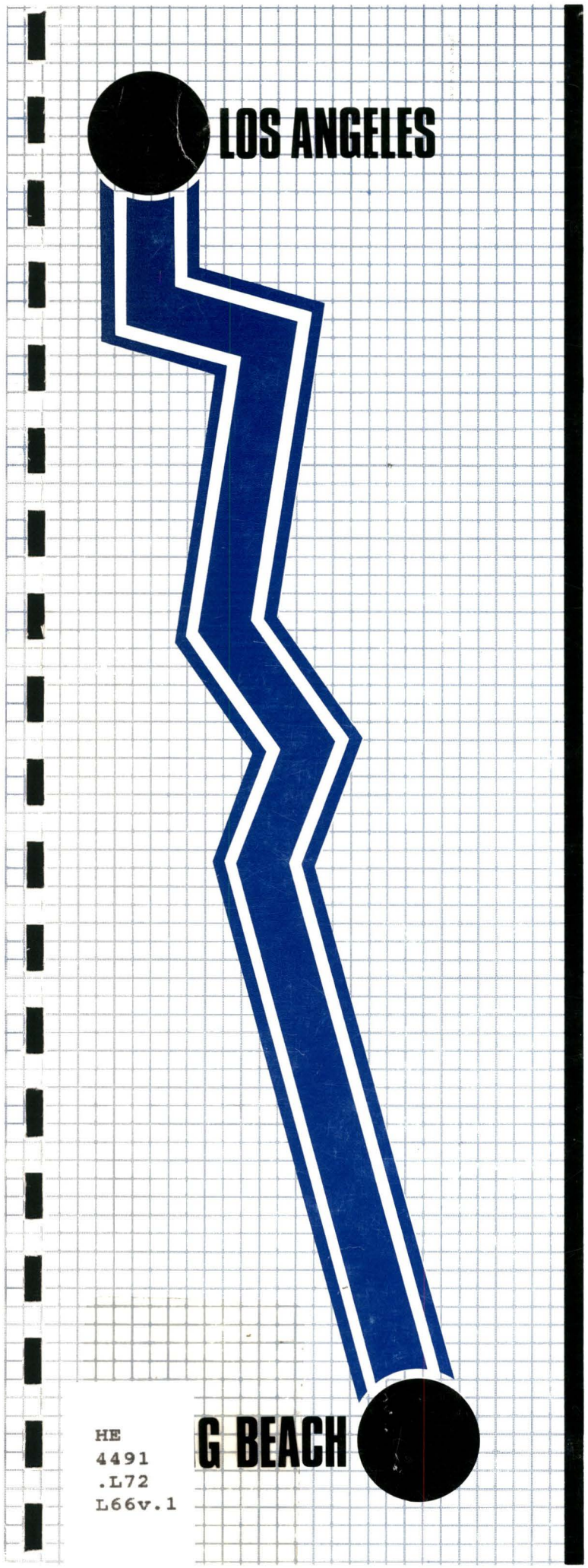

Concept Design Report

Volume I

Long Beach - Los Angeles Rail Transit Project

Parsons Brinckerhoff / Kaiser Engineers
In Association With:

- MYRA L. FRANK & ASSOCIATES
- J. WARREN & ASSOCIATES
- KENNARD DESIGN GROUP
- PACIFIC INTERNATIONAL ENGINEERS
- SEDWAY COOKE ASSOCIATES
- WILLIAMS - KUEBELBECK and ASSOCIATES

September 1983

PARTICIPATING GOVERNMENT AGENCIES

COUNTY OF LOS ANGELES
- Department of Regional Planning
- Road Department
- Engineer - Facilities
- Community Development Commission

CITY OF LOS ANGELES
- Department of Transportation
- Planning Department
- DPW - Bureau of Engineering
- Community Redevelopment Agency

CITY OF COMPTON
- Planning Department
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CITY OF LONG BEACH
- Department of Public Works
- Department of Planning and Building
- Department of Community Development
- Long Beach Transit

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CALIFORNIA PUBLIC UTILITIES COMMISSION
CALIFORNIA DEPARTMENT OF TRANSPORTATION

LACTC LOS ANGELES COUNTY TRANSPORTATION COMMISSION

LACTC

LOS ANGELES COUNTY TRANSPORTATION COMMISSION • 354 SOUTH SPRING STREET—SUITE 500, LOS ANGELES, CALIFORNIA 90013 • (213) 626-0370

September 30, 1983

Interested Persons and Businesses
Community Organizations
Elected Officials
Participating Government Agencies

On behalf of all members of the Los Angeles County Transportation Commission, it is my pleasure to transmit this Concept Design Report for the Long Beach-Los Angeles rail transit project; I invite review and comment by all those with an interest in the project.

The Commission is proceeding rapidly to prepare this project for construction, with financing provided by Proposition A, sponsored by LACTC and approved by Los Angeles County voters in November, 1980. This half-cent sales tax provides for comprehensive public transportation improvements, including low bus transit fares throughout the County and the local share contribution to financing for the federally-assisted SCRTD Metro Rail project.

The Commission intends to link up the Long Beach-Los Angeles rail project to the Metro Rail project in downtown Los Angeles. With the combined 41 mile length of these two projects--from Long Beach to the San Fernando Valley--the Commission intends to see that modern, convenient rail transit service is available across a large portion of the County by the end of this decade. Under Proposition A, we are also planning additional rail transit lines that will build onto these first two projects, to achieve quality rail transit across the entire County over the next thirty years.

The Commission is now preparing an Environmental Impact Report for the Long Beach-Los Angeles rail project, and needs your comments on this Concept Design Report as soon as possible. If we receive your comments by November 1, 1983 we will be able to consider them as we complete the Environmental Impact Report, and keep the project on schedule to begin its final design and construction phase in 1984.

Sincerely,

Pat Russell

PAT RUSSELL
Chairwoman

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Parsons Brinckerhoff/Kaiser Engineers

September 1983

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

CONCEPT DESIGN REPORT

EXECUTIVE SUMMARY

PROJECT BACKGROUND

The current Long Beach - Los Angeles Rail Transit Project is part of an ongoing transportation planning process for Los Angeles County in which this and thirteen other corridors in the county have been identified as candidates for new transit improvements. This Project is one of the first rail projects (along with the SCRTD Metro Rail Project) to be undertaken by the Los Angeles County Transportation Commission (LACTC) in response to the passage of Proposition A, which provides local funding for development and implementation of a county-wide public transit improvement program.

General Description of the Project

The Long Beach-Los Angeles rail project is being planned as a conventional light rail transit system located primarily in the existing Southern Pacific Transportation Company (SPTC) right-of-way (Wilmington and East Long Beach Branches) extending from downtown Los Angeles to downtown Long Beach. A number of alternative routes are under consideration within the downtown areas of these two cities. The proposed line will pass through the cities of Compton and Carson, and the unincorporated areas of Florence-Graham, Willowbrook and Dominguez Hills in Los Angeles County. The total route will be approximately 22 miles in length, with about 18 miles of it following the existing SPTC right-of-way. Much of the project route will be essentially the same as the last line operated by the Pacific Electric Railway's "Red Cars" which ceased operations in 1961. Design and service characteristics, however, will be upgraded and modernized to meet today's transit standards and to satisfy both present and anticipated future needs.

The Present Study

On January 26, 1983 the Los Angeles County Transportation Commission contracted with the joint venture of Parsons Brinckerhoff/Kaiser Engineers (PB/KE) to provide engineering and environmental consultant services for the Long Beach - Long Angeles Rail Transit Project. The purpose of the study is to conduct preliminary design and to prepare an environmental impact report for the project.

The preliminary design will serve to accomplish a number of objectives, including:

- provide a basis for choosing among a number of design options and variations;
- allow further refinement of the rail system's physical and operational characteristics (alignment, stations, equipment, operations plan, fare collection, etc.); and
- contribute to the preparation of a financial plan for project implementation.

The environmental impact assessment will conclude with a Final Environmental Impact Report (FEIR), thus complying with local and state environmental review requirements which must be satisfied prior to project funding and construction.

PURPOSE AND SCOPE OF THIS REPORT

Work on the Long Beach - Los Angeles Rail Transit Project has focused on the progressive refinement and narrowing of potential design options and variations. Appropriate rail technologies have been reviewed. Over 25 alternative alignments and dozens of potential station locations have been defined and evaluated. A variety of system design issues have been explored at a preliminary level, and measures to mitigate potential vehicular traffic impacts have been formulated.

The study is now at the point where it is desirable to have feedback from government agencies and the general public on the findings of the study to date, prior to undertaking the preparation of detailed drawings, cost estimates, environmental impact assessments, and other investigations required to evaluate each of the remaining alternatives. The purpose of this report, therefore, is to summarize the results of the work which has been accomplished up to this time and the process by which the results were obtained, and to describe the alternatives which will be further evaluated. A formal comparison of the evaluations of the alternatives at the conclusion of the study will lead to a selection of a transit system to be implemented in the Long Beach - Los Angeles Corridor.

Volume I of this Concept Design Report contains the following sections:

1.0 Introduction
2.0 Vehicle Technology
3.0 Alignments
4.0 Stations and Stops
5.0 System Operations
6.0 Vehicular Traffic
7.0 System Design Considerations
8.0 Employment and Training
9.0 Economic Development

Volume II contains detailed drawings of the alternative alignments under consideration (plans and profiles), typical sections throughout the corridor, conceptual layouts for a yard and shop facility, and concept plans for eighteen different stations. Approximately 90 drawings are provided.

This Executive Summary covers the major findings and descriptions presented in Sections 2.0 through 9.0 in Volume I. Those sections should be consulted for additional detail.

SUBSEQUENT STUDY ACTIVITIES

A number of reports, meetings, hearings, and decisions will be required before the conclusion of the present study in mid-1984. A list of key study activities and anticipated completion dates is as follows:

Activity	Completion Date
Describe Yard & Shop Alternatives	October, 1983
Refine Patronage Estimates	November, 1983
Estimate Alternative System Costs	November, 1983
Prepare Operations Plans	December, 1983
Circulate Draft EIR	March, 1984
Hold Public Hearings	May, 1984
Preferred Alternative Report	June, 1984

Activity	Completion Date
(continued)	
Adopt Preferred Alternative	July, 1984
Start Detailed Engineering and Conclude Railroad Negotiations	July, 1984
Final EIR	August, 1984

VEHICLE TECHNOLOGY

An early task in the study was the evaluation of alternative rail transit technologies in order to select the vehicle most suited for use in the Long Beach - Los Angeles Corridor. The vehicles were evaluated using criteria covering such issues as: carrying capacity, compatibility with other projects, operational flexibility, competitive procurement potential, and cost. The results of the evaluation confirmed an earlier choice of light rail vehicle technology (LRT) for the following reasons:

- It can be operated in either exclusive right-of-way or in mixed traffic;
- It is compatible with existing railroad tracks in the corridor;
- It is physically compatible with the proposed Metro Rail System;
- It can be used on an upgraded system (fully grade-separated) if desired; and
- It is now available from a variety of manufacturers and can be produced on a competitive basis.

The light rail transit vehicles, modern versions of the trolleycar, will be capable of operating as single cars or in trains. At this time, six-axle articulated vehicles are recommended, but four-axle cars are not precluded. The vehicles will be designed for low-platform passenger loading, and provisions will be made for lifts or ramps to provide access to the elderly and handicapped. Ride characteristics, vehicle interior, appearance, climate, and sound control will all be designed to maximize passenger comfort. Propulsion will be by electric motors and power will be supplied by means of an overhead catenary line and collected with a pantograph. Vehicle operators will be in constant radio communication with control center personnel.

