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**SCRTD  
METRO RAIL PROJECT**

**Revision 2  
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# **Preliminary Engineering Design Control Plan**

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**Southern California Rapid Transit District**

APR 15 93

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1. INTRODUCTION TO PRELIMINARY ENGINEERING  
DESIGN CONTROL

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## 2. PROJECT-LEVEL DESIGN CONTROL

## 2.1 INTERFACE PARTICIPATION CONTROL

Interface participation control is intended to ensure early coordination of information among design groups. The procedures in this phase will be followed before actual design is started. The procedures include:

- . Develop interface matrix
- . Establish interface contacts.

### 2.1.1 Develop Interface Matrix

Purpose: This procedure is intended to identify potential design activity interfaces among design and Systems Engineering and Analysis (SEA) personnel and with sources outside the project that are required for the design effort. The tool for identifying interface requirements is the interface matrix shown in Figure 2-2. The matrix will present the information needs of each group, and the people who should be contacted for the information. The matrices will cover each WBS task and major subtasks.

#### Responsibility:

- . Project Manager/Chief Engineer: approve matrix
- . SEA Manager: develop matrix
- . Design Managers: provide input for matrix
- . Design Groups: provide input for matrix.

When To Perform: At the beginning of Preliminary Engineering when design groups submit their work flow diagrams with interface points.

#### Steps:

- . The SEA Manager will obtain copies of the design groups' work flow diagrams and list the documents required and information needs of each document (reference Figure 2-2, and for a list of proposed project documents during Preliminary Engineering see Appendix C).

Prepared by: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Approved: \_\_\_\_\_

