and the Financial Plan.

7.2.2.2 PDCD

PDCD's Program Control department provides the following estimating functions:

- o Assists the District's Program Control department by reviewing contract estimates submitted by the General Consultant, preparing check estimates, and reviewing contract documents for claims avoidance.

- o Prepares estimates for construction changes and prepares evaluations of contractor claims.

The use of the above information has been described in Sections 7.2 through 7.2.2.1 of this plan.

7.2.2.3 MRTC

MRTC's Program Control department performs the following estimating functions:

- o Coordinates and reviews contract bid documents.
- o Prepares 100% design estimates and Engineer's Estimates prior to bid.

The use of the above information has been described in Sections 7.2 through 7.2.2.1 of this plan.

7.3 COST MANAGEMENT - INTRODUCTION

To manage the Metro Rail Project, a comprehensive cost management system was developed by the Program Control department. This system integrates information from various funding agencies, consultants, and District departments to provide District management the tools to analyze and control Project costs.

7.3.1 PURPOSE

The cost management system provides timely information on funds, budgets, expenditures, obligations, cashflows, and variance analyses, permitting District management to spot deviations in the work and expenditure plans. This "early warning" capability permits District management to assess alternatives, in advance, for effective control of the Project.

7.3.2 RESPONSIBILITIES

Maintaining the cost management system is the responsibility of the Program Control staffs of the District, the General Consultant, and Construction Management Consultant. These organizations and their functions are described below.

7.3.2.1 RTD

Specific responsibilities of the Program Control department are presented below:

- o Prepares and maintains the Financial Plan. The Financial Plan is the key summary control document for the cost management system. It is the end product of Project information solicited by Program Control from District departments, funding agencies, and consultants. The Financial Plan outlines the Project's baseline budgets, schedules, obligations, and cashflow plans from which cost performance is measured. This plan is distributed to District management and funding agencies, and appears in the monthly and quarterly status reports and the Full Funding Contract. The Financial Plan is monitored daily and updated periodically.
- o Prepares and maintains the Work Breakdown Structure (WBS). This document is prepared with input obtained from District management, the consultants, funding agencies, and from information contained in the General Specifications and Contract Unit Description document. The WBS outlines, through a hierarchial system, packages of work and detailed cost codes that facilitate the orderly collection of Project costs within TRACS. The WBS is updated when Project conditions necessitate.
- o Assists in the preparation of the District's Fiscal Year Budget. During this process, detailed budget information is solicited by the Office of Management and Budget (OMB) from all District departments anticipating Metro Rail charges. Program Control then reviews each department's proposed Metro Rail budget for conformance with the fiscal projections contained in the Financial Plan. Program Control's analysis, along with the proposed department budgets, are submitted to

the AGM/TSD for review and approval. After the Board of Directors approves the Fiscal Year Budget, the Financial Plan, if necessary, is updated to provide a control base to track fiscal year costs.

- o Operates and maintains the Funding subsystem within the TRACS. Funds from this subsystem must be linked to a contract before it can be awarded. Once the contract is awarded, the budget cannot be updated until RTD Program Control links additional funds for that change and a change order is processed. This control insures that District management is aware of all changes to the budget information within TRACS.
- o Reviews all purchase requisitions, invoices, and progress payments. These documents are reviewed for proper Grant Numbers and Approved for Expenditure (AFE) and WBS coding. The purchase requisitions are analyzed for their fiscal and Project budget impact. Any potential drawdown on contingency is noted by Program Control in its analysis. This analysis is then attached to the purchase requisition before the document is reviewed and approved by the AGM/TSD. Information from these documents provides a basis for updating budgets and forecasts in TRACS and the Financial Plan.
- o Reviews and analyzes consultant status reports and Annual Work Plans for conformance to the Project baseline budgets in the Financial Plan.
- o Participates in the Change Control Board, supplying cost information to the Board to assist in the disposition of Project changes.
- o Issues monthly and quarterly status reports to the District departments and outside funding agencies. The cost information in these reports will be supplied by TRACS. These reports summarize the cost performance of the Project.

7.3.2.2 PDCD

PDCD performs the following cost functions:

- o Updates information in the TRACS Task Detailing subsystem. This information comes directly from the successful contractor's bid. This same information then rolls up to the total contract budget in the TRACS Budget subsystem and appears in the Progress Payment subsystem after the contract value is verified and awarded by RTD OCPM in the Procurement subsystem/TRACS. Program Control updates the Task Detailing subsystem within TRACS as approved changes are negotiated with the contractor. RTD OCPM awards all negotiated changes or claims in the Procurement subsystem of TRACS.

- o Coordinates the preparation of changes and claims. This responsibility includes assigning numbers to all changes and claims, maintaining an index, evaluating the cost impact of the changes and claims, and tracking the preparation of the full change and claim packages. This responsibility involves extensive interaction with the RE, General Consultant, and the District.

- o Coordinates, with the RE, the preparation of monthly contractor progress payment. This responsibility includes entering data for the units of work installed by the contractor, into the Progress Payment subsystem of TRACS.

- o Prepares and issues monthly Construction Status Reports and PDCD's joint venture Progress Report. These reports analyze deviations to the budgets.
- o Participates in the CCB, supplying cost information to the Board to assist in the disposition of Project changes.

7.3.2.3 MRTC

MRTC performs the following cost functions:

- o Provides a Monthly Progress Report on the design activities during construction.
- o Participates in the CCB, providing the Board with cost information to assist in the disposition of Project changes.

7.4 TRANSIT AUTOMATED CONTROL SYSTEM (TRACS) - INTRODUCTION

TRACS is an automated management information and decision support system designed to meet RTD's management requirements for the Metro Rail Project. TRACS generates timely reports on the cost and schedule status and measures performance throughout the Project's life.

TRACS provides RTD with several fundamental benefits. These benefits include the following:

- o Provides all levels of District management with timely, accurate, and relevant information tailored to suit its specific needs;
- o Provides a mechanism for budget definition and funding allocation and their updating and monitoring;
- o Improves status reporting and forecasting of project costs and schedules by integrating budget, schedule, cost, and other relevant data in a timely and meaningful way;
- o Provides a means for tracking information on the status of procurements, real estate acquisitions, and change orders during their processing cycles;

- o Meets the reporting requirements of funding agencies;
- o Enhances progress payment methods, and obtains timely and objective progress and "projection to complete" information; and
- o Integrates data from Program Control, other RTD departments, and contractors so that the latest information is available, repetitious input is eliminated, and errors are reduced.

Relevant, timely information provides management with the data needed to make the correct decision. An effective management information system provides "early warning" of pending problems, preserving District management's flexibility for corrective action and providing insight into the impact of alternative actions. As an example, early documentation of schedule slippage of a critical path activity can permit District management to either authorize the expenditure of overtime resources, divert resources from other tasks, or redefine the task to bring the activity in, or closer to, on schedule; such corrective actions could minimize extra costs and unacceptable delays of other activities which follow in the schedule.

TRACS provides this "early warning" capability; it collects and automatically integrates data as it originates, giving a single common reference point for all levels of District management reflecting the most recent data collected at every level of the control process.

TRACS is a user-oriented, menu-driven system. It operates on-line, providing immediate, option-prompting feedback to users' inputs; instant (and easily understood) error messages, and ease of data input and editing. Assuming the necessary security clearance, a user can access the system in an orderly, top down manner, interacting only with those components which are of direct concern to the user.

TRACS consists of ten subsystems, each providing for data entry or information reporting, and all sharing a common pool of information called the data base. The information input by a user in one subsystem is automatically available to all other subsystems, both for reporting and analytical purposes. The ten subsystems are shown in Exhibits 7-7 and 7-8, and the function and responsible parties for each subsystem is shown in Table 7-1. These ten subsystems are presented below:

1. BUDGETING

The Budgeting subsystem is for planning and monitoring the basic units of work to be performed, and for defining and monitoring the status of funds used to implement the programs. This subsystem allows the user to subdivide each program into its components, in a hierarchical fashion from the top down. Budgets are assigned to each component, and budget status is monitored here, with updates automatically reflecting contractual obligations, pending change orders, contractor progress payments, and material purchases.

TRANSIT AUTOMATED CONTROL SYSTEM (TRACS)

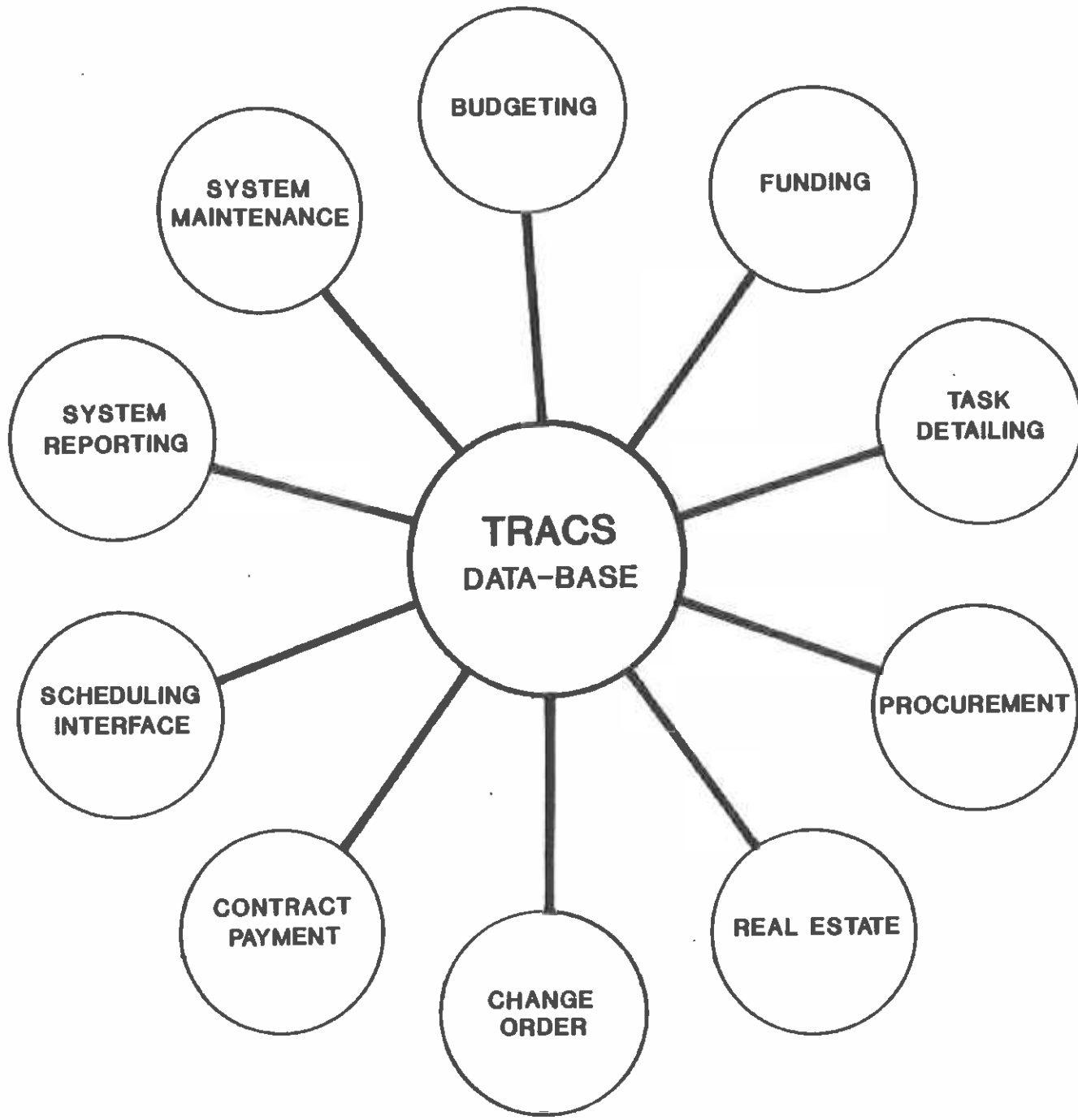


TABLE 7-1

<u>Subsystem</u>	<u>Function</u>	<u>Department Responsibility</u>
<u>Planning Phase</u>		
Budgeting	Define detailed budgets.	RTD and PDCD Program Control, Contract Manager
Funding	Assign and link source of funds to budgets.	RTD Program Control
Task Detailing	Contract Resource definition and scheduling activity and line item linkage.	PDCD Program Control
<u>Operational Phase</u>		
Procurement	Initiate requisition	RTD OCPM
Procurement	Solicit and evaluate bids and award contract.	RTD OCPM
Scheduling Interface	Transfer updated MSCS schedule dates to the TRACS System.	RTD and PDCD Program Control, Contract Manager
Task Detailing	Update resource definition	PDCD Program Control
Progress Payment	At end of each reporting period, initialize period and create contract skeleton form.	PDCD
Progress Payment	Contractor completes contract skeleton form; project manager approves and revises.	PDCD
Change Orders	Add trends and approved change orders to the budget.	RTD and PDCD Program Control

2. FUNDING

The Funding subsystem allows the user to define all sources of funds for the various capital programs and the value of each fund source. The system links the funds to the various components of the work. Subsequent expenditures against each contract update the status of the funding sources so that the unused portion of each source is constantly known.

3. TASK DETAILING

The Task Detailing subsystem permits the specification of manpower and material resources required for each of the Project tasks and activities as defined by the Budgeting subsystem. This detail links the subsystem with the activities of the Project schedule. In addition, this detail is also used for procurement purposes and as a basis for status reporting, making the estimates of percent complete less subjective.

4. PROCUREMENT

This subsystem tracks a requisition for materials or services from the initial request through the execution of a purchase order or contract. It informs the buyer, the project manager, the finance and accounting units, and other interested parties of the status of each request throughout its processing cycle.