RAIL ALIGNMENTS

Alternative rail transit alignments (horizontal and vertical locations of the proposed tracks) have been developed for three discrete segments of the corridor:

- Downtown Los Angeles - Union Station to Washington Boulevard
- Mid-Corridor - Washington Boulevard (Los Angeles) to Willow Street (Long Beach)
- Downtown Long Beach - Willow Street to First Street (Long Beach Transit Mall)

The process of identifying candidate alignments, evaluating them, and selecting those meriting further study was accomplished as a cooperative effort of staff of the LACTC, Caltrans, Los Angeles County, CRA, RTD, and the cities of Los Angeles, Long Beach, and Compton, with consultant assistance. Considerations in the selection of alignments included areas to be served, traffic impacts and other physical limitations, relationship with other planned systems (such as the SCRTD Metro Rail Project) and the potential role of secondary bus feeder/distribution systems. A bus alternative was also developed for the purpose of comparison with the rail alternatives.

In identifying candidate alignments, primary consideration was given to maximizing the use of existing public right-of-way (i.e., city streets) and existing right-of-way of the Southern Pacific Transportation Company (SPTC) which links the downtown areas of Los Angeles and Long Beach.

Over 25 different alignment alternatives in the three corridor segments were identified. In downtown Los Angeles, configurations were influenced primarily by considerations of servicing development and redevelopment in the midtown and westside areas of the CBD. In the Mid-Corridor, the alignment was constrained by the need to stay within the existing SPTC right-of-way; variations in profile were developed to respond to redevelopment and traffic considerations in the city of Compton. In downtown Long Beach, primary consideration was given to the most appropriate routes to the downtown area from the SPTC right-of-way.

After a lengthy screening and review process, a small number of the most feasible and attractive rail alignment alternatives were selected for further study and development. A total of ten alternative alignments were approved for further study—three in downtown Los Angeles, three in the Compton area of the Mid-Corridor segment, and four in downtown Long Beach. These are now described. (Note that the symbols "LA", "MC", and "LB" are used to denote alternatives in Los Angeles, Mid-Corridor, and Long Beach, respectively).

Baseline System

A "Baseline" rail transit system has been defined for the purposes of comparing and evaluating the performance, cost, and impact characteristics of each of the alternative systems under consideration. The Baseline System, shown and briefly described in Figure S.1, is, with the exception of a short aerial segment, entirely at grade, and represents the minimum-cost system which can be implemented within the shortest period of time. The Baseline System is comprised of the following alignment alternatives:

Location	Name	Designation
Los Angeles	Broadway/Spring Couplet/ (At Grade)	LA-1
Mid-Corridor	Rail Transit and SPTC Railroad At Grade in Compton	MC-1
Long Beach	Atlantic with Pacific Avenue Loop (At Grade)	LB-4

A detailed description of the alignment of the Baseline System can be found in Figure S.1. More briefly, the alignment begins at the Los Angeles Union Station, providing connections with Amtrak and the proposed Metro Rail System. From there, it proceeds on an aerial structure above the Hollywood Freeway to Broadway and Spring Streets, where an at grade "couplet" (a single one-way track on each street) is formed—southbound on Broadway and returning northbound on Main and Spring Streets. The two tracks rejoin on Washington Boulevard and proceed to the existing SPTC right-of-way near the intersection of Washington Boulevard and Long Beach Avenue. The alignment then follows this right-of-way south to Atlantic Avenue (just below Willow Street) in Long Beach. The rail transit tracks are grade-separated from three major crossing railroad lines and one street

(Firestone Avenue) in the Mid-Corridor segment; otherwise, they cross streets and other rail tracks at grade. The alignment includes a two-track link down Atlantic Avenue in Long Beach, and then a single-track figure-eight loop on Ninth Street, Long Beach Boulevard, First Street, Pacific Avenue, and Eighth Street.

Downtown Los Angeles Alternatives

In addition to the baseline at-grade alignment, two other grade-separated alignments—one subway and one aerial—have been identified for the Los Angeles CBD. These alignments, along with the at-grade alignment, are shown in Figure S.2. Brief descriptions are as follows (going from south to north):

- Alternative LA-2 (Flower Street Subway). From the railroad right-of-way at the southeast corner of downtown Los Angeles, double tracks proceed northwest at-grade in a reserved median in Washington Boulevard, as in Alternative LA-1. From Washington Boulevard, the tracks swing north at Flower Street. On Flower Street between 11th Street and 12th Street, the tracks enter a portal in the middle of the street to become a subway. The subway line terminates at the Metro Rail station at Seventh and Flower Streets.

  A possible future extension of this alignment to the Los Angeles Union Station is shown in Figure 3.2. The tracks would continue up Flower to First Street and turn right on First to Main Street. There the tracks again turn north, then east along the Hollywood Freeway, and finally north into Union Station.

- Alternative LA-3 (Olympic/Ninth Aerial). From the SPTC railroad right-of-way at the southeast corner of downtown Los Angeles, at Washington and Long Beach Avenue, double tracks continue north at-grade in the railroad right-of-way to Olympic Boulevard. At Olympic the tracks elevate to an aerial guideway and proceed west on Olympic/Ninth Street. The Olympic/Ninth line has a segment (SPTC to Santee) in a median of two-way traffic and a segment (Santee to Figueroa) in the west curb lane of the one-way traffic roadway. At Figueroa, it turns to the north to a terminal station south of Third Street.

  A possible future extension of this alignment would proceed as follows: At Third Street the line turns to the east and goes underground through the Bunker

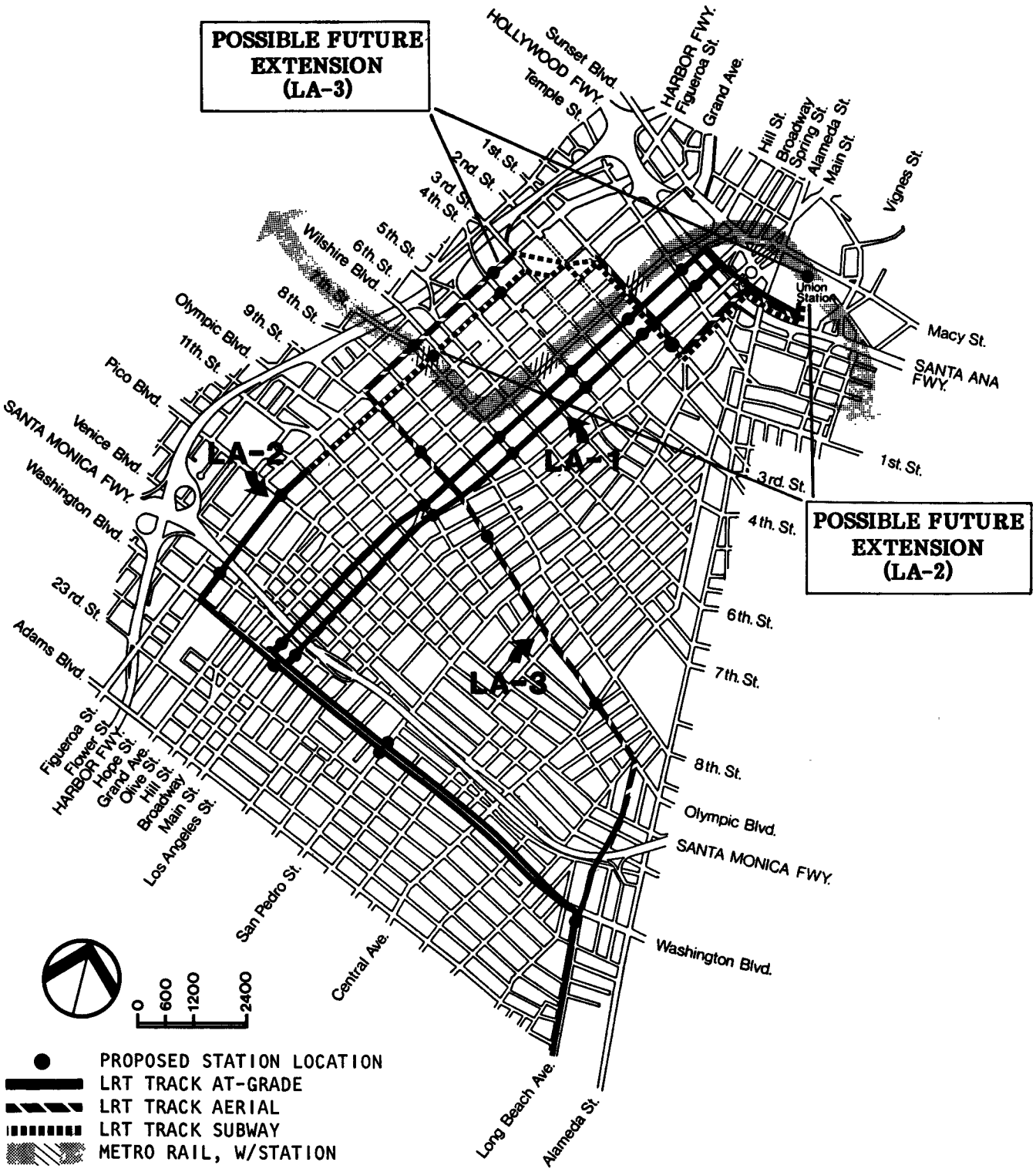

Fig. S.2

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Downtown Los Angeles Alignment Alternatives

PARSONS BRINCKERHOFF / KAISER ENGINEERS

Hill area. The line portals on First Street to an aerial structure east of Hill Street. The line proceeds on First Street to Los Angeles Street where it turns north, and proceeds to the Hollywood Freeway. The line swings to the east along the Hollywood Freeway to a terminal station at the Los Angeles Union Station.

Mid-Corridor Alternatives

The Baseline System calls for both the rail transit line and the existing SPTC Wilmington Branch Line to be at-grade throughout the Mid-Corridor segment, including where they pass through the CBD/City Hall area of the city of Compton (MC-1). In order to reduce the impact of the combination of transit and rail freight traffic through that area, two other alternatives have been developed for the Compton area as shown in Figure S.3. These are:

- Alternative MC-2 (Compton Grade Separation). The rail transit and rail freight tracks are grade-separated (depressed) throughout the central Compton area. All other alignment features in the Mid-Corridor segment are the same as in MC-1.

- Alternative MC-3 (SP Railroad Relocation). The SPTC freight track is relocated from the Wilmington Branch at Watts Junction to the West Santa Ana Branch and the San Pedro Branch. They rejoin the Wilmington Branch at Dominguez Junction. The rail transit tracks are at-grade in exclusive right-of-way through the city of Compton.