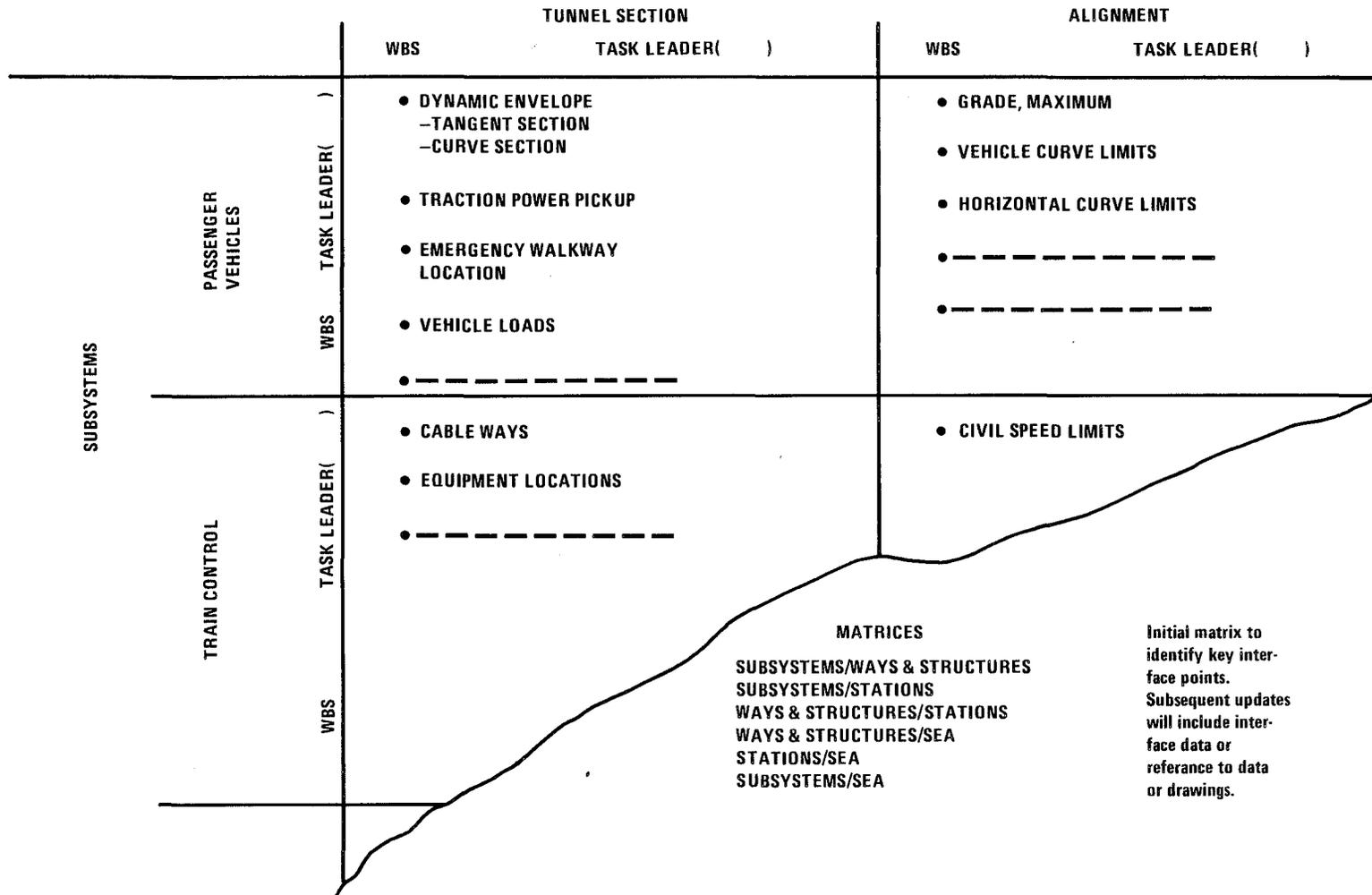


FIGURE 2-2  
 Representative Interface Matrix  
 (Ways and Structures)

- . The SEA Manager will work with the Design Managers to identify key interface points, and to include the names of technical personnel responsible at the task or major subtask level.
- . The SEA Manager will submit the matrix to the Project Manager/Chief Engineer for review and approval by the Design Control Board.
- . The SEA Manager will incorporate the comments of the Design Control Board and distribute the matrix to the Project Manager/Chief Engineer and the Design Managers.

#### 2.1.2 Establish Interface Contacts

Purpose: This procedure is intended to establish informal communication channels among the design groups through early personal contact.

Responsibility:

- . Design Managers: ensure that all necessary contacts are made
- . Design Groups: engineers and architects establish contacts.

When To Perform: Before starting and during a task involving work toward a project document.

Steps:

- . The design groups will review the interface matrix developed and distributed by the SEA Manager (2.1.1).
- . Responsible personnel from each group will contact identified counterparts to establish specific information needs.
- . The Design Managers will monitor and direct the intergroup coordination efforts of their group.

## 2.2 INTERFACE MANAGEMENT AND CONTROL

Interface management and control procedures are intended to result in:

- . Integration of the design groups' efforts as the design is developed
- . Project documents that conform to project objectives and are consistently formatted.

The procedures will be followed during design development and include:

- . Exchange design information
- . Develop designs
- . Resolve design conflicts
- . Number project documents.

### 2.2.1 Exchange Design Information

Purpose: The purpose of this procedure is to ensure that information is exchanged in a timely manner among design and SEA groups, and that the Project Manager/Chief Engineer is informed of project progress.

Four types of meetings will be held to assure design integration and coordination. The four types and their purposes are:

- . Design progress meetings - periodically held to discuss design progress and identify issues of integration, lack of progress, or needs for decisions that have intergroup effects.
- . Design Control Board meetings - meetings of the project management team for the purpose of resolving design conflicts and making design decisions among the design groups.
- . Intergroup meetings - informal meetings held as needed among design groups to identify and resolve problems and exchange design information and interface data.
- . Design review meetings - meetings conducted to provide a critical discussion of the entire design effort for a milestone or system element. Design reviews assure compliance with system objectives and

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consider the most appropriate design to achieve these objectives as reviewed by a group of experts and peers covering the disciplines under review.

The periodic project coordination meetings and informal intergroup contact will be the principal means of exchanging information and avoiding or resolving conflicts prior to document preparation. The Design Control Board and design review meetings will be more formally conducted and the results disseminated.