Besides this tracking function, the subsystem aids the Contract Management or Purchasing department by automating a variety of functions. The subsystem also maintains a vendor history file for generating bidder's list.

5. REAL ESTATE

This subsystem details the status of land and easements acquisitions by the Real Estate department. It reports data for title searches, appraisals, land purchases and takings, relocation, property management, and real estate related legal services. It also tracks the renting or leasing of land required for material storage.

6. CHANGE ORDER

This subsystem tracks change orders through their processing cycle, and updates budgets to reflect the impact of pending and approved change orders. By capturing the expected impacts of change orders early (as soon as the need for a change order is identified) and integrating them with other monitoring functions, TRACS provides all users with the most current estimates of the Project's total cost and expected completion date. This information helps District management make better decisions on the approval and urgency of change orders. This subsystem also informs project managers on the status of all change orders and notices, expedites the approval cycle, and aids in the preparation of the change order documents.

7. PROGRESS/PAYMENT

This subsystem speeds up and simplifies contract payment procedures and ties payment directly to a contractor's progress. This function is accomplished by integrating progress data collection and evaluation procedures for construction and service contracts with payment approval procedures.

TRACS generates a skeleton form, based on the detailed work plan entered in the Task Detailing subsystem. Each contractor's status is recorded on the skeleton during the payment period. After review by District and consultant management, this information is entered into the system. Calculations of value of work are performed and used in preparing a Contract Estimate Report, which records approval of the progress assessments and forms the basis for the Accounts Payable voucher.

8. SCHEDULING INTERFACE

Management Scheduling and Control System (MSCS) is used to schedule RTD's Metro Rail Project. The Scheduling Interface subsystem transfers scheduling information from the MSCS data base to the TRACS data base to establish accurate and up-to-date integration of cost, schedule, and status information.

9. SYSTEM REPORTING

The System Reporting subsystem allows users to create reports from the data base to meet the needs of all consultants and RTD departments (see Exhibit 7-9) These reports are generated at various levels of detail to enable effective Project control.

10. SYSTEM MAINTENANCE

This subsystem is used by the system administrator for defining specific codes required by TRACS to update specific data fields. For example, codes representing departmental responsibilities, project managers, and purchasing agents are defined by the system administrator.

TRACS is managed by a system administrator who is a member of the Program Control department. The administrator oversees the smooth operation of the system and the procedures of system use to achieve management objectives of project management and control.

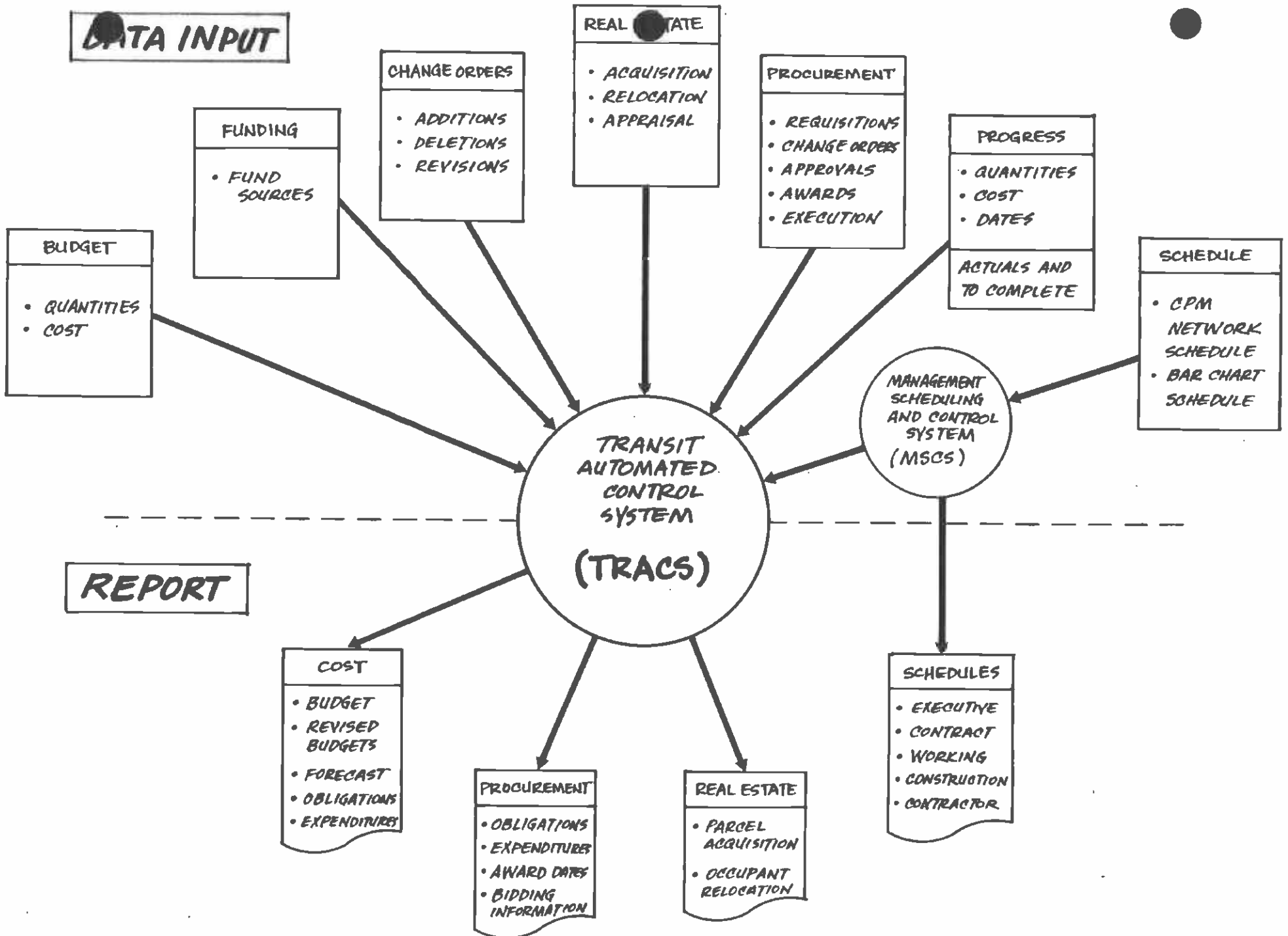


EXHIBIT 7-9

7.5 PROJECT REPORTING

Project control consists of monitoring the Project plan, analyzing Project data, and taking corrective actions. Various reports are available to assist in this process. Work accomplished must be monitored and analyzed in relation to the Project plan. Data must be extrapolated to reflect an estimate to complete or an estimate at completion. This analysis and forecasting provides District management with the necessary information to make decisions and implement corrective actions.

7.5.1 MONITORING

Earlier in this chapter, it was discussed how the control process begins with the development of a baseline budget and schedule. Performance against these baselines is displayed through the use of various curves, histograms, and reports generated by Program Control. Each of these tools depicts a specific aspect of the Project baseline, showing actual performance against the plan. These tracking tools are prepared and updated regularly to show the Project status at selected levels of detail.

7.5.1.1 SCHEDULE REPORTS

During the construction phase, each contract will be monitored and the current status reported on a monthly basis. The Monthly Construction Performance Report, issued by PDCD to the AGM/TSD, includes the following scheduling reports for each contract:

- o Milestone Exception Analysis Report - identifies milestones, as defined in the Level II schedule, which are currently behind schedule. The affect on downstream milestones is assessed and corrective action recommended to reduce the impact.
- o Construction Schedule Status Report - shows the Level III schedule start and finish dates and the current target or actual start and finish dates. The variance, in weeks between the scheduled and current start and finish dates, is calculated.
- o Target Milestone Report - shows the status of all Level II schedule milestones, including the original duration, start date, and completion date, as well as the current duration, start date, and completion date.

- o 30 Day Window Report - identifies all Level III schedule activities currently in progress or scheduled to start within the next thirty days. The activity, remaining duration, start date, and completion date are also displayed.

- o Summary Contract Status Report - shows work accomplished during the report period. It identifies, in a narrative form, work planned during the next thirty days and highlights problem areas and proposed resolutions.

Reports will also be prepared to summarize the status of entire MOS-1 Project. These reports include the following:

- o Level I Schedule - reflects the total MOS-1 progress.

- o Level II Schedule - reflects the MOS-1 milestone progress.

- o Critical Path Analysis - presents a narrative summary of the critical path activities.

- o MOS-1 Schedule Analysis - presents a summary of comments applicable to each contract.

The PDCD Monthly Construction Performance Report will be reviewed and analyzed by the RTD Program Control department. Comments and recommendations will be forwarded and reviewed with the AGM/TSD on a regular basis.

Besides the monthly report prepared by PDCD, RTD prepares monthly and quarterly reports for UMTA and other funding agencies. The reports to funding agencies advise them of current Project status and include the following schedule information:

- o Schedule Status Report - shows the current status of activities on the Level I schedule.
- o MOS-1 Schedule Analysis - summarizes the major accomplishments for the period and identifies problems, actual and anticipated, which could lead to schedule delays.
- o Critical Activities Analysis - summarizes the critical path of MOS-1 and identifies corrective action being implemented.
- o Areas of Concern - highlights critical, and potentially critical, activities.

7.5.1.2

Cost Reports

Metro Rail costs are monitored and analyzed throughout the Project. Internal District reporting is supplemented by monthly performance reports issued by PDCD and MRTC. The following cost reports are issued and updated on a regular basis by Program Control:

- o Financial Plan Report - outlines the Project baseline budgets and is used to measure cost performance as contracts are awarded.
- o Obligations Plan Report - is a subset of the Financial Plan and outlines when contracts will be obligated, creating a financial liability for the District.
- o Cashflow Plan Report - is also a subset of the Financial Plan. It outlines the planned expenditures of the Project and plays a key role in bond issues related to the Project.
- o Grant Status Report - outlines the status of funds received on the Project.
- o Principal Cost Report - outlines the latest contract values, contract forecasts, and expenditures.
- o Monthly and Quarterly Status Reports - summarize the cost status of the Project.

The above reports will address both the UMTA Project and the Local Activities.

GENERAL COMMENTS

1. IF I USE THE GUIDELINES GIVEN TO ME FOR PREPARING CHAPTER 7.0, I SEE LITTLE USE OF THOSE GUIDELINES IN THE OTHER CHAPTERS. FOR EXAMPLE:

- ONLY ONE FLOW CHART (REAL STATE)
- FEW DISCUSSION ON THE VARIATION BETWEEN FUNCTIONS AND PRODUCTS
- FEW DISCUSSION (FORZ), OUTSIDE OF CHAPTER 7.0, ON THE OF TECHNICAL FUNCTIONS AND PRODUCTS TO PROGRAM ON THE LINE
- LITTLE INSIGHT ON HOW PRODUCTS/PRODUCTS ARE DEVELOPED OR BY WHOM

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT

METRO RAIL PROJECT

WORKING DRAFT

PROJECT MANAGEMENT PLAN

FOR

MOS-1 CONSTRUCTION

AUGUST 11, 1986

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INTRODUCTION

INTRODUCTION

This Project Management Plan is designed to provide a framework for administering construction of Minimum Operable Segment One (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 (month) 1986 agreement 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.

VERY LITTLE
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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 the text of this plan. The requirements of these referenced documents are by implication incorporated within this plan, and these requirements will be followed by project personnel in implementing the intent of the plan. As additional procedures are developed, they will be incorporated in plan revisions.

The plan consists of 11 chapters, as follows:

- 1.0 Project Background and System Description
- 2.0 Management Organization and Approach
- 3.0 Design Management
- 4.0 Real Estate Management
- 5.0 Equipment 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

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

1.0 PROJECT BACKGROUND AND SYSTEM DESCRIPTION

1.0 PROJECT BACKGROUND AND SYSTEM DESCRIPTION

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. The results of this analytical work were published in Alternatives Analysis/Environmental Impact Statement/Report (April 1980).

Preliminary engineering on the 18-mile Metro Rail Project began in June 1980. The planning decisions reached during

preliminary engineering are documented in the Final Environmental Impact Assessment (December 1983) and in a series of 12 Metro Rail milestone reports:

1. Preliminary System/Operational Plan
2. System Design Criteria
3. Route Alignment
4. Station Location
5. Relocation Policy
6. Development/Land Use
7. Safety, Security, System Assurance
8. Systems and Subsystems
9. Supporting Services
10. Fixed Facilities
11. Cost Estimate
12. System Plan

Additional environmental analyses are contained in the Environmental Assessments of August and October 1984 and the Reevaluation of Environmental Record, June 1986.

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

- 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
- An integrated, computerized, and operational project controls 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 several early-start 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 18-mile Metro Rail system will, because of funding limitations, be accomplished in stages. The 4.4-mile segment from Union Station to Wilshire/Alvarado Station, and including the yard and shops area, will be the initial construction segment. Design activities for this segment, termed Minimum Operable Segment One (MOS-1), were essentially completed as of June 30, 1986. Construction of

MOS-1 is scheduled to begin in September 1986 and will be guided by this Project Management Plan. The MOS-1 system is described in the following section.