Downtown Long Beach Alternatives

Three alternatives in addition to the Atlantic Avenue with Pacific Loop Alternative (LB-4) are under consideration in downtown Long Beach. Two of these traverse the same general

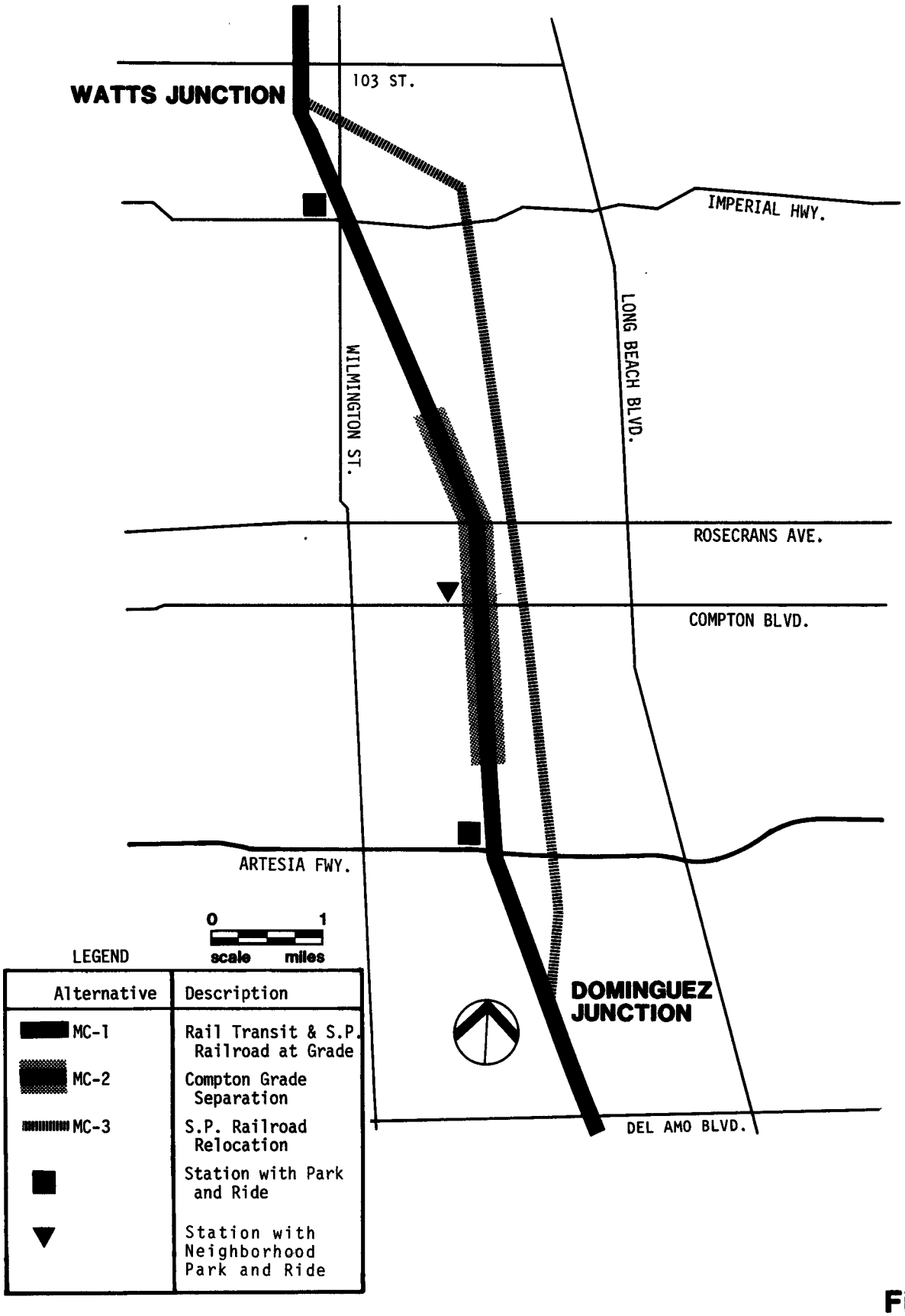

Fig. S.3

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Mid-Corridor Alternatives

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Project Data Sheet - Baseline System

DESCRIPTION

Light Rail Transit technology operating between downtown Los Angeles and downtown Long Beach. Two-track system throughout except for single-track crossing over the Los Angeles River, shared with the Southern Pacific Transportation Company (SPTC). Vehicles operate entirely at-grade, except for aerial section from Broadway or Spring to Union Station, and three new grade-separations at Slauson Junction, Dominguez Junction, and Cota Crossing and one existing at Firestone Avenue. Vehicles generally operate in mixed traffic in downtown Los Angeles and Long Beach, and in reserved right-of-way shared with the SPTC between Washington Boulevard in Los Angeles and Willow Street in Long Beach.

LENGTH

22 miles end to end.

ALTERNATIVES INCLUDED

Los Angeles - Broadway/Spring (Main) Couplet (LA-1)
Mid-Corridor - Compton At-Grade (MC-1)
Long Beach - Atlantic with Pacific Loop (LB-4)

VEHICLE (NOMINAL)

Six-axle articulated LRT car, approximately 85 feet long, with about 64 seated passengers and 96 standees during average peak hour conditions.

STATION FACILITIES

Shelters, benches, information services, elevator and/or escalator access to aerial stations, bus transfer facilities, low-level platforms, and park-and-ride lots at seven stations.

OPERATIONS CRITERIA (PRELIMINARY)

Five two-car trains per hour in each direction during weekday off-peak times. Ten 2-car trains per hour during peak periods. Lower during evenings, weekends, and holidays. Operates 20 hours per day, 365 days per year.

FARE COLLECTION

Pre-purchase at stations; self service system with inspectors. Barrier system eliminated from further consideration. Transfer with Metro Rail system with compatible tickets and/or attendant at interface station. Transfer with bus at rail transit stations provided, with credit or discount.

YARD AND SHOP FACILITIES

Main and satellite yard. Two sites now under consideration--one in Los Angeles and one in Long Beach. Main yard to have full maintenance facilities and storage for 45 cars. Satellite yard to have storage for 12 cars and a light maintenance facility.

TRACTION POWER

750V DC supplied through single-wire catenary throughout.

STATIONS AND STOPS (32 Total; North to South)

1. Union Station (Alameda Street/Macy Street).
2. Broadway north of Temple Street.
3. Broadway between First Street and Second Street.
4. Broadway/Fourth Street.
5. Broadway/Seventh Street.
6. Broadway/Olympic Boulevard.
7. Broadway north of Washington Boulevard.
8. Spring Street north of Temple Street.
9. Spring Street between First Street and Second Street
10. Spring/Fourth Street.
11. Spring/Seventh Street.
12. Main/Olympic Boulevard.
13. Main north of Washington Boulevard.
14. Washington Boulevard/San Pedro Street
15. Long Beach Avenue south of Washington Boulevard.
16. SPTC R.O.W./Vernon Avenue.
17. SPTC R.O.W./Slauson Avenue.
18. SPTC R.O.W./Florence Avenue.
19. SPTC R.O.W./Firestone Boulevard.
20. SPTC R.O.W./103rd Street.
21. SPTC R.O.W./Imperial Highway.
22. SPTC R.O.W./Compton Boulevard.
23. SPTC R.O.W./Artesia Boulevard.
24. SPTC R.O.W./Del Amo Boulevard.
25. SPTC R.O.W./Wardlow Road.
26. SPTC R.O.W. between 27th and 28th Streets.
27. Atlantic Avenue/Pacific Coast Highway.
28. Atlantic Avenue south of Anaheim Street.
29. Long Beach Boulevard/Sixth Street.
30. Long Beach Boulevard/Third Street.
31. First Street between Pacific and Pine Avenues.
32. Pacific Avenue/Sixth Street.

SIGNALS, COMMUNICATIONS, AND CROSSINGS

Manual (operator) control in mixed traffic in downtown areas. Use of block signalling with automatic train protection in the Mid-Corridor area. Grade crossing protection provided at all grade crossings in the Mid-Corridor. Highway traffic signal interconnection throughout with some preemption. Radio communication between operators and central control. Central control to be housed with SCRTD Metro Rail control.

ALIGNMENT DESCRIPTION

The Baseline System begins in the city of Los Angeles (north end) with an aerial, stub-end station located next to Union Station. From there, it proceeds south and then west along the Santa Ana Freeway on aerial structure. An at-grade one-way track couplet is created by a southbound track on Broadway and a northbound track on Spring and Main Streets. They come together on Washington Boulevard, and proceed in a reserved median to Long Beach Avenue. At that point the two tracks join the existing Southern Pacific Transportation Company railroad right-of-way (Wilmington and East Long Beach Branches) and proceed south to Willow Street in the city of Long Beach. The double rail transit tracks are located on the west side of the SPTC track from Washington Boulevard to Slauson Avenue, where they cross on structure over the SPTC track. The Slauson Avenue station is on aerial structure. A third aerial station is located at Firestone Avenue, an existing bridge. The rail transit tracks cross over the SPTC San Pedro Branch Line at Dominguez Junction, and are grade separated with the UP track at Cota Crossing. A new double-track bridge will be provided at Compton Creek. The transit line will share a single-track bridge with the SPTC over the Los Angeles River, the only single track portion of the system. The tracks will leave the SPTC right-of-way at Atlantic Avenue just below Willow Street in the city of Long Beach. Double tracks will be provided on Atlantic, either together in a median or separated at curbside. At Ninth Street, a single one-way track will turn west to Long Beach Boulevard, then south to First Street. There it will turn west to Pacific Avenue, then north on Pacific to Eighth Street. The single track will turn east on Eighth Street to rejoin the other track at Atlantic Avenue.

LEGEND

- ● Station
- ■ Station with Park and Ride
- ▲ Station with Neighborhood Park and Ride

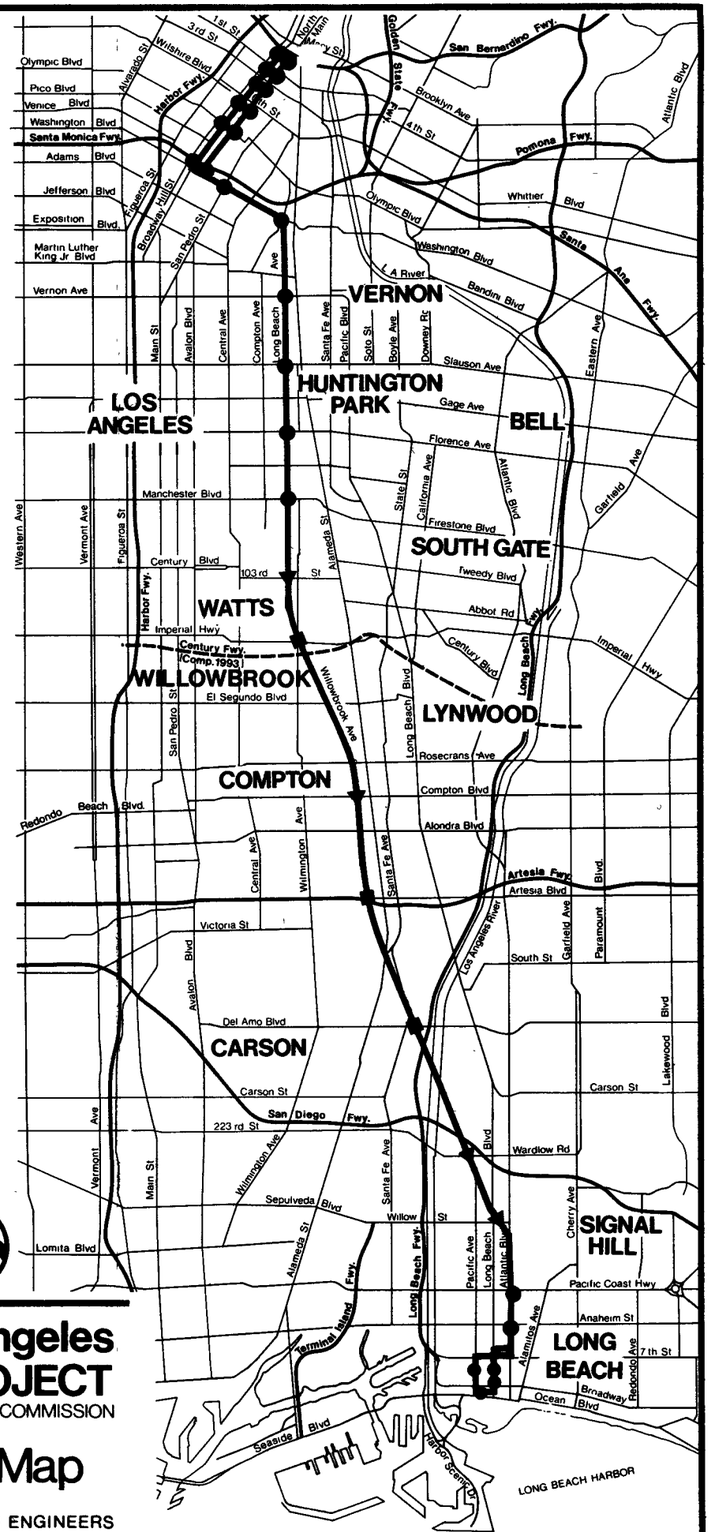


Fig. S.1

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Baseline System Map

PARSONS BRINCKERHOFF / KAISER ENGINEERS

area as the Baseline Alternative, while the other follows a considerably different route. The three alternatives, shown along with the Pacific Loop Alternative in Figure S.4, are:

- Alternative LB-1 (Atlantic Two-Way). This alternative has two tracks at-grade on Atlantic Avenue to First Street, where the tracks turn west and terminate at Long Beach Boulevard. The terminus is a stub-end station with a tail track. Two subalternatives along Atlantic Avenue are: (1) transit tracks in a reserved median; and (2) separated tracks, one at each curb or outer traffic lane.