#### Responsibility

- . Project Manager/Chief Engineer: Approve agendas for formal meetings.
- . Design Manager: Provide inputs to project coordination meetings. Monitor and direct informal intergroup exchanges. Conduct design review meetings for areas of responsibility.
- . SEA Manager: Prepare agendas for project coordination meetings and Design Control Board meetings; prepare design review agendas and coordinate meeting activities.
- . Design Groups: Provide inputs for meetings as required.

#### When To Perform

Project coordination meetings and Design Control Board meetings will be scheduled at least once a month but may occur as often as required. Design review meetings will be scheduled sufficiently ahead of the applicable milestone or other critical event to allow incorporation of the results into the final product.

#### Steps:

- . Design Progress Meetings:
  - The Project Manager/Chief Engineer will schedule the meetings and approve the agenda for distribution.

- The SEA Manager will prepare the meeting agenda. The Design Manager will submit items of concern or issues to be discussed for inclusion on the agenda.
- At the meeting, the Design and SEA Managers will present summaries of the work accomplished since the previous meeting, of work planned before the next meeting, and of relevant problems, needs for decisions, or other technical issues that are affecting work progress.
- The Project Manager/Chief Engineer will provide appropriate direction toward solving the problems. The SEA Manager will prepare meeting notes.

Design Control Board Meetings

- The Project Manager/Chief Engineer will schedule Design Control Board meetings and approve the agenda.
- The meetings will be attended by the Project Manager/Chief Engineer, the Design and SEA Managers, and representatives of the design and SEA group consultants.
- The SEA Manager will prepare the meeting agenda. The Design Managers will submit items of concern to be included in the agenda.
- At the meeting, the appropriate Design and SEA Managers and/or their consultants will present summaries of the material pertinent to the agenda items.
- The Project Manager/Chief Engineer will provide direction to the groups' design efforts as required.
- The SEA Manager will take meeting notes and prepare an action item memorandum (AIM). All managers will issue changes to any controlled documents affected by a design decision reached at a Design Control Board meeting.

- Additional steps affecting Design Control Board meetings are provided in Section 2.2.3.

### Informal Intergroup Meetings

These meetings will occur on an ad hoc basis among Metro Rail managers or directly between consultants. The Metro Rail managers must be informed of any meeting scheduled directly between consultant groups.

### Design Review Meetings

Details of the design review procedure are covered in Section 2.3.3.

## 2.2.2 Develop Designs

Designs are developed within each group. The procedure for control of design development within each group will be established by the Design Manager of the group as described in Chapter 3.

Any design approach or change that would necessitate a modification in project objectives or the System Specification, an increase in preliminary engineering cost or lengthening of preliminary engineering schedule, must be approved by the Project Manager/Chief Engineer before implementation.

## 2.2.3 Resolve Design Conflicts

Purpose: The purpose of this procedure is to determine the appropriate direction for design and SEA groups to follow when a design conflict arises that cannot be resolved among them.

### Responsibility:

- . Project Manager/Chief Engineer: approved final resolution
- . Design and SEA Managers: present positions on conflicting alternatives
- . Design Groups: provide input for conflict resolution.

When To Perform: On notification of conflict by Design or SEA Manager.

### Steps:

- . The SEA Manager will include the item on the agenda of the next Design Control Board meeting, or request a special Design Control Board meeting.
- . The Design Manager whose document is being addressed will present the position of his group regarding the conflict, in terms of meeting project objectives.
- . The Design Managers of other groups will present the position of their groups.
- . The SEA Manager will present an analysis on the effect of the alternatives on the Metro Rail System as a whole.
- . The Project Manager/Chief Engineer will select the alternative that will best meet project objectives, and notify the Design and SEA Managers.
- . The design groups will revise their design as directed by the Design Manager.
- . The resolution of a design conflict may result in a change in project objectives or a change to the System Specification. These changes may only be made by the Project Manager/Chief Engineer.