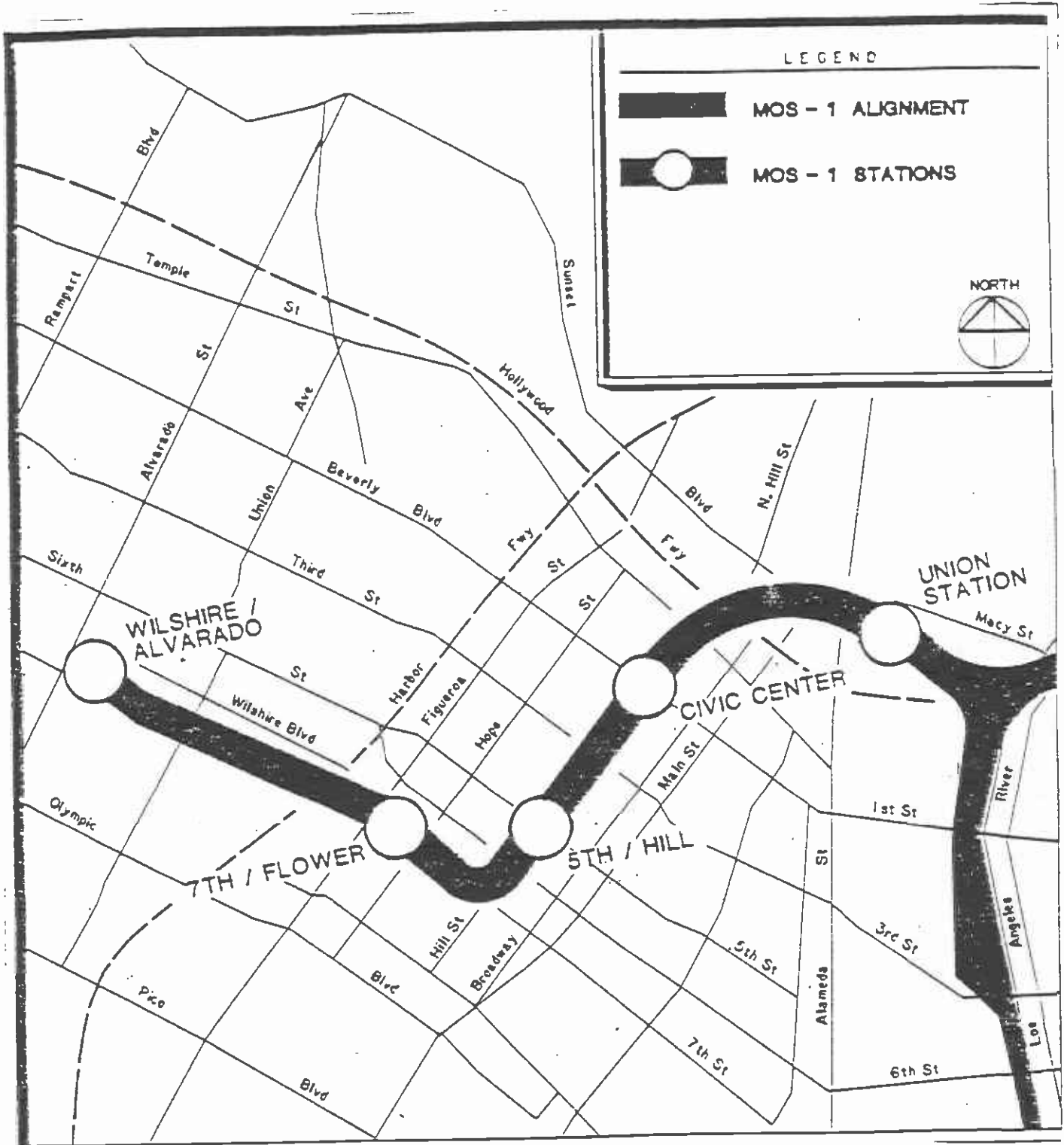
Extensions to the MOS-1 system will be made incrementally as funding permits. The 18-mile Metro Rail system was originally planned to follow a route along Wilshire Boulevard through the Fairfax district and Hollywood to the San Fernando Valley. However, concerns about the safety of tunneling through the Fairfax area resulted in a Federal law requiring SCRTD to reconfigure the alignment to avoid potentially hazardous 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 MOS-1 alignment is shown in Exhibit 1-1. MOS-1 comprises a yard and shop area and a 4.4-mile 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 rail line is entirely subway. Virtually all line segments will be constructed by tunneling methods, and stations and crossovers will be built by cut-and-cover construction techniques. Three crossovers are included in the mainline portion of MOS-1. Two of the crossovers are located at either end of Union Station, and one is 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 light rail line. The 7th/Flower Station will serve as the connecting point between the Metro Rail and light rail lines.

EXHIBIT 1-1

Alignment of Initial Segment of Metro Rail System



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, up to about 110 standing passengers at normal loads, and over 200 standing passengers at crush loads. One wheelchair space will be provided in each vehicle.

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 will be of cut-and-cover construction, with either center or end mezzanines. Each fare collection area will have one or two arrays of entry/exit faregate barriers. The fare structure will be based on a single zone. Escalators and 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. Stations will be equipped for both attended and unattended operation. For planning purposes, following the initial start-up period, all MOS-1 stations will be unattended. 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 54,000 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.

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2.0 MANAGEMENT ORGANIZATION

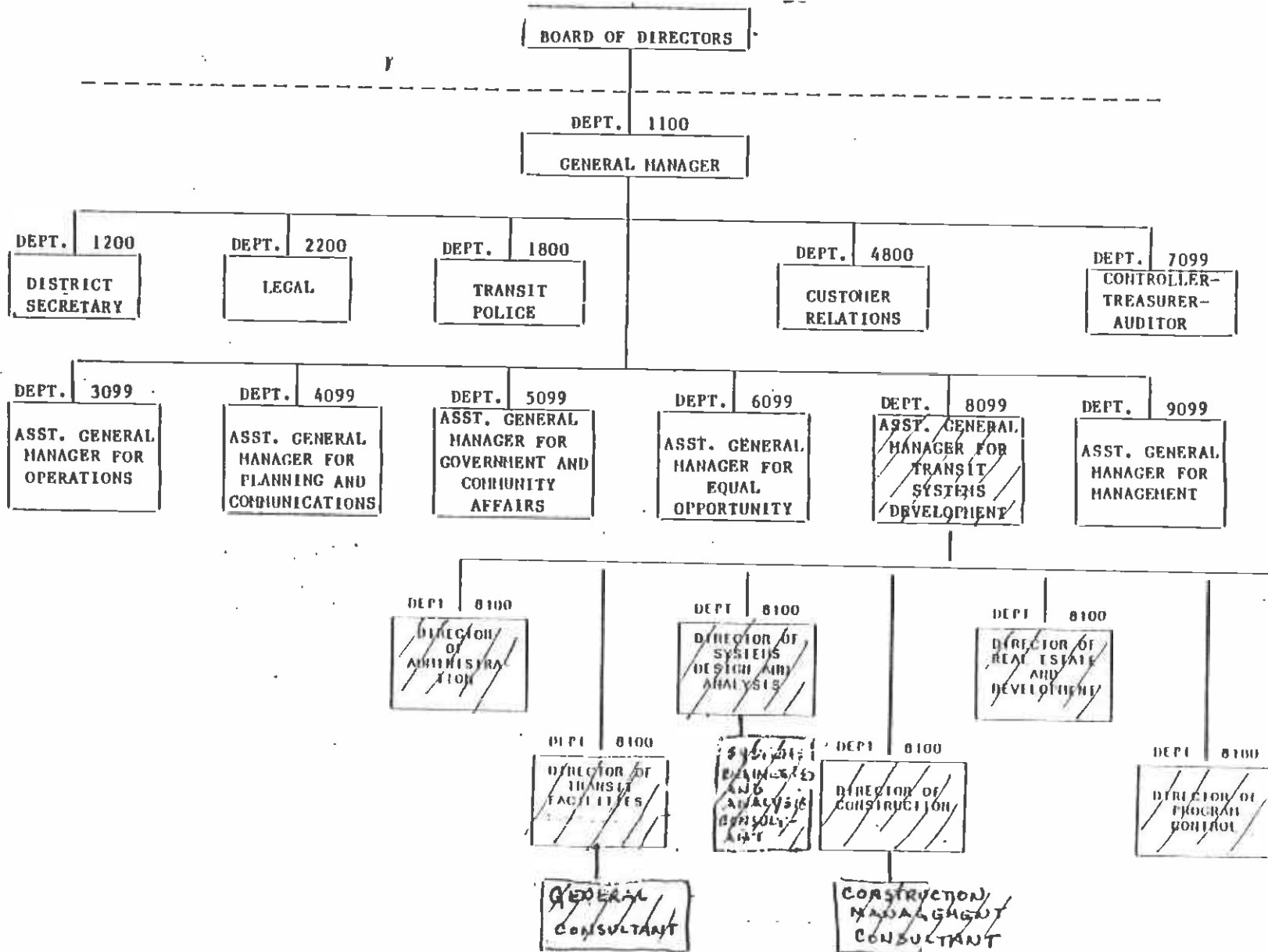
2.0 MANAGEMENT ORGANIZATION AND APPROACH

Chapter 2.0 describes the SCRTD organization and, within SCRTD, the Transit Systems Development (TSD) Department which has been created to manage and administer the Metro Rail Project. To assist in administering the project, TSD has retained the services of three consultant organizations: a General Consultant, a Systems Engineering and Analyses Consultant, and a Construction Manager. This chapter identifies the roles and responsibilities of TSD and its consultants, other SCRTD departments, and Metro Rail committees, and outlines the relationship among them and between SCRTD and outside agencies involved in the project. The overall organization of SCRTD and of Metro Rail Project is shown in Exhibit 2-1.

2.1 ORGANIZATIONAL OVERVIEW

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. SCRTD is governed by state law and administered by a Board of Directors which is delegated authority to appoint the General Manager. The Board is responsible for maintaining, operating, and improving the existing bus system and for designing, engineering, building, and operating a rapid transit system on a regionwide basis. For the Metro Rail Project, the Board establishes the budget; sets policies; and reviews and has final approval of all agreements and claims. The General Manager, appointed by the Board of Directors, has responsibility for management and supervision of all existing services and SCRTD departments.

EXHIBIT 2-1



The General Manager has overall management and supervisory responsibility for all aspects of the Metro Rail Project, including consultants. The General Manager has final approval of all construction drawings and specifications, change orders, procurements, acceptance of construction and equipment installation, and contractor payments

Reporting directly to the General Manager, the Assistant General Manager of Transit Systems Development has overall responsibility for management, coordination, and control of project staff and activities. He is supported by the TSD Directors of Administration, Program Control, Transit Facilities, Systems Design and Analysis, Construction, and Real Estate and Development, their staffs and consultants, and the Metro Rail committees formed to provide expertise in specific project areas. In carrying out its project management responsibilities, TSD is assisted by the directors and staffs of other SCRTD departments.

The following discussion identifies the management organization and responsibilities of each organization with the Metro Rail Project team and defines the responsibilities of other SCRTD departments in providing project support. In addition, the chapter identifies the role of outside agencies and outlines their relationships with SCRTD.

2.2 METRO RAIL PROJECT TEAM RESPONSIBILITIES

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

- 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 organization of the TSD Department is shown in Exhibit 2-2 and is 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, office management, and configuration control. Responsibilities in each of these areas are as follows:

- Contract Administration. Preparation of Board items, invoice review, analysis and processing of contracts and contract amendments, administration of consultant contracts, development and processing of purchase requisitions, administration of the wrap-up insurance program, assisting in the negotiations of consultants' annual work programs, coordination and distribution of change orders, administration of claims, and grant administration.
- Office Management. Responsibilities include monitoring and maintaining payroll records, maintaining personnel records, and providing general office support services.

EXHIBIT 2-2

Configuration Control. Responsibilities include receipt of master copies of all approved Metro Rail documents, Construction Management documents, drawings, and specifications; computer entry of materials and distribution control; transmission of construction documents and drawings to contractors and subcontractors; provision of specifications and drawings for litigation support; preparation of status reports related to system configuration and litigation support; and coordination with all Metro Rail Project organizations concerning centralized filing, storage, and records control.

In addition, the Director is responsible for engineering liaison with Caltrans for obtaining encroachment permits to permit Metro Rail construction within state rights-of-way; engineering design liaison with the City of Los Angeles for obtaining vacation of streets and alleys; preparation of technical recommendations and status reports related to state and city coordination for Metro Rail construction; and negotiation and preparation of master cooperative agreements with utilities and governmental agencies for rearrangement of facilities that interfere with construction of the Metro Rail Project.

The Director will interact with other directors in Metro Rail, with other District departments and with the various Metro Rail Project consultants. The Director will perform the duties of the TSD Assistant General Manager when so assigned.

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 on the Metro Rail Project:

- Systems Design. Design of all Metro Rail operating systems (passenger vehicles, train control, communications, fare collection, traction power, auxiliary vehicles and miscellaneous mechanical/electrical systems) and management of passenger vehicle and fare collection equipment procurement.
- Systems Engineering and Analysis. Systems engineering and integration activities, including determination of system requirements, development and updating of Metro Rail system specification, identification of system interfaces, and monitoring of system design to ensure conformance to criteria and interface requirements; engineering analysis, including development of systems analysis tools and evaluation of system alternatives, optimization of system design, development of operating strategies, projection of operating statistics and estimation of costs; and operations planning duties, including development of the system operating and maintenance plans and management of system testing and activation.

• Safety and Systems Assurance.

Establishment of requirements and criteria for safety, fire/life safety and security; establishment of reliability, maintainability and quality assurance requirements; development of implementation plans; and reviews to ensure criteria are incorporated in designs and in construction of facilities and equipment.

The Director is responsible for overseeing the efforts of the Systems Engineering and Analysis consultant and reviewing the systems-related design work of the General Consultant.

2.2.1.3 Transit Facilities

The Director of Transit Facilities is responsible for providing engineering, architectural design and environmental services for the Metro Rail Project as follows:

• Environmental Engineering. Review of all environmental issues relating to the Metro Rail Project and preparation of environmental reports, impact statements, and environmental studies.