- Alternative LB-2 (Atlantic/Long Beach Couplet). Beginning at the SPTC railroad right-of-way at Long Beach Boulevard (near Willow Street), a one-way at-grade couplet is created by a track southbound on Long Beach Boulevard, eastbound on First Street, and northbound on Atlantic Avenue, returning to the SPTC right-of-way.

- Alternative LB-3 (River Route). This alternative is located just outside the levee on the east side of the Los Angeles River. The line proceeds from the SPTC bridge crossing the river on retained embankment to Seventh Street, then along the Long Beach Freeway right-of-way at-grade to Fourth Street, eastbound on Fourth, south on Pacific Avenue to First Street, and then east to a stub-end terminus just east of Pacific Avenue.

One version of the Atlantic Two-Way Alternative (LB-1) calls for a reserved median in the center of the street. This would necessitate acquiring considerable property on either side of the street to maintain the required street width. As a result, another version of this alternative has been developed with separated tracks in the parking lanes or outside traffic lanes.

Right-of-Way Requirements

In general, the effort to minimize the impact of the proposed system on private property owners has been successful—all of the alignments lie almost entirely within city streets or within the existing right-of-way of the Southern Pacific Transportation Company. Exceptions where additional right-of-way might be required are summarized here. This information is based on a very preliminary level of engineering, and should be considered

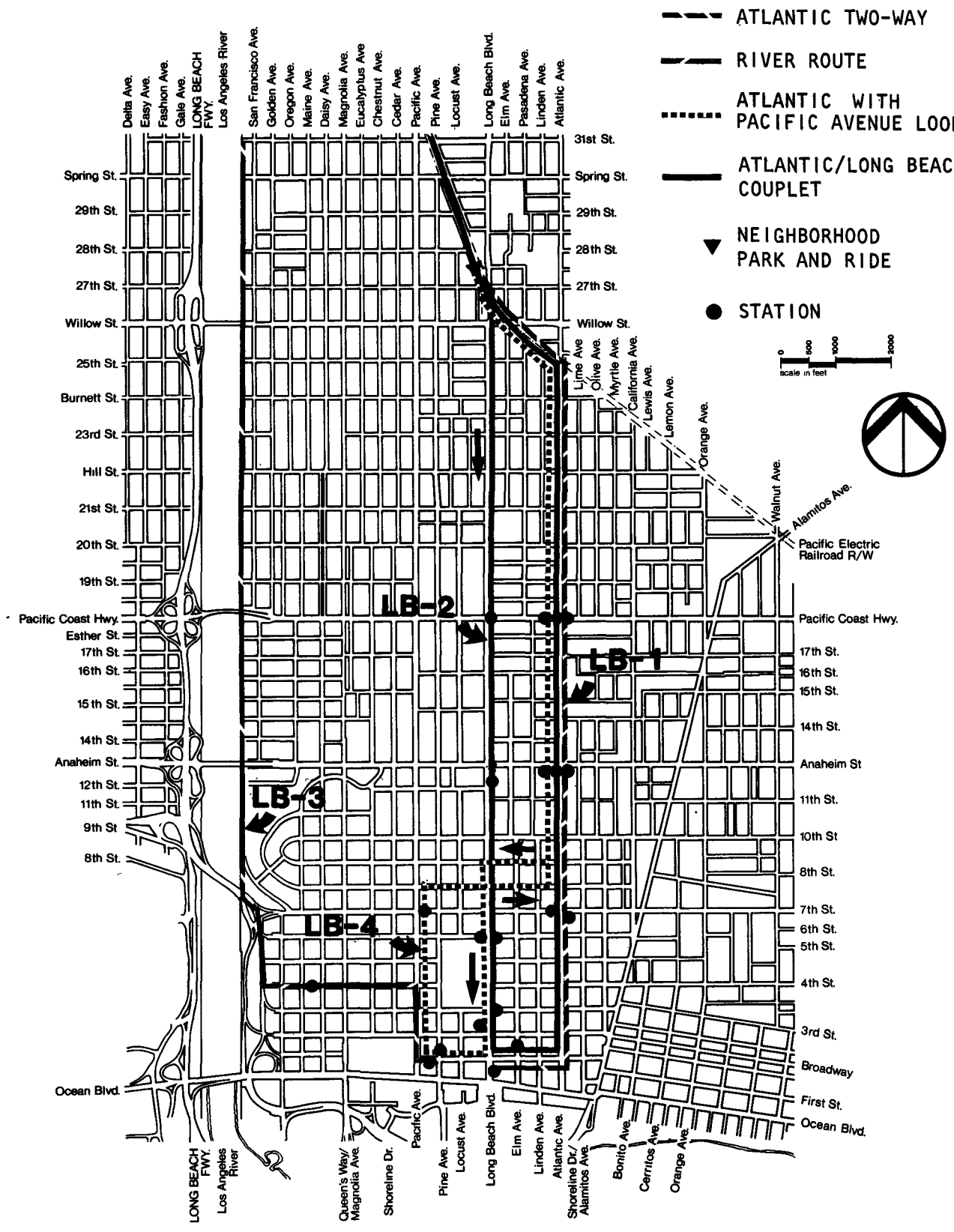


Fig. S.4

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Downtown Long Beach Alignment Alternatives

PARSONS BRINCKERHOFF / KAISER ENGINEERS

only as indicative of likely locations and relative magnitudes of such property requirements, not as firm determinations or estimates.

In downtown Los Angeles, the at-grade alternative (LA-1) will require no acquisition of private property; portions of Broadway will require widening by two feet, which will be taken from the existing sidewalk. The subway alternative (LA-2) will also be generally on or under city streets. Subsurface easements will be required in some areas, particularly if the extension to Union Station is built. The aerial alternative (LA-3) will require aerial easements, and subsurface easements if the future extension is built. Right-of-way in the Union Station area will need to be acquired from either the Los Angeles Union Passenger Terminal Company or Caltrans, which has been negotiating to purchase the site.

In the Mid-Corridor, acquisition of private property will be limited to small parcels at various park-and-ride facilities, and small strips of property at various points to accomodate tracks, road crossing gates, power substations, etc. A negotiated agreement with the SPTC for a joint use of its right-of-way will of course be required as well.

Two of the four Long Beach alternatives will require no direct acquisition of private property (Atlantic/Long Beach Couplet and Atlantic with Pacific Avenue Loop). If the Atlantic Avenue Two-Way Alternative (LB-1) is built with a reserved median, approximately 22 feet of additional street width will be needed, affecting property (including structures) on both sides of the street from Willow Street to Anaheim Street. Some, but not all, of this impact may be mitigable by reducing the amount of additional right-of-way needed by eliminating parking lanes or narrowing sidewalks at critical points. The fourth Long Beach alternative (River Route), will require an easement from the Los Angeles County Flood Control District. Also, several private parcels will be affected by this alternative, as well as a portion of an SCRTD bus yard. Engineering is not yet far enough advanced to allow determination of the exact number of parcels affected by this alternative.

Bus Alternative

To develop a bus alternative for the purpose of comparison with the rail alternatives, alternative bus alignments were developed and evaluated for all three corridor segments. The results of the evaluation were presented to participating agencies and a single alignment (Figure 3.10) was selected for further analysis and comparison with rail alternatives

(and the No-Build Alternative) in the Draft Environmental Impact Report. The alignment is as follows:

- Downtown Los Angeles. It follows the Baseline rail alignment, Broadway/Spring Couplet (LA-1) in the north part of downtown. It then proceeds to Alameda Street via Olympic/Ninth Street. Access to Union Station is on Macy Street.

- Mid-Corridor. The alignment proceeds south on Alameda Street from Washington Boulevard to Artesia Boulevard, then east to Long Beach Boulevard, then south to downtown Long Beach.

- Downtown Long Beach. The alignment continues southbound on Long Beach Boulevard to First Street, where it turns west and terminates at the transit mall.

STATIONS AND STOPS

Utilizing a process similar to that employed for identifying and evaluating alignment alternatives, staff of the LACTC, Los Angeles County and the cities of Los Angeles, Long Beach, and Compton identified candidate station locations for each of the alternative alignments. Prior studies and a review of former Pacific Electric stops were the initial points of departure for this work. Station locations were then screened using such criteria as: system operating speed, proximity to traffic generators, passenger security and safety, ridership potential, availability of land, development impact potential, and relative cost, among others. Selecting station locations required striking a balance between the competing objectives of providing frequent stops for passenger convenience and the need to achieve a relatively high operating speed to attract riders.

Station locations for the Baseline System are shown in Figure S.1. There are a total of 32 stations and stops included in this system—14 in Los Angeles, 12 in the Mid-Corridor, and 6 in Long Beach. With the exception of stations at Los Angeles Union Station and Slauson Avenue, which are aerial, all of the stations are at-grade. Park-and-ride lots are provided at three Mid-Corridor stops, and smaller "neighborhood" parking facilities are included at four other Mid-Corridor locations.

In addition to locating candidate stations, conceptual plans were developed for a variety of site conditions encountered throughout the corridor. These include: at-grade in mixed traffic; at grade in reserved median; at-grade in railroad right-of-way; aerial station at-curb; aerial station in median; and subway station. Several platform configurations were treated, such as center island, side, and staggered. The concepts were developed to assist in developing locations, preliminary costs, and evaluating environmental impacts.

Additional discussion on the selection of stations, as well as maps showing the locations of stations for the other alignment alternatives, can be found in Sections 3.0 and 4.0 of the main report (Volume I). Six of the station concept plans are also included in Volume I, Section 4.0. Concept plans for eighteen stations (including two variations for two of them) are included in Volume II.

OPERATIONS PLANNING

Patronage Forecast

Patronage forecasting has not yet proceeded to the point where detailed operations planning for the Long Beach - Los Angeles rail system can begin. Formal modelling for the Baseline System has been started by the Southern California Association of Governments (SCAG) and is scheduled to be completed in late 1983. Patronage figures in various forms will be provided for seven "build" alternatives and the No-Build Alternative. For comparison purposes, one of the alternatives will be the bus alternative.