### 2.2.4 Number Project Documents

Purpose: The purpose of this procedure is to make project documents easy to identify and interpret by the use of alphanumeric document codes which consist of or incorporate the task WBS number and a standard document format.

#### Responsibility:

- . Project Manager/Chief Engineer: review and approve standard document formats, issue document codes and formats to Design Managers and consultants
- . Design and SEA Groups: properly format documents.

When To Perform: Before documents are prepared.

Steps:

- . The SEA Manager will recommend a standard document format for each type of document (e.g., criteria, drawing, specification, plan, report), and an alphanumeric code identifying the group that developed the document and the type of document, and incorporates or consists of the task WBS.
- . The design and SEA groups will format their project documents as required and will affix the codes assigned by the SEA Manager to the documents.

2.3 DOCUMENTATION REVIEW/APPROVAL CONTROL

The procedures in this phase include the review and approval of design documents, maintenance of a record of the approved documents and periodic review of the system's design. The purpose of the review at this stage is to verify that the design meets project objectives. Three procedures are described in detail here:

- . Review/approve documents
- . Maintain record of the design configuration
- . Conduct periodic design reviews.

2.3.1 Review/Approve Document

Purpose: This procedure is intended to provide a check that project documents are integrated with other groups' designs and that project documents conform to project objectives.

Responsibility:

- . Project Manager/Chief Engineer: review and approve documents
- . Design and SEA Managers: review, approve and present own documents, review other groups' documents
- . Design and SEA Groups: review other groups' documents.

When To Perform: When a project document is completed.

Steps:

- . Design or SEA Managers will review their respective documents upon completion by their group.
- . Design or SEA Managers will distribute copies of the document to the other managers, and involved consultants as appropriate.
- . The other groups will review and comment on the document, and return it to the issuing manager.
- . The issuing manager will resolve the comments and revise the document. If a comment cannot be resolved among the groups, the issuing manager will notify the SEA Manager for inclusion on the Design Control Board agenda (see Section 2.2.3).
- . If no conflict exists, the Design or SEA Manager will submit the document to the Project Manager/Chief Engineer for acceptance.
- . If the Project Manager/Chief Engineer chooses to have a design review:
  - The applicable Design or SEA Manager will be responsible for a presentation on the document's conformance to project objectives.
  - The SEA Manager will check that all the identified interfaces were addressed during the document's development.
- . The design review will be conducted by the Project Design Control Board. The Project Manager/Chief Engineer will decide to accept the document or direct that it be revised, based on the Design or SEA Manager's presentation and comments of the Project Design Control Board.

- . The Design or SEA Manager will have the document revised and returned to the Project Manager/Chief Engineer for approval.
- . The Project Manager/Chief Engineer will sign the document, indicating his approval.

### 2.3.2 Maintain Record of the Design Configuration

Purpose: The purpose of this procedure is to keep a record of the design configuration, as defined by the latest approved project documents.

Responsibility:

- . SEA Manager: maintain and audit document status log
- . Design Managers: provide audit information.

When To Perform: Ongoing as project documents are accepted by the Project Manager/Chief Engineer.

Steps:

- . The SEA Manager will check that all documents issued are properly formatted, approved (signed and dated), and have the correct identification code.
- . The SEA Manager will record the date issued and the revision number in a document status log.
- . The SEA Manager will distribute a list of project documents and their status to the Design and SEA Managers at least every three months.
- . The Design Managers will resolve inconsistencies between their records and the project records.
- . The SEA Manager will distribute a final list of the correct document status to the Design Managers.

### 2.3.3 Conduct Periodic Design Reviews

Purpose: The purpose of this design control procedure is to provide an in-depth and formal review of the entire project design development at periodic intervals during Preliminary Engineering.

Responsibility:

- . SEA Manager will prepare review agendas.
- . Design and SEA Managers will present design drawings and other design data, and critique designs of other design groups.
- . Other design review participants (as invited) will critique design presented and recommend changes.
- . Project Manager/Chief Engineer will approve design or request changes.