• Architectural. Provision of architectural review of all facility designs and preparation of alternative design approaches and schematics as appropriate.

- Project Engineering. Directing and monitoring of activities of the General Consultant and section designers engaged in final design and engineering.
- Engineering Design. Review of designs, drawings and specifications for civil, structural, and mechanical portions of the project.
- Engineering Services. Negotiation of Master Agreements with affected public agencies and private utility companies and coordination of designs with affected railroads; right-of-way engineering; and right-of-way certification.
- Utilities Engineering. Administration of Master Utility Agreements and review and coordination of all utility issues relating to the Metro Rail Project.

2.2.1.4 Construction Management

The Director of Construction Management is responsible for managing and coordinating Metro Rail construction-related activities, including:

- Review and approval of bidding documents to ensure feasible, practical, economical, and safe construction
- Evaluation of construction contract bids to determine responsibility and responsiveness of the apparent low bidders

- Preparation of notices to proceed to contractors
- Oversight of the work of the Construction Management consultant
- Coordination of the construction safety program
- Review and approval of all construction contract change requests
- Monitoring and coordinating Master Agreement work
- Review of and recommendation for approval of progress and final payments to contractors
- Monitoring and oversight inspection of all construction and recommendation for final acceptance.
- Acquisition of vendor data/manuals and preparation of facility subsystem operating and maintenance procedures and manuals
- Participation in testing, start-up and activation activities
- Acquisition of initial spares.

2.2.1.5 Real Estate and Development

The Director of Real Estate and Development Department is responsible for all purchase and lease acquisitions in support of approved 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 program
- 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 plan and direct 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 for the Metro Rail Project
- Preparation of regular progress reports and evaluation of performance
- Conduct of special studies to identify and define potential problems and to suggest corrective action
- Review and analysis of construction and procurement expenditures and cost estimates to determine reasonableness and consistency with financial plans
- Development and maintenance of contingency plans for addressing likely problem areas that may occur as particular projects evolve from preliminary stages through construction.

MTA LIBRARY

2.2.2 Consultants

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

2.2.2.1 General Consultant (GC)

The General Consultant 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 (MRTC); *... ..*

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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 passenger vehicle and fare collection equipment. The SE&A consultant is Booz, Allen & Hamilton Inc.

2.2.2.3 Construction Management (CM) Consultant

The Construction Management consultant is responsible for the management of all fixed facility construction and the procurement of all equipment, except passenger vehicles and fare

collection equipment. The CM's scope of work also includes safety and security, quality assurance, equal opportunity, and community relations. The CM consultant is PDCD, a joint venture formed by the Ralph M. Parsons Company; Dillingham Construction, Inc.; and De Leuw Cather and Company.

2.2.3 Metro Rail Committees

To assure supportive interaction between the TSD Department, their consultants, 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, make recommendations and evaluations relative to fire and panic safety. The FLSC is chaired by the SCRTD Supervisor of Safety and System Assurance and includes representatives from the:

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

- GC
- CM consultant
- SE&A consultant.

The FLSC was established by a charter signed by the SCRTD and the Board of Fire Commission in _____ . The FLSC meets on a periodic and 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 SCRTD Supervisor of Safety and System Assurance and is comprised of representatives from:

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

- CM consultant
- SE&A consultant

The Security Subcommittee was established by a charter signed by the SCRTD and local law enforcement agencies in _____. The Security Subcommittee meets on a periodic and scheduled basis.

2.2.3.3 Operations and Maintenance Committee

SCRTD has established an Operations and Maintenance (O&M) Committee. The O&M Committee coordinates the exchange of information and establishes policies relating to operations and maintenance of the Metro Rail system. The O&M Committee is chaired by the SCRTD Manager of Systems Engineering and is comprised of representatives from:

- SCRTD Department of Operations
 - Facilities Maintenance
 - Equipment Maintenance
 - Rail Transportation
- GC
- CM consultant
- SE&A consultant.

The O&M Committee meets on a periodic and scheduled basis. The O&M committee recently established a Maintenance Integration Subcommittee, which is charged with working cooperatively with LACTC and 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 by a team of experienced safety personnel of evidence needed for certification. The safety certification program establishes a Safety Certification Review Team (SCRT), charged with the safety review, evaluation, and approval of all safety-related documentation. The SCRT is chaired by the SCRTD Supervisor of Safety and System Assurance and consists of voting representatives from:

- SCRTD Department of Operations
 - Facilities Maintenance
 - Equipment Maintenance
 - Rail Transportation
- SCRTD Transit Police
- System Design and Analysis
- Transit Facilities Engineering
- Construction Management.

The SCRT is supported by non-voting consultant representatives from the GC, CM consultants, and SE&A consultant, and a representative of 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 District Secretary

The primary function of the District Secretary is to carry out the processes necessary to ensure that Board meetings 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.

2.3.2 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, and assist in contract negotiations and negotiations for property acquisition and joint development along the right-of-way.

2.3.3 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 internal security of SCRTD employees, revenues, and property. For the Metro Rail Project, the Transit Police Department is responsible for participating in security planning efforts.

2.3.4 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 security plans; recruit and train operations staff; and, participate in system start-up, check-out, and turn-over.

2.3.5 Department of Planning and Communications

The Department of Planning and Communications is responsible for all transit service planning and analysis, public and passenger communications, promotional and advertising programs. For the Metro Rail Project, the Department will prepare ridership forecasts, conduct alternative analyses and ensure service integration of the bus, Metro Rail, and light rail systems. The Department will also assist in the planning of Station Area Master Agreements.

2.3.6 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.

2.3.7 Department of Government and Community Affairs

The Department of Government and Community Affairs has overall responsibility for SCRTD relations with Federal, state, and local governments, public agencies, and community groups. The Department will provide support to the Metro Rail Project by preparing grant applications, preparing reports to funding agencies, and holding community meetings. The Department will also keep the public informed about construction activities.

2.3.8 Department of Community Relations

The Department of Community Relations has the responsibility for executing and monitoring all SCRTD policies and instructions regarding community relations, including public relations, public and media information, elected official liaison, and complaint mitigation. For the Metro Rail Project, the Department will be responsible for directing a community relations program applicable to the communities affected by the construction effort and for providing public information on the re-analysis and SEIS work program required for the Metro Rail alignment.

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 monitor compliance with Disadvantaged Business Enterprise/Women's Business Enterprise (MBE/WBE) goals and will maintain a listing of qualified disadvantaged and woman-owned businesses.

2.3.10 Department of Controller, Treasurer, Auditor

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

2.3.11 Department of Management

The Department of Management is responsible for administrative services, personnel, contracts and purchasing, and 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 the design, procurement, and construction activities.

2.4 OUTSIDE ORGANIZATIONS

The successful completion of the project will require close cooperation between SCRTD and many outside organizations. The roles of these agencies are described below. The primary agencies with which SCRTD must interface to obtain permits are listed in Exhibit 2-3.

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, it is responsible for monitoring the progress of the project. To enable UMTA to fulfill that responsibility, SCRTD will provide UMTA with quarterly progress reports describing accomplishments, problems, funds expended, etc. In addition, SCRTD will meet with UMTA representatives to provide briefing and status reports and to allow site inspections of the work in progress.

2.4.2 ^{PROSPECT} Construction Management Oversight (CMO)

An independent contractor is retained to overview SCRTD management of the Metro Rail Project. The CMO reports directly to an UMTA-designated representative and verifies that work is accomplished in accordance with prescribed procedures and meets cost, schedule, and quality requirements.

EXHIBIT 2-3

To Be DEVELOPED

NEEDS TO MENTION
THEIR ROLE AS ONE OF
THE ...

2.4.3 Los Angeles County Transportation Commission
(LACTC)

The LACTC is responsible for developing the Proposition A rail system approved by the electorate in 1980. The first projects are the Long Beach-Los Angeles and Century Freeway light rail lines. Because the light rail lines will be operated by SCRTD and will share a common station at 7th/Flower, the two agencies are cooperating through the use of functional working groups, utilization of common design criteria, and conduct of reviews of each other's program documents.

2.4.4 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. 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.

2.4.5 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 the design, construction, and operation for the purpose of minimizing the fire and life safety hazards to the public and SCRTD employees.

2.4.6 Community Redevelopment Agency

To be developed.

2.4.7 Caltrans

NEED TO MENTION THEIR ROLE AS ONE OF THE FUNDING AGENCIES

Caltrans is responsible for planning, design, construction, operation, and maintenance of highways in California. The Metro Rail Project must interface with Caltrans for all encroachments upon Caltrans' rights-of-way. This includes coordination to incorporate Caltrans' requirements for the design and construction of the Metro Rail facilities. Once the design is acceptable, Caltrans issues a permit referencing those documents and incorporating their stipulations. 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.

2.4.8 Department of Water and Power

The Los Angeles Department of Water and Power will perform power and water relocations prior to station excavation, so that contractor access to

perform work can be established. 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 make new service connections prior to station work.

2.4.9 Los Angeles City Department of Transportation

The Los Angeles Department of Transportation will approve and monitor traffic detouring necessary to construct Metro Rail stations. During preconstruction, Los Angeles Department of Transportation has designed worksite traffic control plans which have become contract documents that outline the traffic detours to be installed during construction.

2.4.10 Santa Fe Railroad

SCRTD will coordinate with the Santa Fe Railroad as necessary to support construction of the spur track north of Ducommun Street and completion of track and ties removal from Commercial Street.

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

SCRTD will coordinate with these departments regarding enforcement for noise and construction activities in compliance with variances and permits.

2.4.12 Los Angeles County Coroner/Medical Examiner

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.

2.4.13 Los Angeles Public Works Department

The City of Los Angeles Public Works Department has the responsibility of inspecting work involving rearrangement of city facilities and new facilities to be maintained by the city.

2.4.14 Southern California Gas Company

Southern California Gas Company will relocate gas mains and laterals prior to Metro Rail construction, and will construct new mains, install new gas meters, and make new service connections in advance of station construction.

2.4.15 Pacific Bell

Pacific Bell will lower existing facilities, build new telephone ductbank facilities where needed prior to station construction, pull and splice cable in new facilities, and make new building connections as necessary.

2.5 MANAGEMENT APPROACH

SCRTD's basic management approach to successfully implement the Metro Rail Project includes the following factors:

- Project team structure, as described previously, with clearly delineated authorities and responsibilities
- The establishment of SCRTD policies and procedures for monitoring all aspects of the program
- The development of construction documents for facilities and systems that have been verified for accuracy and completeness to minimize potential claims by contractors
- The establishment and operation of a comprehensive and integrated project controls system for the entire project
- A comprehensive system assurance program meeting requirements of UMTA, other Federal, and state and local agencies.

TSD, during the preconstruction phase, has required the preparation of procedures for accomplishing and controlling work by all portions of TSD and its supporting groups and consultants. A representative list of the various procedures and/or manuals developed to define how work will be accomplished, controlled, and satisfactory performance documented is shown in Exhibit 2-4. These documents are referenced in the following chapters of this plan.

EXHIBIT 2-4

To Be Developed

A TSD project manager is responsible for coordinating, reviewing, and approving the procedures; for providing guidance and direction to consultants; and for ensuring that work performed meets all cost, schedule, and technical requirements. TSD project and construction engineers track the progress of the various work packages and contracts and coordinate the activities required to resolve problems; expedite design, procurement, and construction activities; ensure established milestones necessary to meet scheduled completion dates are maintained and that activities, particularly safety-related activities, meet fire/life safety, security, and system assurance requirements.

TSD, through system assurance surveillance and formal reviews and audits, documents that all Metro Rail work is performed in a systematic manner in accordance with procedures and results in work that meets design criteria and plans and specifications. Procedures are documented in the following chapters.

BY WHOM?
WHAT IS IT?

3.0 DESIGN MANAGEMENT

3.0 DESIGN MANAGEMENT

The design of the Metro Rail system is virtually complete. The design activities have been managed by:

- SCRTD's Director of Transit Facilities, who is responsible for the design of all stations, tunnel segments, yard and shop facilities.
- SCRTD's Director of Systems Design and Analysis, who 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 reliability.

The design of all elements of the Metro Rail system is documented in several key baseline documents, including System Design Criteria and Standards; standard and directive drawings; System Operating Plan; System Maintenance Plan; System Safety and Security Program Plan; System Assurance Program Plan; and design directives. Each of these key documents is outlined in this chapter, together with the contract specifications that will be used to construct the system. Changes to any of these design documents will be subjected to the configuration management controls described in Chapter 8.0. Design reviews will also be held to ensure that the design of all procured equipment conforms to the basic design documents.

3.1 SYSTEM DESIGN CRITERIA AND STANDARDS

Design criteria and standards define detailed functional requirements for all elements of Metro Rail and are 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 - Station
- 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.

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

The subsystem 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.

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 is updated periodically throughout the project as more detailed information becomes available.

BY WHOM?

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

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. Like the SOP, the SMP is a dynamic document that is periodically updated throughout the project as more detailed information becomes available. The SMP serves as a baseline document which integrates all maintenance planning activities for the Metro Rail.

BY WHOM?

The SMP states the policies and objectives for the maintenance of the Metro Rail system; prescribes the preventive and corrective maintenance programs which will maximize the availability and dependability of Metro Rail facilities and equipment; describes a functional organization for the management of the Metro Rail maintenance programs; describes

3 SCRTD Metro Rail Project, System Maintenance Plan, August 1986.

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 with other system requirements are incorporated into Metro Rail facilities and equipment.