Operational Plan - Preliminary Concepts

Using a preliminary figure of 27,800 daily riders, preliminary operating plan concepts have been formulated. With this patronage level, two-car trains will operate at 12- to 15-minute intervals during normal service hours. Six-minute intervals will be required during the AM and PM peak periods, while reduced service (15- to 20-minute intervals) will be offered during nights, weekends, and holidays. The system will operate 20 hours per day, 365 days per year.

With final patronage numbers, a full conceptual operations plan will be formulated for the system. It will include such items as: peak and off-peak service frequencies; car capacities and loading standards; number of cars per train; night, weekend, and holiday service; running speeds; crew requirements; operating hours; and fleet sizes.

Complementary Bus Network

Existing bus service in the Long Beach - Los Angeles Corridor was reviewed with SCRTD and Long Beach Transit for the purpose of identifying potential modifications to (1) direct bus service to and from rail transit stations, and (2) to eliminate un-needed parallel service after inception of rail transit service.

Two types of bus service modifications have been identified: (1) changes in actual routes (including elimination of some lines and addition of new lines), and (2) changes in service frequency. Few modifications will be necessary in the corridor. Existing service in downtown Los Angeles and Long Beach is such that most local lines will either provide direct access to a rail transit station or will operate within close proximity of a station. In the Mid-Corridor segment, major existing east-west lines will intersect the rail transit in many locations, providing collector/distributor service to most stations. Supplemental bus service will be operated on a demand basis over existing or relocated routes to connect with rail stations. A feeder bus system completely separate from the areawide network of local and express buses will not be needed.

SYSTEM DESIGN CONSIDERATIONS

Preliminary study has been given to operations facility design issues associated with construction and operation of the Long Beach-Los Angeles Rail Transit System. It is anticipated that the conceptual material summarized here will be refined during the latter part of the current study.

Yard and Shop Facilities

The rail transit system will require a major facility for performance of maintenance activities and for storage of transit vehicles when not in service. A second, or "satellite," yard will be highly desirable to provide a secondary storage area and light maintenance facility at the other end of the system from the main facility. This will reduce "dead-head" time, (time when vehicles are moved for reasons other than revenue service).

Several candidate sites have been identified and evaluated using basic screening criteria. Some have been eliminated due to conflicting plans for their use and/or their potential cost. Two potentially feasible sites have been identified--one in downtown Los Angeles

between Hooper Street, 16th Street, and Long Beach Avenue; and one in Long Beach located between the San Diego Freeway (I-405), the Los Angeles River, and the existing SPTC right-of-way. The Los Angeles site (10.3 acres) is too small to serve as a main yard facility. The Long Beach site (23.4 acres) is suitable as either a main yard or a satellite yard.

The project team is currently investigating the availability of additional sites in the corridor. Following completion of this investigation, all remaining sites will be evaluated to select the most appropriate site or sites for the system.

Operating Systems

Preliminary design concepts and criteria have been developed for electrification, signaling and communications, safety, security, and fare collection. Major elements are summarized here.

- Electrification. The electrical system will provide power for vehicle propulsion (DC current) and auxilliary needs (AC current), as well as for station and maintenance yard requirements. Power will be supplied directly by the city of Los Angeles Department of Water and Power and the Southern California Edison Company. Power for the vehicles will be distributed through an overhead wire catenary system, and collected with a pantograph. Redundancy, interlocking, and other design features will help ensure system reliability during normal and abnormal operating conditions.

- Signaling and Communications. A control center unified with the Metro Rail System will be the focal point of system operations and security functions. It will house control and communications equipment and operating personnel. The amount and type of signaling equipment necessary to maximize the safe and efficient movement of trains will be determined separately for each track section. The train operator will have primary responsibility for train protection in mixed traffic, while a block detection system may be used in the Mid-Corridor segment. These systems will be evaluated at the end of the current engineering phase. All road crossings will have automatic gate protection.

The communications system will provide the means for exchange of information between the train operators, security, emergency, control center, administrative and maintenance personnel; and the operator to the passengers. It will include radio (four channels), telephone (three systems), public address at selected station, closed circuit television at stations, and a data transmission system for monitoring remote equipment conditions. A cable transmission system will provide signal paths for all other systems except radio. The operations and security cable systems will be combined.

- Safety. All dynamic (moving) system elements will be designed to be fail-safe--that is, the system will revert to a safe condition when a failure occurs. In general, under conditions which do not pose an immediate threat to the health or safety of passengers or staff, vehicle evacuation will be performed only under the supervision of emergency personnel. However, all facilities and procedures will be designed to permit unsupervised vehicle evacuation in emergency conditions.

- Security. High levels of perceived and actual security/control will be provided. Enforcement will be the responsibility of the SCRTD transit police and law enforcement organizations throughout the corridor. Security provisions for the rail transit system will likely include the following: the system will have open and well-lighted stations, each equipped with at least one closed circuit television camera; maintenance facilities will have intrusion alarms and closed circuit cameras. Fencing will be provided along all at-grade sections and on structures that pass over or are adjacent to the railroad tracks. Silent alarms will be provided for all train operators. Vehicle windows will be made of impact-resistant materials to provide protection from thrown objects. Seating and interior finishes will be vandal-resistant, and windows at car ends will afford visibility between cars. Inspectors and sworn transit police will ride the trains and be stationed at high-crime locations. Closed circuit camera monitors will be staffed 24 hours a day, and personnel will report all observed violations to appropriate local police agencies for response.

- Fare Collection. A system for fare collection on the rail transit system has not yet been finalized. However the system will likely include several of the following elements. Regular fares will be handled through self-service pre-

purchase at transit stations, and will be enforced by patrolling inspectors. A zoned fare system will be used, with possible use of bus transfers and county-wide transit passes for all SCRTD operations. Transfers to and from Metro Rail will be handled either by magnetically encoded tickets suitable for both light rail transit and Metro Rail operations, or transfer attendants at interface stations, or both.

Streets and Utilities

Construction of any of the at-grade alternatives will require extensive modifications to and, in some cases total reconstruction of, city streets and utility systems. This will be the case in all three segments, but particularly in downtown Los Angeles and Long Beach. Both aerial and subway alternatives in Los Angeles will have somewhat less impact--much of the subway boring will be at a level below existing utilities, while the aerial configuration will create problems only at pylon locations. In general, utility lines that are perpendicular to the alignment will not require relocation or modification. Overhead utility wires, street lights, and traffic signals will require modification and/or relocation at various points throughout the corridor. A major storm drain relocation will be needed in the vicinity of Compton Avenue in the event that Alternative MC-2 (Compton Grade Separation) is implemented.

Railroad Freight Operations

All of the proposed alignments will share a portion of the Southern Pacific Transportation Company right-of-way with rail freight operations. While there is sufficient room at virtually all points to accommodate the two-track rail transit system and a single-track SPTC line, a number of industrial spur turnouts along the route will necessitate that the two systems--transit and freight--cross at-grade.

For all three Mid-Corridor alternatives, rail transit grade separations will be built over rail freight lines at Slauson Junction, Dominguez Junction, and Cota Crossing. In addition, five industrial spur lines will be crossed by the rail transit tracks at-grade for all three alternatives. Freight traffic on these spurs is forecast to be very light, and fail-safe interlocking signals will be maintained at every at-grade crossing.

The rail transit system will share an existing single-track bridge over the Los Angeles River with the SPTC freight line, which will also require the use of interlocking signals. Freight operations are presently very light over this bridge, and plans by the SPTC call for abandonment of this track section, which will eliminate this transit/freight conflict point.

OTHER PROJECT CONSIDERATIONS

Impact on Vehicular Traffic

A traffic impact analysis was conducted to assess the probable effect of the planned rail transit system on traffic circulation, roadway capacity, parking and loading, and traffic safety. Mitigation measures were identified for areas with unacceptable design conditions.

In downtown Los Angeles, the impact of the at-grade alternative (LA-1) on traffic should be moderate, including some potential conflicts on Broadway and Main Street near Washington Boulevard. The subway and aerial alternatives will have little or no impact on downtown traffic, except possibly in the areas of support pylons or the subway portal. None of these impacts is considered severe, and many will be mitigable with modifications to signals, lane configurations, etc.

In the Mid-Corridor, an analysis of running service at six-minute intervals in both directions in the Year 2000 was conducted. The results indicate that transit service alone will not significantly affect traffic flow at most locations--resulting queues will usually clear within two signal cycles. A simulation of the effect of rail freight operations showed that if long freight trains pass in rush hours, excessive queueing will occur at over half of the street crossings, whether or not there is rail transit service in the corridor. A traffic signal progression system was developed for the rail transit system, and showed that both vehicular traffic and rail transit traffic can be accommodated with a mix of preempted traffic signals, and signals where the trains must wait for their portion of the cycle.

Traffic impacts in downtown Long Beach will be similar to those described in downtown Los Angeles. Conflicting movements at several locations, including the rail crossing at Eighth Street and Long Beach Boulevard in the Baseline Pacific Loop Alternative, will require application of specific traffic control devices to maintain proper priority assignment at these locations.

Employment and Training

The Los Angeles County Transportation Commission will be addressing ways to ensure that proper affirmative action in employment will be addressed in contracts for final design and construction of the project. Policies may be restricted by such considerations as provisions of law, labor union agreements, the specialized nature of rail transit construction, and the need to limit costs. The Commission is now investigating the feasibility of adopting program components for AA/EEO hiring by contractors, MBE and WBE participation in design and construction, apprenticeship and training programs, and a limited youth training program. None have been adopted as of this report date.

Economic Development

The Los Angeles County Transportation Commission is now in the process of defining an appropriate role to be assumed during construction of the rail project, in order to maximize the project's potential for impact on economic development in the corridor. The Commission will work closely with redevelopment and planning agencies throughout the corridor to coordinate redevelopment programs with the location and design of stations. The Commission welcomes proposals from agencies and private developers for joint-development projects at station sites.

LONG BEACH - LOS ANGELES RAIL TRANSIT PROJECT

CONCEPT DESIGN REPORT

VOLUME I

Parsons Brinckerhoff/Kaiser Engineers

September 1983

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

The current Long Beach-Los Angeles Rail Transit Project is part of an ongoing transportation planning process for Los Angeles County in which it and several other corridors in the county have been identified as candidates for new transit improvements.

On November 4, 1980 voters in Los Angeles County ballot approved Proposition A. This measure authorized a county-wide ½ percent sales tax to raise money for use in improving and expanding existing public transit county-wide, reducing fares and constructing and operating a rail transit system serving at least a minimum number of designated corridors (including south central Los Angeles and Long Beach). Court challenges to the voter approval of Proposition A were favorably resolved in May, 1982, and collection of the ½ percent sales tax began July 1, 1982.

Following the passage of Proposition A, two planning studies were completed on the feasibility of constructing new transit facilities in the Long Beach-Los Angeles Corridor:

- The Long Beach to Los Angeles Light Rail Transit Feasibility Study, prepared by the California Department of Transportation (Caltrans) District 07, Public Transportation Branch, in October 1981; and

- The Los Angeles - Long Beach Rail Project (Preliminary Analysis, February 1982; and Summary Report, February 1983) conducted by Parsons Brinckerhoff Quade & Douglas, Inc. and Kaiser Engineers.

The latter study was undertaken to refine and further develop the findings of the Caltrans study, and to investigate and evaluate transit opportunities in other corridors throughout the county relative to the Long Beach-Los Angeles corridor. Also included was an assessment of various forms of light rail transit (LRT), automated guideway transit (AGT) and cable-suspended transit (CTS) technologies.