When To Perform: At the discretion of the Project Manager/Chief Engineer.

Steps:

- . Four weeks prior to design review, the SEA Manager, with approval of the Project Manager/Chief Engineer, will prepare the design review agenda. The agenda will include progress reports on all design activities under way in the Metro Rail Project and presentations of all approved designs.
- . At the same time, the Project Manager/Chief Engineer will invite participants for the design review. Participants may include other SCRTD staff, consultants, and persons from outside agencies.
- . The design review participants will discuss and critique the design presentations based on adequacy of technical content and adherence to project objectives and system specification.

- . The Project Manager/Chief Engineer will seek recommendations for modifying designs as critiqued, and these recommendations will be implemented upon concurrence of the Project Manager/Chief Engineer.
- . The design review may result in a recommendation to modify project objectives or the System Specification.
- . The SEA Manager will record the results of all reviews.
- . Responsibility for modifying the design, per design modification decisions, will be assigned to the appropriate Metro Rail Design Manager. That Design Manager will be responsible for preparing and submitting an implementation plan for the modification to the Project Manager/Chief Engineer, who will review and authorize the implementation.

3. GROUP-LEVEL DESIGN CONTROL

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### 3. GROUP LEVEL DESIGN CONTROL

Each design division is responsible for developing and implementing its own internal design control plan. The Metro Rail Project Design Control Plan will not dictate control procedures within design groups (design divisions plus general consultants).

To most effectively develop and implement group-level design control procedures, it is recommended that Design Managers adopt a set of procedures that are compatible with the established internal control procedures of their general consultant. Since the general consultants will be deeply involved in the design process, these procedure will be most effective if they are an extension of the general consultant's already existing procedures. Design Managers should work with their consultants and adopt control procedures.

This chapter presents guidelines for Design Managers in reviewing consultants' design control procedures and in establishing the group-level design control plan.

The purpose of group-level design control is to ensure that:

- . Project objectives are properly reflected in each group's designs as designs are developed.
- . Designs meet professional engineering standards for integrity and quality.

Adherence to project objectives may be verified through design reviews within each group. Regular reviews should support the Design Manager in directing design development to conform to project objectives. Design integrity and quality will result from adherence to normal engineering practices dictating that designs be safe and cost-effective in fulfilling their purpose.

Group-level procedures should address the following internal control measures:

- . Design reviews
- . Documentation control
- . Design interface
- . Conflict resolution.

APPENDIX A  
GLOSSARY OF TERMS

monitor their achievement. The SEA Manager will also be responsible for development of system programs and plans including:

- . Operations plan
- . System safety program plan
- . System specification
- . Project definition and objectives
- . Design control plan
- . Management plan
- . System security plan.
- . System assurance program plan.

The SEA Manager will participate in Design Control Board design reviews. When design conflicts arise among design groups, the SEA Section will analyze the alternatives and recommend the means for their resolution. Similarly, once alternative configurations have been developed for final analysis in Preliminary Engineering, the SEA Section will perform the evaluation and report on the preferred configuration.

#### B.2.6 Program Control Section Manager

The Program Control Section Manager supervises a group that is responsible for the development of information for the purpose of cost, schedule, labor, budgeting and program analysis of the Metro Rail Project. Specific responsibilities include:

- . Developing and implementing policies for the Project Control System
- . Developing and maintaining the Work Breakdown Structure
- . Developing and monitoring program costs and schedules to provide detailed information for budgetary forecasting, allocations and expenditures, trend analysis, and performance measurement
- . Providing program cost, schedule and progress reports to all levels of management.