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

- Hazards associated with the Metro Rail system are identified and then eliminated or 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 program.
- 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 program plans are 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 document policy directions affecting design; new design requirements, or clarifications to existing requirements. The Design Directive process provides a rapid means for disseminating design information and is not intended to duplicate or replace the more lengthy Change Request process (see Chapter 8.0 for a description of Change Requests). Any Design Directive that has a ^{??}significant^{??} project impact must reference an implementing Change Request number. All Design Directives must be submitted to Configuration Management for processing and must be reviewed and approved by the Assistant General Manager of TSD and the Directors of Transit Facilities, Systems Design and Analysis, and Program Control.⁵

VERY
AMBIGUOUS!!

To date, four Design Directives have been issued:

- 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."

⁵ See Procedure No. E.2.2, "Design Directives: Origination, Processing, and Approval," 7 December 1983.

3.7 CONTRACT SPECIFICATIONS

Contract specifications have been developed for each Metro Rail facility and for each major system (e.g., passenger vehicles, fare collection, communications, and train control). The specifications provide for appropriately sized work units, encourage competition, and can be monitored by SCRTD. The specifications are referenced in the Metro Rail Contract Unit Descriptions, which defines four general types of contracts:⁶

- Facility contracts
- System contracts
- Furnish and install contracts
- Utility Master Agreements.

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, pavement markings, traffic stripes, signs, traffic signals, maintenance of traffic, fencing, concrete, structural steel, reinforcing steel,

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TO THE
CUB!

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

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 is all plumbing and mechanical work and all electrical work, including portions of the systems installation work which are identified in the facilities contract scopes of work.

REFER BACK
TO THE
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3.7.2 System 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.

3.7.3 Furnish and Install Contracts

To be developed.

3.7.4 Master Agreements

Contracts for relocating telephone lines, water, power, and gas and oil lines and cable TV conduits will be signed with local companies providing these services. Exhibit 3-1 lists current Master Agreements.

EXHIBIT 3-1 (Continued)

Metro Rail Master Utility Agreement Matrix

AGENCY	TYPE OF AGREEMENT	REMARKS
CALTRANS	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED
CITY OF LOS ANGELES	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED
COUNTY OF LOS ANGELES	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED WHICH INCLUDES LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
DEPT OF WATER & POWER -WATER-	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED
DEPT OF WATER & POWER -POWER-	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED
CHEVRON	SPECIFIC REARRANGEMENT	SENT AGREEMENT 10/23/84.
CITY OF WEST HOLLYWOOD	FACILITIES REARRANGEMENT	NEGOTIATIONS WILL BEGIN WHEN CITY GOVERNMENT IS ESTABLISHED
PACIFIC BELL	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED
SANTA FE RAILWAY	ACQUISITION OF FIRST ST YARDS	PLAN DEVELOPED FOR PROPERTY REQUIRED FOR METRO RAIL. PURCHASE AGREEMENT IN PROGRESS.
SOUTHERN CALIF. EDISON CO.	FACILITIES REARRANGEMENT	
SOUTHERN CALIF. GAS COMPANY	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED
WESTERN UNION TELEGRAPH CO.	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED.
LAUPT (UNION STATION)	FACILITIES REARRANGEMENT	PLAN DEVELOPED FOR PROPERTY REQUIRED FOR METRO RAIL.
COMMUNICOM (CABLE TV)	FACILITIES REARRANGEMENT	AGREEMENT EXECUTED.
AMERICAN TELEPHONE & TELEGRAPH	FACILITIES REARRANGEMENT	SENT AGREEMENT 08/27/84

4.0 REAL ESTATE ACQUISITION AND MANAGEMENT

4.0 REAL ESTATE ACQUISITION AND MANAGEMENT

The Director of Real Estate and Development has principal responsibility for implementing the Metro Rail real estate acquisition and joint development programs. Final authority for decisions rests with the SCRTD General Manager and Board of Directors. See Chapter 2.0 for a description of the organization of SCRTD and the Metro Rail Project.

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

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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.

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.

4.1.1 Identification/Certification of Required Real Estate

Property Identification Plans (PIPs) have been developed by SCRTD's General Consultant (GC) that identify every parcel affected by the Metro Rail alignment.⁵ From the PIPs, preliminary title reports are obtained to ascertain the owner of record and a legal description of the parcel.

Detailed ROW requirements are identified by the GC and recommendations are developed. To support a recommended ROW requirement, the GC prepares a certification package that contains detailed property plats and ROW maps, a legal description, and a Property Impact Statement. The recommendation and certification package are then submitted to the Director of Transit Facilities. The Director of Transit Facilities reviews the recommendation and, if he approves, certifies the ROW requirement to the Director of Real Estate and Development.

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

The certification of required real estate is 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 are processed in the same manner as the original submittal.

Upon receipt of the approved certification package from the Director of Transit Facilities, the Director of Real Estate and Development obtains 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 are based on the fair market value of the property as determined by an appraisal. Two independent appraisals are generally obtained to establish the amount of just compensation. The following summarizes the basic process:

- The selection of independent fee appraisers is based on qualifications and experience.
- The property owner is notified in writing of Metro Rail Project requirements and the name(s) of the selected appraiser(s).
- The completed appraisal reports are reviewed by the appraisal staff.

The amount of just compensation is recommended by the review appraiser. The recommendation is submitted to the Chief Appraiser, the Director of Real Estate and Development, and the Assistant General Manager of TSD for concurrence. Final approval of just compensation is reserved to the General Manager.

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 is required only for real estate appraisals in excess of \$250,000.
- UMTA concurrence is required before the commencement of condemnation proceedings only when the offer is in excess of \$250,000.
- UMTA concurrence is required whenever an administrative settlement for real estate acquisitions exceeds the UMTA-approved just compensation by \$25,000.
- Only one independent appraisal is required for real estate acquisitions from governmental agencies.
- Only one SCRTD staff appraisal or one independent appraisal is required to establish fair market value for property disposition.

4.1.3 Acquisition Program

Every reasonable effort is made to acquire real property required for the Metro Rail Project through negotiation. A Real Estate Specialist is assigned to each parcel and personally contacts 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 personally contacts each property owner to offer the approved amount of just compensation.
- The written offer is accompanied by a summary appraisal indicating the basis for the amount established as just compensation.
- The property owner is given a relocation brochure which explains relocation benefits. Business owners are also informed of their possible right to compensation for loss of goodwill and are 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 is 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 is 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 is made. The administrative settlement is 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 is requested to authorize condemnation action. Upon approval by the Board, a condemnation attorney is retained to file the condemnation suit.

Negotiations 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

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.

for replacement housing and moving expense 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 are 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 are terminable upon 30-day notice. This provision ensures the availability of the parcel as required by construction schedules.

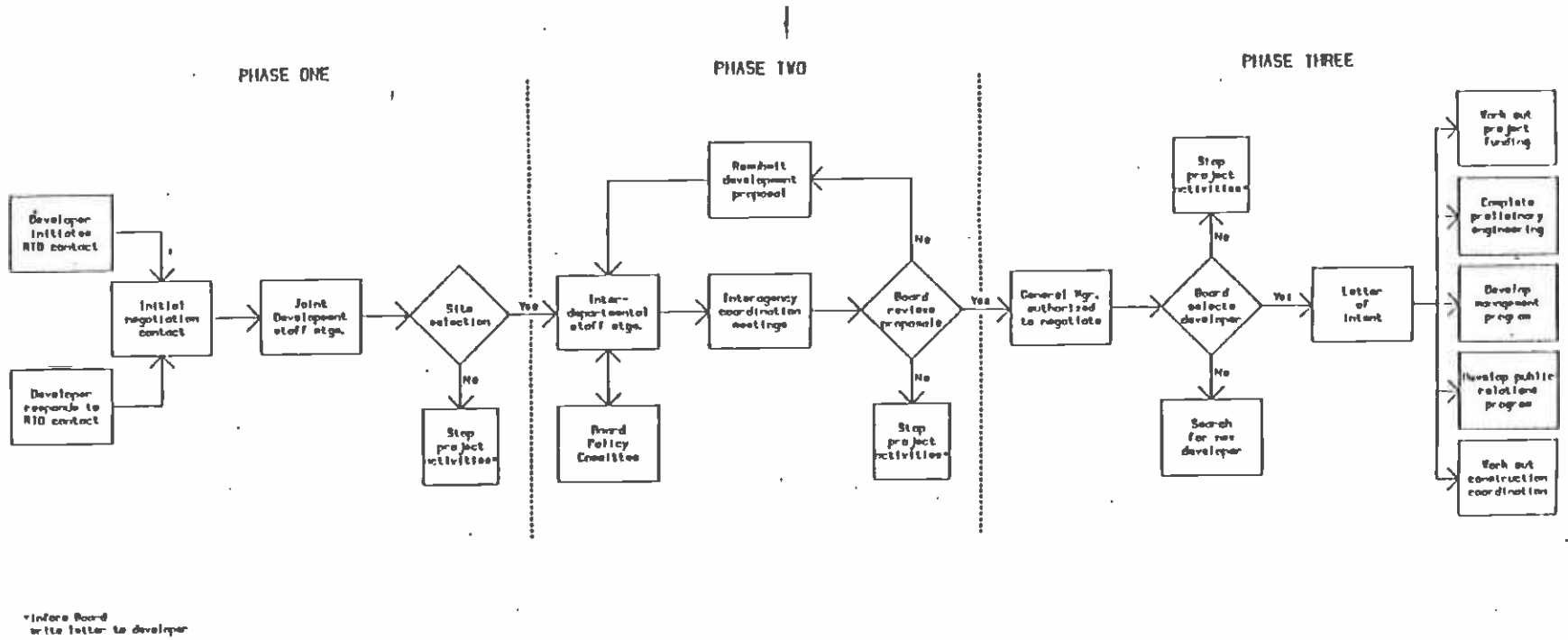
4.2
~~4.1.6~~ Joint Development and Disposition of Excess
Properties

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 process is illustrated in Exhibit 4-1.

The General Manager carries out negotiations on joint development projects, obtaining authorization from the Board of Directors to complete negotiations and execute final agreements. An interdepartmental team designated by the General Manager defines for Board approval the negotiating position of the SCRTD on each particular joint development proposal. This team meets periodically to coordinate interdepartmental efforts, formulate negotiating positions, and expedite the development process. This team also coordinates negotiation strategies with affected local agencies. The Real Estate and Development Department has the lead role in preparing and negotiating development agreements and for liaison with local agencies. The interdepartmental team also includes representatives from the Legal Department and Planning and Communications Department.

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.

EXHIBIT 4-1 Joint Development Process



Once a joint development/value capture agreement has been approved by the Board of Directors, the responsibility for the administration and monitoring of the agreement rests with the Director of Real Estate and Development.

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5.0 EQUIPMENT PROCUREMENT MANAGEMENT

5.0 EQUIPMENT PROCUREMENT MANAGEMENT

This chapter describes the general process to be used in the procurement of major 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.

Overall management of procurement will be provided in accordance with the organization set out in Chapter 2.0 of this plan. The Manager of the SCRTD Contracts and Purchasing Department will be responsible for administering the procurement process, which will be governed by procedures established by SCRTD and those SCRTD-approved implementing procedures of its consultants.¹ All such procedures will adhere to provisions of the Federal Acquisition Regulations as they apply to the Metro Rail Project.

5.1 ADVERTISEMENT

For each equipment procurement, a list of potential bidders will be prepared. This list will include all manufacturers having the facilities and experience needed to provide high-quality equipment in compliance with specification requirements. All manufacturers on the list will be invited to

1 Details on procurement procedures are contained in the SCRTD Procurement Manual and in the Metro Rail Project procurement plans that have been developed for major system contracts. See, e.g., Metro Rail Project Passenger Vehicle Procurement Plan, 17 April 1986.

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 to control bid documents.² The procedures define steps to be taken in issuing and controlling of bid documents.

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-proposal conference will be held to brief prospective proposers and explain proposal and 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 equipment procurements (e.g., passenger vehicles, train control, communications, fare collection systems) will involve a

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

WE WHY WE WANT A TWO-STEP
PROCESS, WHAT ARE ADVANTAGES?

two-step process. In the first step, technical proposals will be received from manufacturers in response to the design specification and contract documents. Those firms which are found responsive to the specification and contract documents will be invited to submit price proposals during the second step.

The evaluation of technical proposals will follow a rigorous equipment-specific evaluation process³ established for each procurement to ensure that proposers are capable of performing the contract and to ensure that the proposed equipment will meet all SCRTD requirements. Proposers who clearly do not satisfy SCRTD requirements will be eliminated from the competition. However, SCRTD may elect to hold discussions with any and all manufacturers to resolve any outstanding issues or differences in proposals and to maximize price competition during the second step.

For equipment that is regarded as standard (e.g., elevators, escalators), a one-step competitive procurement process will be used. In this process, proposers will simultaneously submit their technical and price proposals to SCRTD. The evaluation process will be specified in advance in an evaluation plan and will treat the technical and price proposals separately.

Committees will be established to evaluate proposals and will include persons knowledgeable and experienced in the design, manufacture, testing, and operation of the subject equipment. In addition, committees will include members with

3 See, e.g., Passenger Vehicle Proposal Evaluation Procedure, June 1986.

experience in contracts and project management. The committees will participate as required in discussions with proposers, and will document the results of their efforts.

The evaluation of technical and price proposals will result in the identification of the lowest price bidder who is fully responsive to the technical requirements and financially responsible.

how is this determined?

5.3 CONTRACT AWARD

Before a contract is awarded, a pre-award survey will be conducted to assure SCRTD that the prospective manufacturer has the personnel, facilities, procedures, and experience necessary to complete the contract in a satisfactory manner. The procedures specified in the Quality Pre-Award Survey Manual (July 1984) will be used to ensure that such surveys are uniformly carried out and to guide the analysis of the survey data. If SCRTD finds that the prospective manufacturer is satisfactory, a contract will be prepared and executed. If not, SCRTD will investigate the second-ranked bidder.