The Long Beach-Los Angeles Rail Transit Project is the first rail project to be undertaken in response to Proposition A as part of a county-wide transit improvement program by the Los Angeles County Transportation Commission. It was chosen by the Commission on March 24, 1982 as the first project to be implemented in the thirteen county-wide transportation corridors associated with Proposition A, along with the SCRTD Metro Rail Project.

1.2 PROJECT DESCRIPTION

The Long Beach-Los Angeles rail project is being planned as a conventional light rail transit system located primarily in the existing Southern Pacific Transportation Company (SPTC) right-of-way (Wilmington and East Long Beach Branches) extending from downtown Los Angeles to downtown Long Beach. A number of alternative routes are under consideration within the central areas of these two cities. The proposed line will pass through the cities of Compton and Carson, and the unincorporated areas of Florence-Graham, Willowbrook and Dominguez Hills in Los Angeles County. The total route will be approximately 22 miles in length, with about 18 miles of it following the existing SPTC right-of-way. Much of the project route will be essentially the same as the last line operated by the Pacific Electric Railway's "Red Cars" which ceased operations in 1961. Design and service characteristics, however, will be upgraded and modernized to meet today's transit standards and to satisfy both present and anticipated future needs.

1.3 THE PRESENT STUDY

On January 26, 1983 the Los Angeles County Transportation Commission contracted with a joint venture of Parsons Brinckerhoff/Kaiser Engineers (PB/KE) to provide engineering and environmental consultant services for the Long Beach-Los Angeles Rail Transit Project. The basic purpose of the contract is to prepare a preliminary design and environmental impact assessment of the Long Beach-Los Angeles Rail Transit Project.

The preliminary design will serve to accomplish a number of objectives, including providing a basis for choosing among a number of design options and variations that are possible. This will lead to further refinement of the project's physical and operational characteristics, including the interaction of transit, railroad and

street traffic vehicles; right-of-way requirements; capital and operating costs; auxillary facilities (such as storage yards and maintenance and repair shops); station locations and characteristics; vehicle and system-wide elements (i.e. signal and control systems, fare collection equipment, and so on); and a financial plan for implementation of the preferred alternative. The environmental assessment will conclude with the preparation of a Final Environmental Impact Report for the project thus complying with local and state requirements which must be satisfied prior to securing project funding and being able to proceed with construction and implementation of service.

1.4 PURPOSE AND SCOPE OF THIS REPORT

The study process has been responsive to changing project needs and circumstances and has evolved over time. As presently constituted it features ten tasks. In addition, many of the tasks have been divided into subtasks. A review of the original workplan shows that as of October, 1983 considerable work has been accomplished with respect to the Long Beach-Los Angeles Rail Transit Project. Of particular importance is the narrowing down and progressive refinement of the potential design options and variations. This study is now at the point where it is desirable to have feedback from government agencies and the general public on the findings of the study to date, prior to undertaking the preparation of detailed drawings, cost estimates, environmental impact assessments and other studies required in equal depth for each of the remaining alternatives to be evaluated. The purpose of this report, therefore, is to summarize the results of the work which has been accomplished to this point in time, the process by which the results were obtained, and to describe the alternatives which will be further evaluated.

Volume I of this report consists of the following major sections:

- Vehicle Assessment - presents the basic design criteria and physical and operating characteristics of light rail transit vehicles (LRVs), including the two-truck non-articulated vehicle, and the three-truck articulated version.

- Alignments - discusses the process, evaluation criteria, and selection of alternative vertical and horizontal alignments for the rail transit system. A bus alternative is described as well for purposes of comparison with the rail

alternative. Alignments are shown separately for three corridor segments: downtown Los Angeles, the Mid-Corridor area, and the city of Long Beach.

- Stations and Stops - describes the design process followed to establish station/stop locations and basic physical and functional characteristics of each type (at-grade, aerial, subway, etc.). Findings are presented for the three corridor segments.

- System Operations - includes patronage estimates from previous studies, criteria for development of a system operations plan, and a description of the proposed complementary (feeder) bus system.

- Traffic Considerations - discusses anticipated problems at rail/street grade crossings, and possible solutions.

- System Design Considerations - addresses various topics related to engineering and operation of the system, including yard and shop facilities, various operating systems (electrification, control and communication, etc.) modifications to existing streets and utilities, and the interaction of the transit system with SPTC rail freight operations.

- Employment and Training - explores potential employment created by construction and operation of the rail transit system.

- Economic Development - briefly describes the possible effects of the transit system on future economic growth and new development activity in the corridor.

Volume II of this report contains plan and profile sheets, typical cross-sections, typical station site layouts and similar material intended to convey a more complete understanding of each of the alternatives being evaluated.

1.5 THE NEXT STEPS

The major milestones in the Long Beach-Los Angeles Rail Transit Project process beyond the publication and circulation of this report are as follows:

- Assemble, review and assess the responses and comments received to this report; reflect the results as appropriate in subsequent study activities.

- Complete the refinement and evaluation (including environmental impact assessment) of all alternatives still under consideration.

- Summarize findings and evaluations in the form of a Draft Environmental Impact Report (DEIR).

- Print and circulate the DEIR for review and comments, including the holding of formal public hearings and taking of written submissions.

- Prepare responses to written comments submitted and oral comments at the public hearings.

- Secure adoption of a preferred alternative by the Los Angeles County Transportation Commission and certification of the Final Environmental Impact Report.

- Secure inclusion of the preferred alternative in the regional and state transportation improvement plans.

- Implement the approved project financial plan to furnish funds for construction.

- Prepare final plans, specifications and cost estimates as a basis for competitive procurement and bidding for system construction and implementation.

- Carry out all necessary steps needed to implement the preferred alternative, including construction, pre-operation testing and start-up of revenue service.

The original study schedule has been modified; however, the intended result is the same: A formal comparison of the evaluations of alternatives at the conclusion of this study will lead to a selection of the transit system to be implemented in the

Long Beach-Los Angeles corridor. The following is a list of remaining activities and their scheduled completion dates:

Activity	Completion Date
Refine Patronage Estimates	November, 1983
Describe Yard & Shop Alternatives	October, 1983
Estimate Alternative System Costs	November, 1983
Prepare Operations Plans	December, 1983
Circulate Draft EIR	March, 1984
Hold Public Hearings	May, 1984
Preferred Alternative Report	June, 1984
Adopt Preferred Alternative	July, 1984
Start Detailed Engineering and Conclude Railroad Negotiations	July, 1984
Final EIR	August, 1984

2.0 VEHICLE TECHNOLOGY

2.1 BACKGROUND

As one of the first steps in development of the rail transit project, work began on the selection of a transit vehicle for the Long Beach-Los Angeles rail transit system early in 1983.

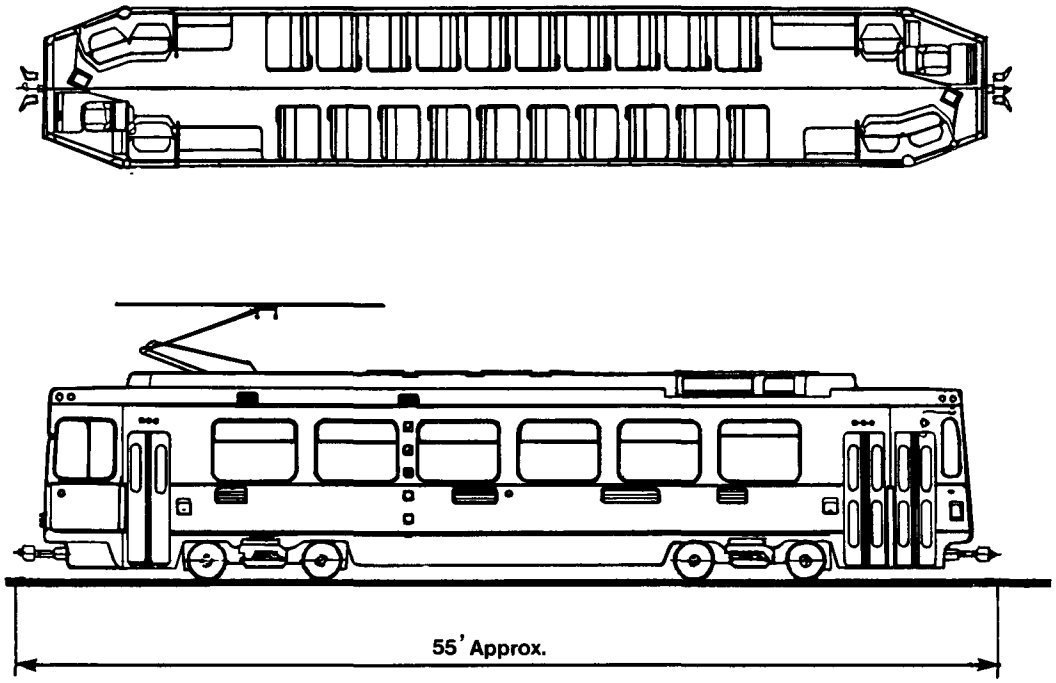
State-of-the-art light rail transit vehicles were studied to determine their suitability for this system. Vehicle data were accumulated from suppliers, operating properties, and published documents. For purposes of comparison, data were also collected on proven automated guideway and heavy rail transit vehicles. Table 2.1 summarizes the characteristics of each of the four vehicle types.

These vehicle types were evaluated against the following system objectives:

- meets Long Beach-Los Angeles corridor travel demands;
- is cost-effective;
- can be implemented early;
- is comparable with auto travel times;
- is compatible with metro rail and future proposition "A" transit lines;
- has physical and operational flexibility; and
- has competitive and flexible procurement potential.

The evaluation results confirmed the choice for conventional light rail vehicle technology for several reasons. First, among the rail vehicle technologies considered, only conventional light rail vehicles have capability for initial construction without need for a full grade separation or exclusive guideway median. Second, the light rail system is compatible with at-grade crossings of the existing railroad track in the Mid-Corridor. Third, it will be possible to use the same vehicles while upgrading the guideway with more grade separations in the future, if desired. Finally, the light rail vehicle will be compatible with the tracks and tunnels of the Metro Rail system. If required by the future rail system, it will be possible to move cars on the Metro Rail tracks to other light rail systems. A typical light rail vehicle is shown on Figure 2.1.