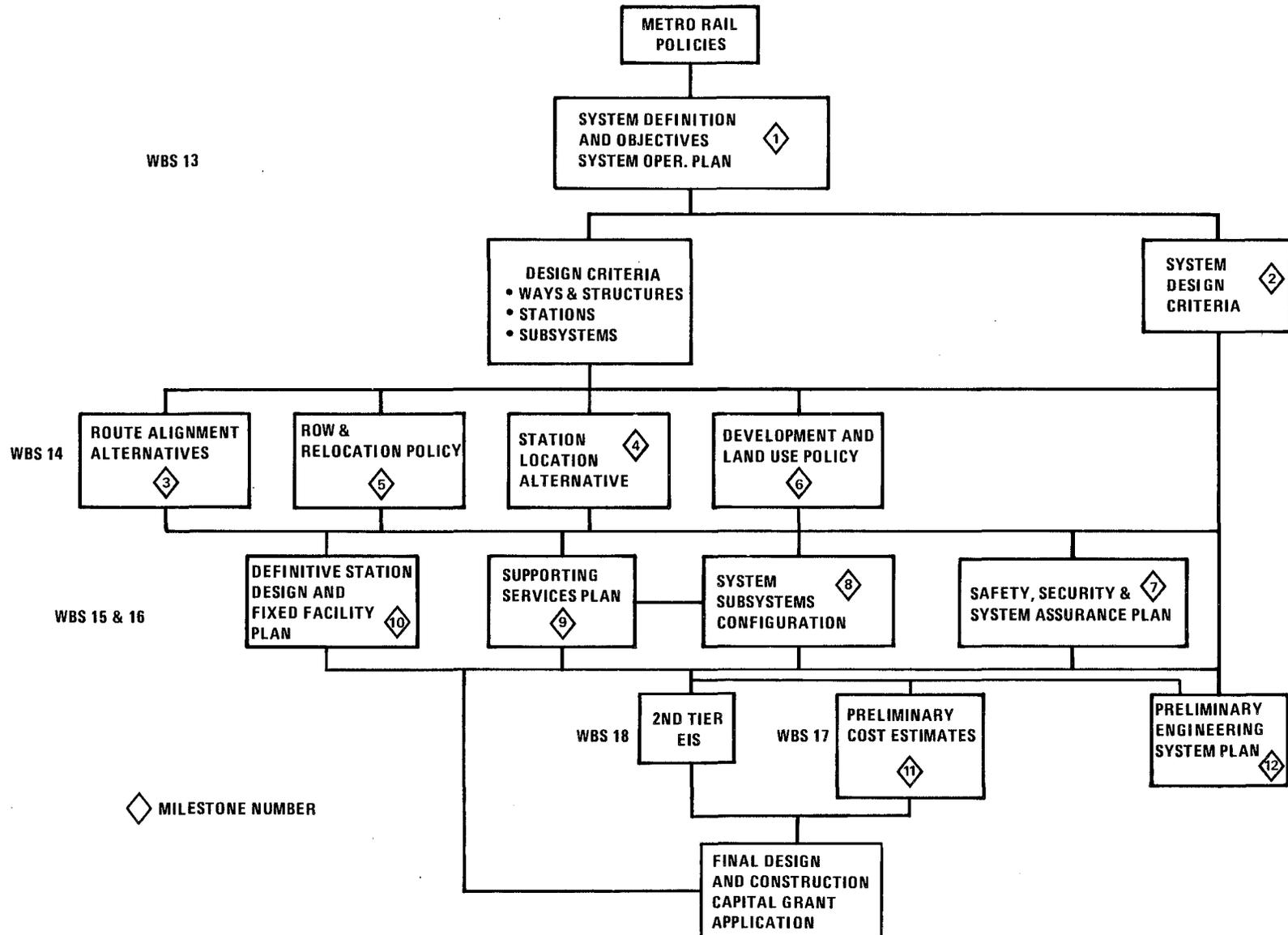
#### B.2.7 Administration Section

The Administration Section is a staff unit responsible for providing general office services and the following specific administrative support to the Metro Rail Project:

- . Maintenance of all contracts and grants

APPENDIX C  
KEY PRELIMINARY ENGINEERING DOCUMENTATION

KEY PRELIMINARY ENGINEERING DOCUMENTATION



C-2

- . System Safety Program Plan
- . RAMD&QA Plan
- . Master Final Design and Construction Schedule and Project Criteria Path Plan.