5.4 DESIGN CONTROL

what is SCRTD responsible & responsible?

During the manufacturing cycle, SCRTD will monitor and control equipment design by:

- Evaluating manufacturers' management plans, 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, SCRTD will evaluate design drawings and mock-ups to ensure compliance with specification

requirements. Design review requirements are specified in Design Review Procedures (August 1983). A description of the design review process is contained in Chapter 8.0 of this plan.

To provide SCRTD with visibility over contractor progress and to ensure that work is consistent with SCRTD requirements, most contractors will be required to submit Contract Deliverable 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 and crushing analyses; reliability, maintainability, and safety analyses.
- Configuration documentation, such as drawings, parts lists, and history books.

All CDRL items will be reviewed in a comprehensive and systematic manner, as described briefly below:

- The contractor delivers the CDRL item to the Resident Engineer, who forwards it to the Configuration Control Section (CCS).
- The CCS sends copies to cognizant program participants based on standard distribution lists.
- The SCRTD's technical staff reviews and comments on the CDRL item and submits comments to SCRTD's designated project manager.

- SCRTD's project manager meets with the technical managers to resolve comments.
- The project manager approves or rejects the CDRL item.
- Notice of approval or rejection is transmitted by letter to the contractor. Copies of the letter are distributed to SCRTD technical staff, Program Control Division, the Contracting Officer's representative, and the contracting officer, through the CCS.

5.5 FABRICATION/ASSEMBLY MONITORING

During the equipment fabrication and assembly cycle, SCRTD will monitor the quality of components and of the final product. For major equipment procurements, a Resident Inspector will be located in the manufacturer's plant to monitor quality levels and schedule adherence. The Resident Inspector 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 QA review procedures and the procedures specified in the QA/QC manuals of SCRTD consultants and other applicable manuals and plans. (See Chapter 11 for further discussion of the QA program.)

5.6 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.) Defects will be documented and the manufacturer will be required to correct them before final payment is made.

5.7 WARRANTY ENFORCEMENT

VERY AMBIGUOUS!

All equipment purchased for the Metro Rail Project will have an appropriate warranty period. During the warranty period, equipment failures will be corrected by the manufacturer or by SCRTD. If SCRTD performs the warranty work, the manufacturer will reimburse SCRTD so that full value is obtained from the warranty provisions of the contracts.⁴

LA086898R

4 SCRTD Metro Rail Project, Warranty Management Plan, July 1984.

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 the 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 Director of Construction Management has overall responsibility for Metro Rail construction and is supported by assigned staff and the Construction Management 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 Certificate 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 and 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.

A pre-bid meeting, including site visit, will be conducted for each contract to assist prospective bidders in fully understanding the nature and scope of the work and to clarify technical and administrative requirements. Bid periods will range from 20 to 45 calendar days, depending on the nature and complexity of the contract. Bids will be publicly opened in the SCRTD Board Room at the advertised time and date.

The SCRTD will evaluate the bids and prepare a recommendation for the SCRTD Board of Directors to approve and execute the contract. After Board approval and receipt of payment and performance bonds and insurance certificates, the contract will be awarded.

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 the project scope of work. It will also provide the SCRTD with the opportunity to reiterate actions that must be accomplished prior to starting the work.

The Director of Construction Management will issue 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 for the construction phase.¹ The Resident Engineer (RE) is the focal point for on-site construction management activities and the primary point of contact with the contractor during the construction phase. The RE will be assisted by the Construction Management consultant and SCRTD personnel.

The primary function of the RE is 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 charges and claims are properly documented and promptly processed and negotiated.

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

The RE will ensure that all contract deliverables (e.g., shop drawings, list of subcontractors, project schedule, safety

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

plan, quality control plan, change proposals and claims, progress payment requests) are properly documented and promptly processed.

Regular job site meetings will be held to review contractor progress, status of deliverables, problems, safety items, schedules of work, and other items pertinent to contractor performance.

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

The RE will ensure that measurement of and payment for work performance are in strict conformance with the specifications. Monthly progress payment estimates will be prepared by the RE, compared, and submitted to the SCRTD for approval and payment.

All changes during construction will be tightly controlled in accordance with the configuration management procedures described in Chapter 8.0.

Criteria have been established and implemented for claims avoidance and expeditious processing and resolution of contractor claims on the Metro Rail Project.

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 RE and SCRTD representatives. The final inspection will

confirm that the work has been completed in conformance with all contract requirements.

The RE will prepare a complete set of record documents to reflect as-built conditions. The SCRTD, prior to final acceptance of the contract, will ensure that:

- All accounts between the SCRTD and the contractor are in order
- 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
- Contractor has submitted an affidavit releasing the SCRTD from all claims and liens arising from the contract.

Final payment will not be made until final acceptance by SCRTD.

6.4 CONSTRUCTION SAFETY AND SECURITY

SCR TD has developed and implemented a construction safety and security program that is specifically tailored for construction of the Metro Rail Project:¹

- All tunnel construction will be performed in strict compliance with Cal-OSHA requirements
- Special safety plans have been prepared in the event that methane gas, abandoned oil wells, hazardous wastes, or other extraordinary circumstances are encountered
- All contractors are required to develop a project-specific safety and security program
- The SCR TD will closely monitor and control safety and security compliance to ensure that work is performed safely for the benefit of construction workers and the public and for the protection of property.

LA086899R

1 Construction Safety and Security Manual.

7.0 PROGRAM CONTROL

MTA LIBRARY

7.0 PROGRAM CONTROL

The program control function provides project management with the data to monitor the project and the performance of the project team against cost and schedule objectives. The Director of Program Control has the responsibility for those activities, and two methods are used to gather and present project status information for management action:

- The project management information system which is called the Transit Automated Control System (TRACS)
- The Management Information Center (MIC).

The TRACS incorporates typical project management components (cost, schedule, performance measurement, report generation, etc.) with additional capability to monitor the status of the real estate program and the availability of project funds.

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

- Budgeting: updates and monitors budget information.
- Funding: initiates, updates, and monitors the sources of funds, and links funds to budgets in the budgeting subsystem.

- Task Detailing: defines and quantifies budgets and provides scheduling linkages.
- Procurement: establishes and monitors the flow of procurement information from the initial requisition through contract execution.
- Real Estate: monitors major events in the right-of-way process.
- Change Order: identifies and tracks changes to contracts.
- Progress Payments: updates and processes the contract progress by quantities installed and quantities to complete.
- Scheduling Interface: transfers information from TRACS to the Management and Scheduling System and vice versa.
- System Reporting: generates user-requested reports through the report generator called IMAGINE.
- System Maintenance: enables the system administrator to identify valid codes for the subsystems and establish escalation and cash flow curves.

PDCD and the SCRTD Program Control Department use TRACS to produce reports which provide management visibility. These reports are derived from the orderly collection of project cost, schedule, funding, real estate, and procurement information.

The MIC is the nerve center for the project. The center is a room wherein all project status information is displayed. The information is updated continuously and the Assistant General Manager for Transit Systems Development convenes weekly project status meetings in the center. These weekly meetings review progress on the project, and address current problems and issues. Minutes of each meeting are taken and actions are assigned to resolve outstanding problems.

TRACS and MIC gather and present data on the key elements of program control:

- Defining the tasks to be accomplished
- Budget management
- Schedule management
- Project status reporting.

Each of these elements is addressed in the remainder of this chapter.

7.1 DEFINING THE TASKS TO BE ACCOMPLISHED

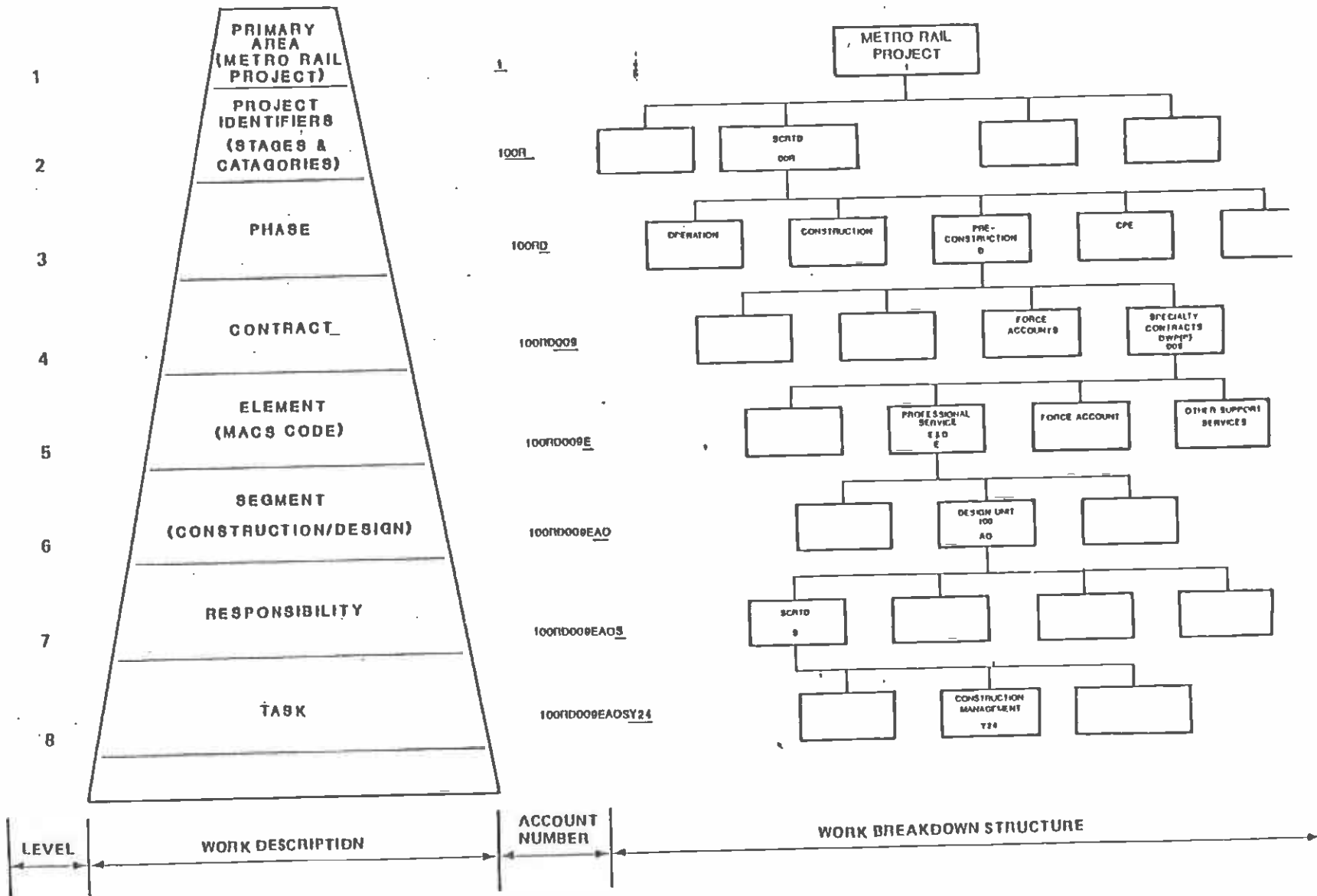
To define all the tasks to be accomplished on the project, a detailed Work Breakdown Structure (WBS) has been prepared.¹ The WBS increases the ability to efficiently plan and manage the Metro Rail Project.

The WBS subdivides the overall project effort into increasingly detailed tasks, until the desired visibility and level of control is achieved. The WBS is the key to defining and organizing all work schedule control, cost control, filing, and progress reporting on the Metro Rail Project.

1 SCRTD Work Breakdown Structure Manual, Program Control Department, February 20, 1986

EXHIBIT 7-1

Southern California Rapid Transit District
Work Breakdown Structure



7-4

August 8, 1986

The WBS levels that make up the code of accounts include the following:

- Primary Area: This level identifies the SCRTD's capital project (e.g., the Metro Rail Project).
- Project Identifier: This level identifies discrete projects (e.g., MOS-1, MOS-2).
- Phase: This level identifies the phase of the project (e.g., preliminary engineering, construction, start-up testing).
- Contract: This level identifies each contract on the project.
- Element: This level identifies specific management and control system codes. Costs will be aggregated to this level.

For each WBS element, a statement of work has been prepared and the responsibility for the conduct of the task is recorded as the work is assigned.

7.2 BUDGET AND COST MANAGEMENT

A budget for the entire Metro Rail Project has been prepared. The budget is based on estimates of the cost of each element of the Metro Rail system and the activities required to construct it. The estimates are based on historical cost data with appropriate allowances made for inflation and for differences in equipment or facility configuration. Utility right-of-way and insurance costs are included and a contingency allowance has been made for unexpected events.

The budget has been continuously updated during the design phase and this process will continue as bids for the various contracts are received, purchase orders are written, and contracts are signed. The budget will also be updated as design and contract changes are made during the construction phase.

To maintain control of the Metro Rail budget, a cost management process has been implemented. The process provides timely information on funding status, expenditures, obligations, cash flows, and estimated costs to complete each Metro Rail task. All participants in the Metro Rail Project prepare monthly reports which describe their progress and account for expenditures which have been made. The Program Control Office analyzes these reports, compares the cost data against anticipated expenditures, and examines cost trends. Problems which are identified are discussed with the responsible project engineer and contracting officer's representatives and appropriate action taken. This action includes changing budgets, disallowing costs, or negotiating cost reductions.

After the analysis is complete, invoices are approved for payment, the TRACS files are updated, and the Program Control Office conducts a variance analysis on all Metro Rail budgets and presents SCRTD management with a monthly summary of the cost status on the project.