4-Axle / Double-End



6-Axle / Articulated / Double-End

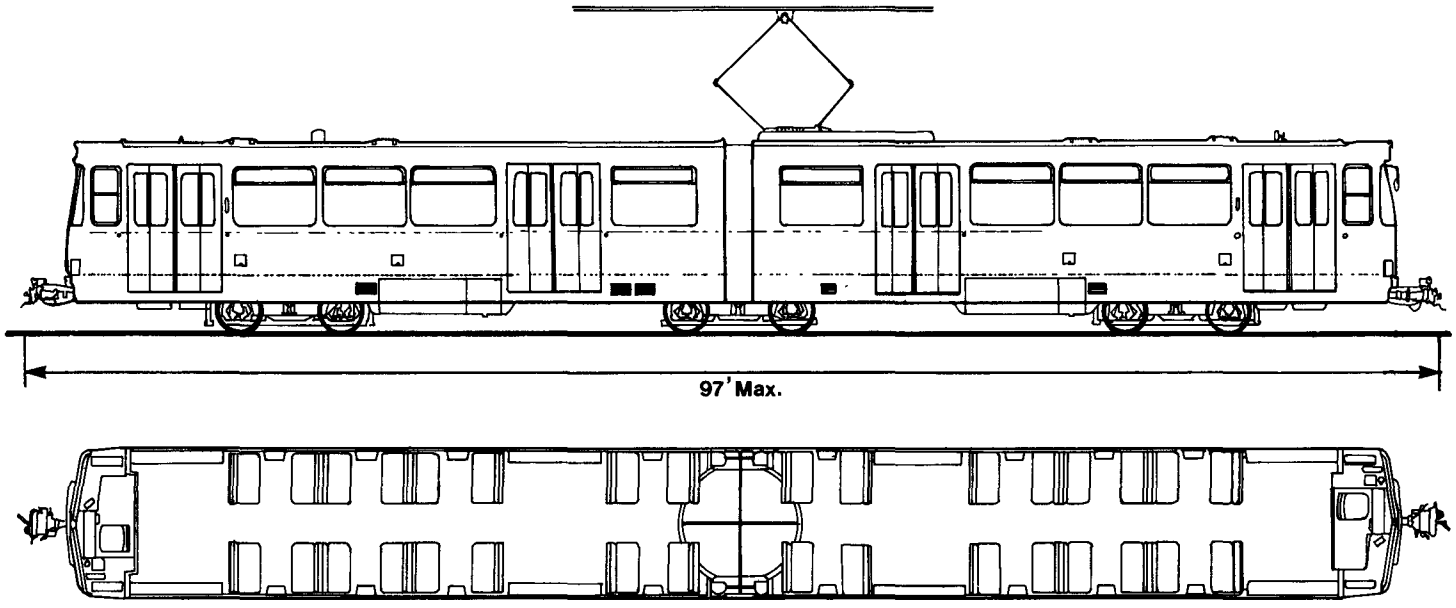


Fig. 2.1

Long Beach - Los Angeles RAIL TRANSIT PROJECT
LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Typical Light Rail Vehicles

PARSONS BRINCKERHOFF / KAISER ENGINEERS

TABLE 2.1

VEHICLE CHARACTERISTICS OF ALTERNATIVE RAIL TECHNOLOGIES

CHARACTERISTIC	HEAVY RAIL TRANSIT	AUTOMATED GUIDEWAY TRANSIT	LIGHT RAIL TRANSIT
Persons Capacity/Vehicle	150-250	30-125	100-270
Systems Capacities (passengers/hour)	10k-30k p/hr	2k-10k p/hr	2k-20k p/hr
Maximum Speed	50-80 m.p.h.	20-50 m.p.h.	10-55 m.p.h.
Right-of-Way	Exclusive Grade/Separated	Exclusive Grade/Separated	Non-exclusive Mixed Traffic
Station Platforms	High	High	High/Low
Vehicle Length (ft.)	45-75	20-45	45-97
Weight (tons)	30-40	10-16	25-50

2.2 VEHICLE DESCRIPTION

The light rail vehicles (LRV) will be designed to provide safe and dependable service, easy access, and maximum riding comfort. They will be capable of operating as single cars or in trains, and the maximum train length will be such that all doors can open within the length of the station platform. They will be designed for low-platform passenger loading. At this time, six-axle articulated vehicles are recommended, but four-axle vehicles have not been precluded from consideration.

Maximum vehicle dimensions are presented below. Note that a typical vehicle length is approximately 80 feet.

Length of vehicle (articulated) -	97ft. max (over couplers)
Width over thresholds -	9'4.2" max
Height of floor from top of rail (TOR) -	30.6" min -40" max.
Height of roof from top of rail -	13'8" max (equipment)
Height of ceiling from floor (min) -	6'8"
Under car clearance (min) -	2.5" above top of rail

The vehicle body will be constructed of low-alloy, high-strength steel and will be painted to achieve an aesthetically pleasing appearance. Smooth performance and riding characteristics will assure a high level of passenger comfort, acceptable to both standing and seated passengers. The interior will be designed to enhance passenger comfort by providing comfortable seats, adequate lighting, and standee support, and to promote a feeling of security and comfort suitable for conversation, reading or resting. Temperature, humidity, and air flow will be controlled to provide comfortable conditions within the vehicle during normal climatic and environmental conditions. The sound level, both on the vehicle and at locations adjacent to the track, will be controlled by use of accepted sound-control techniques and will permit normal conversation on board the train and normal land use in areas adjacent to the right-of-way.

Propulsion will be by electric motors and power will be collected from the overhead catenary by means of a pantograph installed on the vehicle roof. Each vehicle will have at least two independently actuated braking systems: a service brake

system and an emergency brake system. In addition, the parking brake will be capable of holding the vehicle on a 10% grade for an indefinite period. The propulsion system and the emergency brake system will be interlocked so that propulsion and braking effort cannot function simultaneously.

A vehicle public address system will be provided to enable announcements to be made to all passengers by either control center personnel or the train operator. Communications between the train operator and the control center will be by radio. In addition, an intercom system will be provided to allow passengers to communicate with the train operator. This will provide a security measure when vehicles are operated as multi-unit trains.

The vehicles will be usable and accessible by elderly and handicapped patrons. Space will be provided for passengers in wheelchairs and interfaces will be provided for wayside lifts or ramps.

3.0 ALIGNMENTS

This section addresses the development, analysis and selection of alternative alignments for rail and bus transit systems to serve patrons in the Long Beach-Los Angeles Corridor. Alternatives for rail transit are discussed in three segments of the corridor consisting of the following:

- Downtown Los Angeles - Union Station to Washington Boulevard.
- Mid Corridor - Washington Boulevard (Los Angeles) to Willow Street (Long Beach).
- Downtown Long Beach - Willow Street to First Street (Long Beach Transit Mall).

Alternative rail transit alignments described below are labelled with the codes "LA", "MC" and "LB" for the three corridor segments. The bus alternative (presented for comparison purposes only) is addressed in one corridor-long segment. Stations, park-and-ride lots, yard and shop facilities, etc. are discussed in subsequent sections of this report.

3.1 METHODOLOGY

3.1.1 General Approach

The development of alignment alternatives was conducted as part of Subtask 7.4 of the study workplan, and involved the following activities:

- development of evaluation criteria for screening and analyzing alternative transit configurations;
- preparation of transit scenarios (alignments, number of tracks, stations) and concept plan sketches of alternative routes with descriptive material;

- documentation of the agreed-upon definitions of the alternatives; and

- development of physical and operational data to be applied with evaluation criteria in the screening process of alternatives.

Working with staff members of the LACTC, Caltrans, and the cities of Long Beach, Los Angeles, and Compton in a series of workshops, reviews were made of planning work to date on this and other corridors in the county. This was done in order to identify locations of planned routes, stations or corridors for other systems such as SCRTD's Metro Rail and other transit programs which are in the early planning stages. Their operational relationship with each other and with the Long Beach-Los Angeles system were explained and used as a basis for determining alignment measures to link them together. Consideration included proposed route alignments for Metro Rail and other possible Metro-type rail lines, feasible surface or aerial alignments for lower capacity rail lines (e.g., light rail), the need for possible subway segments on these lines, and the potential role of secondary distribution systems (e.g., feeder bus) in the overall system. Taking into consideration the representative technology specifications for vehicles developed in Task 4, alternative rail system scenarios were developed for Los Angeles, Mid-Corridor, and Long Beach segments.

In the process of identifying candidate alignments, primary consideration was given to maximizing the use of existing public right-of-way (i.e., city streets) and existing right-of-way of the Southern Pacific Transportation Company (SPTC), Wilmington and East Long Beach Branch lines.

The workshop effort with Los Angeles county and city agencies produced agreement on the areas of downtown Los Angeles to be served, primarily midtown and westside areas.

Mid-Corridor conditions were examined and one basic alignment was developed with several track configurations and options for grade separation between transit and rail freight lines along the SPTC right-of-way. Consultations were held with Compton and Los Angeles County staff on impacts of rail transit operations on traffic circulation and community disruption.

Long Beach agencies staff conducted development, analysis and selection of possible alternatives to serve their community in a comprehensive program, and presented these to LACTC for evaluation with total system requirements.

3.1.2 Evaluation Criteria for Screening Alternatives

In order to establish the most viable alternatives in each corridor segment, evaluation criteria were developed for screening the various alignments developed in workshop sessions. Criteria were developed separately for the Los Angeles and Long Beach segments because of the diversity of transit requirements and other planning considerations in those areas. These are shown in Table 3.1.

TABLE 3.1

RAIL TRANSIT ALIGNMENT EVALUATION CRITERIA

LOS ANGELES	LONG BEACH
Service Level to Corridor	Income Level Restraint
CBD Downtown/Access	Jobs in the Vicinity
Transit Interface with Other Corridors	Bus Route Interface
CBD Traffic Impacts	Travel Time
Operations/Maintenance	Redevelopment Potential
Capital Cost Impacts	Development Goals
Land-Use Development Goals	Sensitive Land Use
Joint Development Value Capture	Landscaping Impacts
Acceptability/Marketability	Residential Impacts
Traffic Convenience	Business Impacts
Construction Feasibility	Parking Impacts
Construction Impacts	Intersection Crossings
Right-of-Way Impacts	
Parking Impacts	
Transit Travel Time	

3.2 RAIL ALTERNATIVES CONSIDERED

Workshop sessions in Long Beach and Los Angeles developed alternative transit configurations which were based on scenarios for rail and bus transit service in those areas. A list of alternatives for each of those areas are summarized in the following sections with status following the first and second level screenings conducted by agencies and staff, with consultant assistance.

- Downtown Los Angeles. Alternative configurations were influenced primarily by scenarios of transit service directed to midtown or to westside areas in the CBD. These scenarios produced a series of alternatives which are summarized in Table 3.2.

- Mid-Corridor. Alternative configurations were influenced primarily by scenarios directed to rail transit's joint use of the SPTC Wilmington Branch right-of-way running between Washington Boulevard in Los Angeles to Willow Street in Long Beach. Alternatives using other routes were precluded by the absence of suitable right-of-way width in public roadways and railroad lines through this segment of the Long Beach-Los Angeles corridor. Alternative configurations developed for this route consisted of the same alignment with one-track and two-track schemes and two levels of transit-railroad crossings: at-grade and grade-separated. An optional configuration was developed for transit and railroad grade separation from cross streets in the Compton City Hall/CBD area. Alternatives for Mid-Corridor were developed for three baseline configurations and three options as summarized in Table 3.3. Optional measures were developed for bridge crossings at the Los Angeles River and Compton Creek.

- Downtown Long Beach. Alternatives were considered across all of central Long Beach, spanning an area from the Los Angeles River east to Orange and Alamitos Streets, with a number of routes along principal arterials in between. These scenarios produced a series of alternatives which are summarized in Table 3.4.