7.3 SCHEDULE MANAGEMENT

To monitor and control all activities on the Metro Rail Project, several schedules have been prepared:

- Level 0 is the executive schedule which provides a brief overview of project events but has insufficient detail for monitoring and control

- Level I is the contract schedule which presents, in the form of a bar chart, the major milestones for each construction contract on the project
- Level II is the working schedule which presents more detailed information on the critical path in the form of a precedence diagram
- Level III is the construction management summary schedule which is used by the construction managers to measure, and report on, contractor progress
- Level IV is a contract schedule showing the lowest level of detail for each contract. Schedules are prepared and maintained by each contractor and submitted to SCRTD for approval.

SCRTD and its consultants will use the Level III and Level IV schedules to monitor progress during the construction phase of the project. Progress against these schedules will be reported each month to the Program Control Office, together with revised completion dates when appropriate. If the revised completion dates could affect the project completion date, 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 of the Transit Systems Development Department of the available options. Major changes to the project schedules will be reviewed and approved by the Change Control Board.

7.4 PROJECT STATUS REPORTING

All contractors on the project are, and will continue to be, required to submit monthly reports describing:

- Progress on their contract
- Problems impacting progress
- Expenditures which have been made
- Changes to the expected cost at completion or the expected completion date.

In addition, each SCRTD department working on the project also submits a monthly progress report.

The Program Control Office analyzes these reports and prepares a consolidated monthly report on the project for review by the senior management and Board of Directors of the SCRTD. The consolidated report will highlight the major accomplishments and problems on the project and report against the overall budget and Level II schedule.

8.0 CONFIGURATION MANAGEMENT

8.0 CONFIGURATION MANAGEMENT

The Metro Rail Project is a large and complex undertaking involving of numerous interdependent entities. Therefore, in configuration management techniques must be applied to ensure that the project progresses along a predetermined path, and that any change to that path receives proper levels of management and technical review.

JIM NOT
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CONFIG.
MANAGEMENT

The configuration management program for the Metro Rail is defined in two documents.¹ Because of the importance of proper management of the configuration of project documents, the major consultants have been assigned responsibility for configuration control. The GC has been responsible for configuration management during the design phase, and the CM will assume responsibility for the remainder of the project.

This chapter discusses the management process for:

- Document control
- Baseline change control
- Design review
- Bid document control
- Change orders
- Claims.

1 GC, Configuration Management Implementation Plan and Procedures Manual, October 1984; and CM, Project Control Procedure Manual.

8.1 DOCUMENT CONTROL

Configuration accountability and historical records of the project design are an integral part of configuration management. Consequently, an effective document control effort 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 of the Metro Rail, a Document Control Center 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 Document Control Center are:

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

After contracts are signed, the Document and Material Control System (DMCS) will be the primary focus of all document control activities. The DMCS will be managed by the CM consultant. All contract documents and drawings, including those for the vehicle and fare collection procurements, will utilize DMCS.

DMCS, as utilized on the Metro Rail Project, 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. The design package system provides for the tracking of the review cycle of constructibility review packages through the 60 percent, 85 percent, and 100 percent development stages. In addition to constructibility packages, this system will track the review cycle of design criteria, standard and directive drawings, and special studies (research papers or special reports).
- Correspondence Index System. The correspondence index system provides for the indexing, cross referencing, and sorting of information by document type. The four types of documents currently being used are: correspondence, interoffice correspondence, meeting minutes, and library reference materials. The documents are entered according to their type and are reported in a variety of sorts and selections.
- Equipment Status System. The equipment status system provides for the statusing 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. Exception reports are available for any combination of comparisons. The equipment status system is initiated by the placement of the purchase order and tracks the fabrication/shipping status of the items on the purchase order.

- Contract Document Index System. The 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, updating the data base allows for printing change order reports showing the latest revision level of each document.
- Shop Drawing Review System. The shop drawing review system provides for the tracking of shop drawing submittals through the review and approval cycle and back to the contractor. Exception reports, identifying items behind schedule, are provided for each scheduled date tracked. The information provided by this system allows for control of contractor submittals and resubmittals and identifies the current stage of the review cycle for any data item.
- Maintenance System. The maintenance system provides for the setup and changing of contract numbers and their description in DMCS as it relates to the other systems.
- System Information System. The system information system supplies information about DMCS. The information obtainable from this system ranges from a listing of the current users to the amount of time and storage used.

Each of the DMCS systems provides several report selections (or sorts). All reports are based on a standard format and the user can change a report format to meet a

specific need with little expenditure in time or effort. The variety of available report formats and selections can meet the needs of most projects.

A standard project filing index has been developed.¹ Upon SCRTD's acceptance of a facility or system, the entire file will be turned over to the SCRTD.

8.2 BASELINE CHANGE CONTROL

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

- ① Project Schedule
 - 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
 - ② Design Directives
 - ③ Contract Unit Descriptions Book
 - Contract Specifications Books (Conformed).
- I DON'T SEE THE
CCB MEETING TO ONLY
DISCUSS SCHEDULE OR
CUD CHANGES, WILL
IT MEET ON A
RECURRING BASIS?
WHO CHAIRS
(STATE ACTUAL)?*

The change control procedure for the first nine baseline documents is described below. Changes to conformed contract specifications are handled through a formal contract change control process that is described in Section 8.5.

A formal process has been defined for ensuring that any change to a baseline document receives a comprehensive technical review before it's implemented. A baseline change control procedure has been established to describe how changes are initiated, controlled, approved, and implemented.²

The process is described briefly below:

- Any participant in the SCRTD Metro Rail Project may initiate a proposed change to a baseline document if the change is mandatory, cost effective, and/or adds clarity.
MANDATORY CHANGES MAY NOT BE COST EFFECTIVE!
- A proposed Change Request will specifically identify the section of the baseline proposed for revision and define in detail the proposed change, the reason for the change, other Metro Rail Project areas the change will affect, and any other pertinent or substantiating data as required on the standard Change Request form.
- After completion of the items required on the Change Request form, the initiator obtains concurrence of his Division Manager or Director. Upon concurrence, the proposed change is submitted to the Configuration Management office for further processing.
- The Configuration Management office reviews the submitted material to assure that all data required has been submitted and to determine what technical review areas are necessary.

2 Metro Rail Project Configuration Management Implementation Plan and Procedures Manual, Procedure E.2., 9 Oct. 1984.

WHAT? NO COST/SCHEDULE
ASSESSMENT!!

- Reviewers complete the technical impact assessment. Upon receipt of the impact assessment, the Configuration Management office prepares a summary statement for the SCRTD Configuration Control Board (CCB).
- The CCB meets to approve or disapprove the Change Request. The CCB has final authority over disposition of all Change Requests and directs implementation of the proposed Change Request. CCB actions on Change Requests are implemented via formal direction by the CCB Chairman or Co-Chairman and tracked and reported until satisfactory closure.
- The Configuration Management office prepares a Notice of Action (NOA) for each approved Change Request. This NOA specifically establishes the actions required, date for completion, and the person(s) responsible.
- Upon notice of satisfactory completion of the action, the Configuration Management office closes that action. When all actions are completed, the MRTC Configuration Management office then closes the change request file.

8.3 DESIGN REVIEWS

This section provides a description of the process for incremental SCRTD design review and approval of contract documents. It also describes design reviews for each procurement contract.

8.3.1 SCRTD Design Reviews

The preparation of Metro Rail contract specifications books has been 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 have been 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 specification requirements in their areas of interest. This process is also required to ensure that changes to the baseline documents resulting from design reviews are recorded and the appropriate change action 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.

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 Configuration Management office and are sorted and collected. Each comment is individually addressed and resolved. The cognizant design manager ensures that the reviewer concurs with the action taken after incorporation of the proposed resolution. Formal Design Review meetings are held. Action item lists are maintained to track all unresolved issues. Each review package, along with comments, responses, actions, and minutes, is then filed by DCC 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.

Formal design reviews have been completed for each segment of the SCRTD Metro Rail Project as defined by the Contract Unit Description Book. The required review points have included:

- Preliminary Design Reviews. These reviews were accomplished at approximately 30 percent of design maturity and included preliminary drawings and other pertinent data.
- In-Progress Design Reviews. These reviews were accomplished at approximately 60 percent of design maturity. At this review point, all design elements appeared in the drawings and specifications. This review point was extremely important because it represented the last time significant changes could be made to contract documents without substantial impact on the design effort. At this point, the basic layout of all drawings was completed with only final details remaining.
- Prefinal Design Reviews. These reviews were accomplished at approximately 85 percent of design maturity and essentially represent completion of the final design product. Drawings and specifications were complete, but final checking and coordination was not finalized. Detailed drawings and specifications were included at this point.

• Final Design Review. This review is of the 100 percent completed contract documents before they are prepared for advertisement. All contract documents were widely distributed to all program participants as well as appropriate industry sources for review and comment.

8.3.2 Contractor Design Reviews

System contractor designs will be managed by the use of incremental design reviews. Several 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 Identification.

These reviews will be conducted to evaluate the progress and technical adequacy of the design and 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 review meetings will be distributed by SCRTD.

• Conceptual Design Review (CDR). The CDR will usually be held no later than 60 days after NTP. 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 operating procedures and philosophies.

Preliminary Design Review (PDR). The PDR will be conducted incrementally prior to detail design to evaluate the progress and technical adequacy of the selected design approach, and its compatibility with the 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 subsystems 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 a subsystem functional description, interface description, 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 of a subsystem is essentially complete and the production drawings are ready for release. The

FDR will determine that the detail design of the subsystem under review will satisfy the design requirements and establish the exact interface relationships between the subsystem 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 these reviews 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 Identification (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.

SCRTD will be notified a minimum of 10 days prior to date of FACI. The contractor will be advised regarding SCRTD attendance.

The FACI will verify that production hardware complies with production drawings as agreed upon during 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 indenture list of drawings, will be submitted to SCRTD.

8.4 BID DOCUMENT CONTROL

The Contract Services Section of the Configuration Management office is organized to control and document the sale and distribution of all bid and related documents for the Metro Rail Project. The Control 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, and other bid-related documents.
- Provide positive control of the distribution and identification of specific bid document copies.
- Establish historical records and documentation of the assembly, printing, distribution, and sale of bid and related documents.
- Operate and maintain a Plan Room to be open to the prospective bidders during the bid phase of the project.

The 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, except as indicated elsewhere in these procedures.

Specific procedures have been developed relating to:

- 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 and regulations.

The Contract Services Section is responsible for the control of all contract documents until the contracts are approved by the SCRTD Board of Directors. After the contracts are formally signed by the Board of Directors, the relevant project manager will assume responsibility for management of contract documents. The following section describes contract change control procedures.

8.5 CHANGE ORDERS

Because any change to contracts may result in cost and schedule impacts to the project, a formal system is required to evaluate and approve any changes to the basic contracts. However, because of the potential volume and the minor nature

of a large percentage of the changes, the change control process must balance the efficiency of the process with the proper amount of management control. The change order process described herein is consistent with SCRTD's strict procurement procedures and also provides for expeditious processing.³

Specific change order procedures are clearly documented in the Project Control Procedures Manual and cover such topics as:

- Class One and Two Configuration Changes
- Routine and Emergency Changes
- SCRTD vs. Field Initiated Changes
- Change Request Approval Authority
- Change Control Responsibilities and Authority
- Unilateral Change Orders
- Change Order Documentation forms.

The award of a contract establishes the baseline contract documents. Upon contract award, the amount of the contractor's bid constitutes a budget for the baseline scope of work and conditions until it is amended. During the course of

3 Office of Contracts, Procurement and Material, Procedures Manual, no date; SCRTD Rules and Regulations, Section 8 and 9 (Purchasing and Sales of District Property), 7-28-83; Policy Implementation Procedure - John Dyer to Board of Directors, 2-4-82; SCRTD Administrative Procedures for Consultant Contract Negotiations, 1-3-83; all as amended by the Response to Draft Report on the Certification Review of the SCRTD, 6/6/86.

construction of the Metro Rail Project, there will be many prospective changes to the baseline contract documents.

Examples include:

- SCRTD-directed changes that become necessary as the designs evolve
- Contractor's proposed changes to specifications for such items as materials and specialized equipment
- Changes proposed to improve constructibility
- Value engineering change proposals to improve system performance, improve schedules, or reduce costs
- Differing site conditions
- Schedule delays due to unforeseen conditions.

Some prospective changes can be expected to be mutually interactive with other changes, with other facets of the construction operations and schedules, with system testing, and with operations and maintenance. Accordingly, the SCRTD's configuration management program is designed to identify, account, evaluate, approve, and control the implementation of necessary changes to the baseline.

A formal Configuration Control Board (CCB), established during the design phase, will continue to function through construction, testing, and start-up. The CCB will control changes that:

- Impact project milestones

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

Upon award of each facility or system procurement contract, all drawings, specifications, costs, and schedule milestones for that contract are "frozen" as a baseline. Thereafter, formal approval for any deviation from the baseline must be obtained. The original baseline may have a number of revisions on a cumulative basis, and a clear, traceable link to the baseline will be maintained. 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.

The following description provides an overview of the SCRTD process to control a routine class I change, originated by a contractor in the field. Reference should be made to procedures for different processes followed for emergency and class II changes, and changes originated by other project participants. The general process is as follows:

YOU SHOULD USE A FLOW CHART TO DESCRIBE THIS PROCESS. IT TAKES 5 PAGES TO DESCRIBE & THERE WILL BE A TO FORGET WHAT YOU READ IN THE BEGINNING BY THE TIME YOU GET TO THE END!!!!

- The contractor proposes a change to the on-site Resident Engineer (RE). If the proposed field change will require modification to drawings and/or specifications, the RE will prepare a Change Request form and develop a Change Request package.

- The Change Request package will include the Change Request form, a finding-of-fact statement, and copies of relevant correspondence. The RE transmits the Change Request package to the Construction Management consultant's office.
- The Construction Management consultant's Change Control Section (CCS) adds an estimate of cost and schedule implications to the Change Request package and gets approval from the Deputy Construction Manager-Operations to transmit the package to SCRTD.
- The SCRTD Director of Construction Management (DCM), as the contractual point of contact with Construction Management consultant receives the Change Request package and distributes copies to the Director of Transit Facilities or Systems Design and Analysis, and to the Director of Program Control for review. He also obtains permission from SCRTD's Contracting Officer's Representative (COR) to continue the change process.
- The DCM resolves any internal SCRTD concerns about the Change Request package, approves it, and transmits it back to the Construction Management Consultant's CCS.
- The CCS transmits the Change Request package to the RE, who requests that the contractor submit a formal proposal.
- The contractor prepares a Field Change File, which expands the Change Request package to include his proposed cost and schedule estimate.

- The RE transmits the Field Change File back to the CCS, which distributes copies to TSD Directors of Construction Management, Transit Facilities, Systems Design and Analysis, and Program Control, who review and comment on the proposed change, its schedule, and cost.
- The DCM resolves any internal comments and transmits them back to the CCS.
- The CCS prepares a complete Change Request package for its internal Construction Configuration Control Board (CCCB), which is charged with recommending changes to SCRTD.
- Upon approval by the CCCB, the package is forwarded to SCRTD Configuration Control Board (CCB). The CCB is chaired by SCRTD's COR and consists of representatives from the TSD Construction Management, Transit Facilities, Systems Design and Analysis, Program Control, and Real Estate Departments, as well as relevant consultants.
- Upon approval of the CCB, the Change Request package is forwarded to the Contracting Officer in SCRTD's Contracts, Procurement and Materiel Department.
- After the Contracting Officer's approval, the Change Request package is sent via the DCM to the CCS. A copy is sent to Program Control for input into TRACS.
- The CCS prepares a Change Order (CO). The CO instructs designers to change the drawings and

specifications, which are then returned to the CCS. The CCS refines the cost and schedule impacts based on the final changes to drawings and specifications.

- A negotiating team consisting of the RE, the DCM, and a representative of the SCRTD's Contracts, Procurement and Materiel Department, meets with the contractor to negotiate the cost of the CO.
- The SCRTD representative from the Contracts, Procurement and Materiel Department prepares a summary of negotiations.
- The CO and the summary of negotiations is returned to the DCM for distribution and approval depending on the dollar amount of the CO, as listed below:
 - Under \$25,000 - Approval by the DCM
 - Between \$25,000 and \$100,000 - Approval by the COR
 - Between \$100,000 and \$1,000,000 - Approval by the SCRTD General Manager
 - Over \$1,000,000 - Approval by the Board of Directors.
- After approval by the proper level of SCRTD authority, the SCRTD Legal Department approves the CO.
- The approved CO is returned to the DCM for distribution to the CCS. A copy is sent to TSD Program Control for input to TRACS.

- The CCS advises the RE to give the contractor Notice to Proceed, and also inputs the information into TRACS.

8.6 CLAIMS

This section provides a description of SCRTD's process for handling claims. As with the change control process, the SCRTD has developed procedures that balance the rapid response needed for claims avoidance with necessary management controls.

A claim is a written demand by a contractor for contract adjustment (money and/or time extension) based on alleged conditions or performance 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.

Claims involving allegations of differing site conditions are generally complex and require rapid response, particularly if all or most work must be halted while the alleged condition is verified.

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 instigate claims. To help avoid claims, SCRTD is focusing efforts on indoctrinating staff in the need for:

- Familiarization with contract documents including terms, conditions, drawings, specifications, and standards
- Development of clear and distinct packages
- Thorough and consistent contract administration
- Good communication and a professional working relationship with the contractors
- Timely response to correspondence and problems
- Avoiding interference with contractor's planning and performance of work
- Proper preparation and maintenance of documentation.

The process described below summarizes the Metro Rail claims procedures. These procedures are consistent with SCRTD procurement management control procedures:

- As soon as a project manager or RE becomes aware of an unusual situation which could give rise to a

claim, the matter will be documented, a file opened, and all available information obtained. The contractor will submit a Notice of a Claim, advising the project manager or RE of their intention to file a claim.

- The project manager or the RE submits the Notice of a Claim to the Configuration Control Section (CCS). The CCS records the claim notice in a log and immediately sends the Notice of a Claim to the SCRTD Contracting Officer's Representative (COR).
- The COR will formally request claim details from the contractor. The letter will be transmitted back to the contractor through the CCS and the project manager or RE.
- The contractor will prepare and submit the claim to the project manager/RE, who will forward the claim to the CCS for distribution.
- The CCS will distribute the claim to the TSD Directors of Construction Management, Transit Facilities, Systems Design and Analysis, and Program Control, and relevant consultants as well as to SCRTD's Legal Department.
- The COR will meet with cognizant representatives of the above organizations and evaluate the merits of the claim. The COR will prepare disposition instructions and forward them to the CCS.
- The CCS will record the disposition, and have the program manager or RE submit the disposition instructions to the contractor.

- If the contractor concurs with SCRTD's evaluation and disposition instructions, the claim will be submitted by the program manager or RE to the CCS to be processed as a change order. (The change order process was described in the previous section.)
- If the contractor disagrees with SCRTD's decision, it may appeal to the SCRTD Claims Appeals Board (CAB). The contractor submits his appeal to the project manager or RE, who transmits it to the CCS for processing.
- The CCS sends the appeal to the SCRTD Legal Department for CAB review. The Legal Department requests information from the COR as necessary.
- If the CAB approves the claim, the CCS is notified, who in turn notifies the project manager or RE. The project manager or RE instructs the contractor to submit a cost proposal. The cost proposal is transmitted to the CCS, which prepare a Change Order. The standard Change Order procedure is then followed.
- If the CAB rejects the claim, it is also transferred back to the contractor. If the contractor is still not satisfied, the matter is settled in accordance with contractual dispute clauses.

9.0 TEST MANAGEMENT

9.0 TEST MANAGEMENT

Throughout the construction phase and during start-up operations, a comprehensive test program will be implemented to ensure that:

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

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

9.1 TEST PLANNING

Test planning was initiated during the final design phase of the Metro Rail Project and will continue during facilities construction and equipment procurement. A Test Program Plan (TPP)¹ has been prepared to:

- Establish the process for conducting, monitoring, and coordinating the test program

1 SCRTD Metro Rail Project, Test Program Plan, July 1986 (draft).

- Delineate the test organization and specify its authority and responsibilities
- Describe the administrative requirements of the test program.

The TPP is intended to ensure that management and technical resources are applied in a coherent and organized manner to achieve the Metro Rail test program objectives. The elements of the test program include:

- 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 between equipment and/or facilities has been achieved.
- 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 System Engineering and Analysis Section of the Systems Design and Analysis Department. A Supervising Test Engineer will manage the test program. Additional engineering staff will be recruited during the construction phase, and the test program will be supported by consultants.

9.2 CONTRACTUAL TESTING

Contractual testing will commence when the Metro Rail project is in the construction stage 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 at the component/subsystem level during contractor engineering to demonstrate compliance to specification.
- Production/Construction Verification Tests will be conducted 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 at the subsystem level to ensure proper installation.
- Acceptance Tests will be conducted at the subsystem level to verify that performance of all delivered equipment is in compliance with specification.

Demonstration Tests will be conducted in the pre-revenue and revenue operations phases to demonstrate the reliability of the system equipment.

Each contractor will be responsible for preparing the test plans and procedures for the contractual test requirements identified in the contract documents. The contractor will submit the test plans and procedures to SCRTD for review and approval. SCRTD will ensure that an adequate review is conducted and will authorize the contractor to proceed with the test and will monitor test execution. The test will be scheduled, conducted, and documented in accordance with the approved schedules, plans, and procedures.

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 its documentation are questionable. Contract-specific inspection and test plans will identify the products/materials which most likely require testing. Testing will be accomplished and results documented in accordance with SCRTD Test Program Plan requirements.

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 SCRTD with support from consultants. The Supervising Test Engineer will provide overall guidance and direction to the test engineers administering the specific contract for the performance of tests determined necessary by SCRTD. Preparation of procedures, conduct of tests, documentation of results, and the review and approval cycle are defined in the SCRTD Test Program Plan and the construction management procedures.

Formal test reports will be prepared after the completion of each test. Tests which affect system safety will be reviewed independently by the Metro Rail Safety Supervisor 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, SCRTD will recruit and train personnel to operate and maintain the Metro Rail system. Pre-revenue operations will be intended to 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/safe normal revenue service.
- 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.
- That certificates of compliance can be issued to substantiate that necessary plans, rules, procedures, equipment, facilities, and personnel are ready for safe Metro Rail revenue service and use by the public.

10.0 VALUE ENGINEERING

10.0 VALUE ENGINEERING

To design and construct the Metro Rail Project at the lowest capital and life-cycle cost, a value engineering program has been implemented. Value engineering involves an organized and rigorous analysis of system functions and requirements. It has been applied during the design phase to all aspects of the system design, including facilities, equipment, operations strategies, and maintenance planning. The program will continue during the construction phase of the project.

Value engineering is the responsibility of the Director of Transit Facilities, and the Director of Systems Design and Analysis. 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 use of a barrier-free 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 the service life, quality, economy of operation, ease of maintenance, or safety standards are not impaired. If the suggestion has merit, a change proposal will be prepared and executed according to the procedures described in Chapter 8.0.

*COST REDUCTION
IS NOT V.E.!!*

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 Director of Systems Design and Analysis is responsible for managing the quality assurance program for passenger vehicles and fare collection equipment. The 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 the following steps ensure that the Metro Rail Project meets its objectives and requirements.

11.1.1 Design Reviews

Design reviews are conducted to evaluate and compare design progress against the applicable design standards and criteria (see Chapter 3.0) and to allow reassessment

of these requirements as the design matures. Formal design reviews are conducted on all designs and specifications at the following stages:

- A Preliminary Design Review, conducted at approximately 30 percent of design maturity and including the preferred design concept, preliminary analyses, interface requirements, etc.
- An In-Progress Design Review, conducted at approximately 60 percent of design maturity and including all major design details and specifications
- A Prefinal Design Review, conducted at approximately 85 percent of design maturity and representing practically all design drawings and specifications
- A Final Design Review of all completed design drawings and specifications.

11.1.2 Safety, Security, and System Assurance Reviews

The safety, security, and system assurance functions have been kept independent of the design groups to ensure unbiased critiques of designs and specifications. The safety, security, and system assurance staff prepare quality assurance requirements for each specification, safety and security plans, and reliability and maintainability requirements which are being used for all project activities.

11.1.3 Value Engineering Reviews

Value engineering reviews are conducted on major elements of the Metro Rail Project to enhance cost-effectiveness of the project.

11.1.4 Constructibility Reviews

Constructibility reviews are conducted on the tunnels, stations, and other Metro Rail facilities to identify potential problems in their construction and inspection.

11.1.5 Configuration Management

Configuration management practices described in Chapter 8.0 have been established to ensure that all design changes are made in accordance with established criteria, and that their effect on budgets and schedules is identified.

11.2 EQUIPMENT PROCUREMENT

The Metro Rail Project staff will monitor the performance of each manufacturer's work. 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 others will be standard "off-the-shelf" items. The quality controls to be applied to each procurement will be determined by the size of the procurement, the complexity of the equipment, and the degree of standardization, but will consist of one or more of the elements described in the following sections.

11.2.1 Pre-Award Survey

Before a major equipment contract is awarded, SCRTD with support from consultants 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 pre-award survey will be conducted in two steps:¹

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

11.2.2 In-Process Inspections

In-process inspections are conducted to ensure that the manufacturer's quality procedures are acceptable and effective and that the quality standards are enforced. The in-process inspections will employ a resident inspector for major or critical procurements. The inspections will be performed according to a written checklist, and a log book will be maintained for each procurement. The inspections will 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 used

1 See Quality Pre-Award Survey Manual.

on each procurement. Inspection results will be documented and filed for reference if problems occur in the future.

11.2.3 Quality Audits

Periodically, for each 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.² These audits will be independent of the in-process inspection activities. They will be conducted in accordance with an overall audit plan and use 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.

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.

2 See Quality Assurance Review Guidelines.

11.3 CONSTRUCTION

Metro Rail Project staff will monitor all construction activities. This monitoring will address issues such as technical compliance, schedule adherence, product quality, and material testing. A Resident Engineer, supported by quality control personnel, will be assigned to each construction contract to provide on-site quality inspections and liaison between the contractor and SCRTD. The construction quality 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. These plans will be implemented by the Resident Engineer.

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 SCRTD
- Performing inspections of specially furnished equipment and fabricated construction materials

- Inspecting work in progress
- 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 SCRTD construction engineers and by the Construction Management consultant's quality assurance personnel. In addition, for each construction contract, a periodic quality audit will be performed to verify, by physical examination of hardware and relevant documents, that the contractor is conforming to the applicable quality procedures and standards. These audits will be independent of the Resident Engineer's activities. They will be conducted in accordance with the construction management QA/QC manual.³ 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.

3 See QA/QC Procedures Manual.

11.3.11.3.4 Final Inspections

When construction activities, including any necessary documentation, have been completed, a dedicated acceptance team will perform a final inspection. The team will include SCRTD personnel, the Resident Engineer, and other 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.

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 require engineering investigations, possible redesigns, and subsequent retrofits by the manufacturer. Revised designs and retrofits will be monitored for conformance to the established Metro Rail criteria and quality control standards.