TABLE 3.2

RAIL TRANSIT ALIGNMENTS CONSIDERED DOWNTOWN LOS ANGELES

Alternative	Routing/Description	Result of Screening Process 1st Level	2nd Level
1	Washington/Broadway, two way to Union Station, all at-grade.	Retained	Deleted
2	Washington/Broadway-Spring one-way couplet, at-grade to 101 Freeway with aerial guideway to Union Station.	Retained	Retained
3	Washington/Hope, two-way to Los Angeles Library, all at-grade.	Retained	Deleted
4	Washington/Flower/First/Los Angeles, two-way to Union Station, all at-grade except short Bunker Hill Tunnel.	Deleted	- -
5	Washington/Figueroa/First/Los Angeles, two-way to Union Station, all at-grade except short Bunker Hill Tunnel.	Deleted	- -
6	Washington at-grade/Figueroa DPM aerial two-way to Union Station.	Deleted	- -
7	Olympic/9th, at-grade with continuation by any of Alternatives 1-6.	Deleted	- -
8	Olympic/9th, aerial with continuation by Alternative 6 to Union Station.	Retained	Deleted
9	San Pedro Street to Union Station, at-grade.	Deleted	- -
10A	Washington, at-grade/Hill, subway to Union Station.	Deleted	- -
11A	Washington at-grade to Flower and 11th; subway to Union Station (later shortened to Flower and Seventh).	Retained	Retained

TABLE 3.2 (continued)

RAIL TRANSIT ALIGNMENTS CONSIDERED
DOWNTOWN LOS ANGELES

Alternative	Routing/Description	Result of Screening Process 1st Level	2nd Level
12	Olympic-9th/Flower/First/Los Angeles to Union Station, all aerial with Bunker Hill Tunnel segment.	Retained	Deleted
10B	Olympic-9th/Hill to Union Station, subway.	Retained	Deleted
11B	Olympic-9th/Flower to Union Station, subway	Retained	Deleted
13A	Washington at-grade/Figueroa aerial/Bunker Hill subway/First-Los Angeles aerial to Union Station.	Retained	Deleted
13B	Washington at-grade/Figueroa-First-Los Angeles subway to Union Station.	Retained	Deleted
13C	Olympic-9th subway/Figueroa-First-Los Angeles subway to Union Station.	Retained	Deleted
13D	Olympic-9th aerial to Figueroa; Bunker Hill subway; aerial from First and Olive to Union Station (later shortened to Third and Figueroa).	Retained	Retained

TABLE 3.3

RAIL TRANSIT ALIGNMENTS CONSIDERED
MID-CORRIDOR

Alternative	Routing/Description	Result of Screening Process 1st Level	2nd Level
Baseline "A"	Single-track rail transit in SPTC R.O.W., at-grade, with grade crossings at railroad main line/sidings and roadways, sharing use of SPTC bridges at Los Angeles River and Compton Creek.	Retained	Delete
Baseline "B"	Double-track rail transit in SPTC R.O.W. with other items per Baseline "A".	Retained	Deleted
Baseline "C"	Double-track rail transit in SPTC R.O.W., at-grade, with three grade separations over railroad mainline junctions (ATSF-Slauson, SPTC-Dominguez and UPRR-Cota) grade crossings at roads and railroad sidings or spurs, and shared SPTC bridge (single-track) at Los Angeles River and SPTC bridge (double-track) at Compton Creek.	Retained	Retained
Option 1	Compton subsurface grade separation of rail transit and railroad tracks from area roadways between Rosecrans and Greenleaf.	Retained	Retained
Option 2	Los Angeles River bridge for rail transit two-track configuration.	Retained	Deleted
Option 3	Compton Creek bridge for rail transit two-track configuration.	Retained	Retained
Option 4	Grade separation for double-track rail transit over arterial street crossings in addition to those already separated by Baseline "C" and Option 1.	Retained	Deleted

TABLE 3.4

RAIL TRANSIT ALIGNMENTS CONSIDERED
DOWNTOWN LONG BEACH

Alternative	Routing/Description	Result of Screening Process 1st Level	2nd Level
1	Los Angeles River route, two-way, at-grade except separations at several streets crossing the river; at-grade from First to SPTC R.O.W.	Retained	Retained
2	Pacific Avenue, at-grade, from First to SPTC R.O.W.	Deleted	- -
3	Long Beach Boulevard, two-way, at-grade, from First to SPTC R.O.W.	Deleted	- -
4	Atlantic Avenue/First, two-way, at-grade from Long Beach Boulevard to SPTC R.O.W.	Retained	Retained
5	Long Beach Boulevard/Atlantic Couplet, one-way, at-grade, from First to SPTC R.O.W.	Retained	Retained
6	Alamitos/Orange Avenue, in street, two-way, at-grade/First at-grade from Long Beach Boulevard to SPTC R.O.W.	Deleted	- -
7	Alamitos/Orange Avenue, off-street, two-way, at-grade/First at-grade from Long Beach Boulevard to SPTC R.O.W.	Deleted	- -
8	Willow terminus, at-grade, in SPTC R.O.W. at Willow.	Deleted	- -
9	Atlantic/Long Beach Boulevard Loop, at-grade (Atlantic Avenue two-way/10th one-way/Long Beach Boulevard one-way/First one-way/ Atlantic one-way) from SPTC R.O.W.	Retained	Deleted
10	Atlantic/Long Beach Boulevard-Pacific Loop, at-grade (Atlantic Avenue two-way/10th two-way/Long Beach Boulevard one-way/First one-way/Pacific one-way, 10th one- one-way) from SPTC R.O.W.	Retained	Deleted

TABLE 3.4

RAIL TRANSIT ALIGNMENTS CONSIDERED
DOWNTOWN LONG BEACH

Alternative	Routing/Description	Result of Screening Process 1st Level	2nd Level
11	Atlantic/Long Beach/Pacific Loop, at grade (Atlantic Avenue two-way/Ninth one-way/Long Beach one-way/First one-way/Pacific one-way/Eighth one-way) from SPTC R.O.W.	Retained	Retained

3.3 RAIL ALTERNATIVES SELECTED

After a lengthy screening and review process, a small number of the most feasible and attractive rail alignment alternatives were selected for further study and development. This process involved the application of selection criteria (shown in Section 3.1.2) in numerous review meetings with the LACTC, agency staffs of the cities of Long Beach, Los Angeles, Compton, and Los Angeles County; modifications of alignments as problems were identified; and finally, recommendation of final alternatives to governing bodies for approval. A total of ten alternative alignments were recommended and approved for further study--three in downtown Los Angeles, three in the Compton area of the Mid-Corridor segment, and four in downtown Long Beach. A description of the alternatives recommended--including maps showing the routes in the corridor segments--and the adoption measures associated with each corridor segment are summarized in the following sections.

With limited exceptions detailed below, the full corridor alignment from Union Station, Los Angeles to the Long Beach Transit Mall is shown on 250-scale plans and profiles included as part of Volume II of this report. Typical sections at various points in the corridor are also shown. These plans and profiles should be consulted to obtain a more detailed picture of the proposed routes, street and rail crossings, right-of-way acquisition requirements, etc. It should be noted that the plans reflect a very preliminary level of design, and will undoubtedly change as further engineering is accomplished.

3.3.1 Downtown Los Angeles

The downtown Los Angeles alternatives were considered by the Los Angeles County Transportation Commission on May 25, 1983. In that meeting, the Commission adopted three alternatives for further study: Alternative 2, Alternative 11A, and Alternative 13D. Due to considerations of capital cost and funding availability, the Commission further modified the two grade-separated alternatives (11A and 13D) by eliminating the segments from Seventh Street (interface with the proposed Metro Rail line) to Union Station for Alternative 11A, and (on September 14, 1983) from Third Street to Union Station for Alternative 13D. The Commission directed that, for the purposes of the present study, these connections to Union Station be considered as possible future extensions of the Long Beach-Los Angeles rail transit line.

The downtown Los Angeles alternatives have been renumbered according to the following equivalence table. The alignments are shown in Figures 3.1, 3.2, and 3.3. Additional details can be found in Volume II.

New Number	Name	Old Number
LA-1	Broadway/Spring At-Grade	2
LA-2	Flower Street Subway	11A
LA-3	Olympic/Ninth Aerial	13D

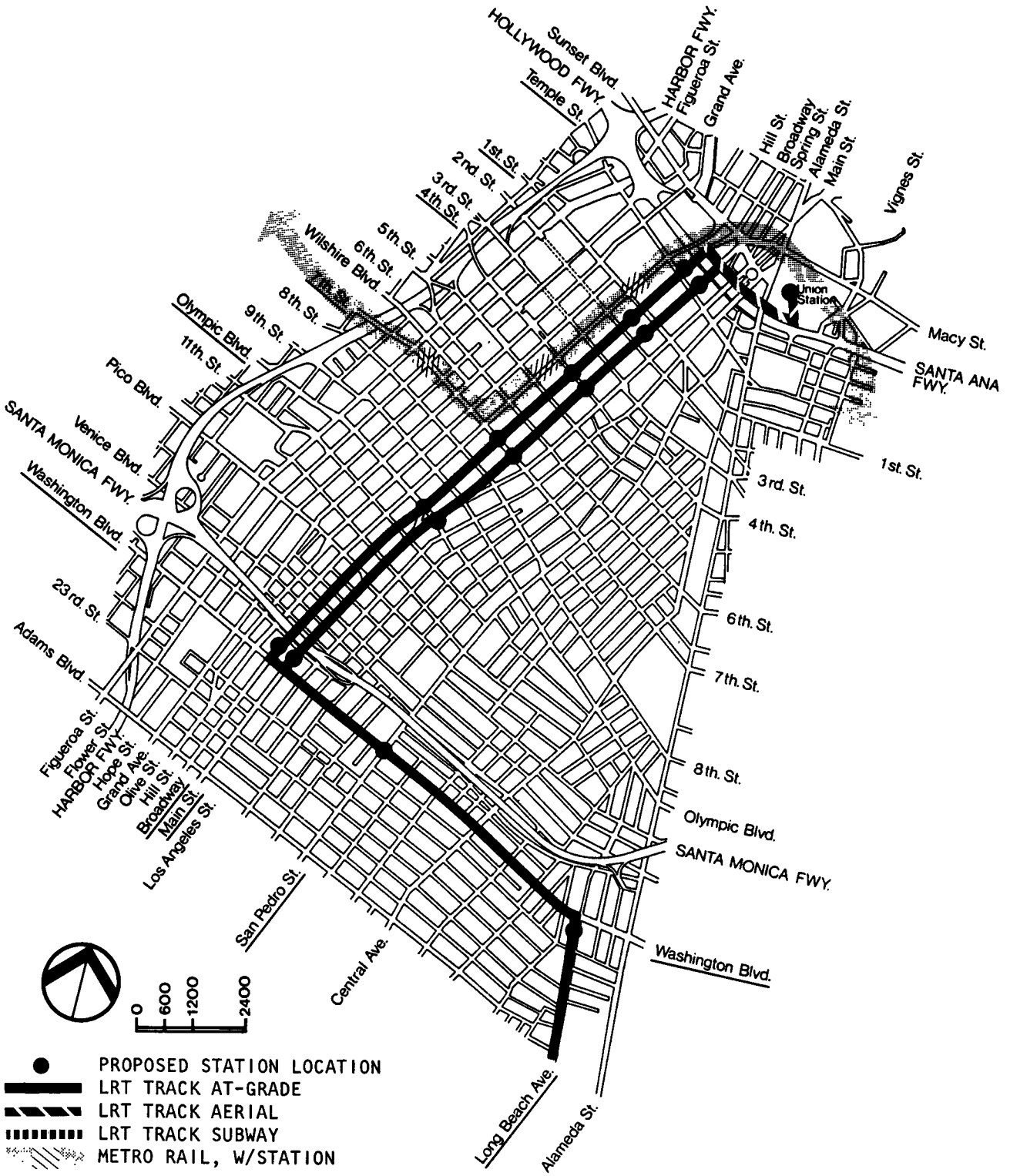
Descriptions of the three Los Angeles alignments are as follows:

- Alternative LA-1 (Broadway/Spring Couplet, At-Grade). From the southeast corner of downtown Los Angeles at Washington Boulevard and Long Beach Boulevard, double tracks proceed northwest at-grade in a median in Washington Boulevard to Main Street and Broadway. An at-grade one-way track couplet is created by a north bound track in Main Street/Spring Street, and a south bound track in Braodway. They come together north of the downtown area and proceed on aerial structure parallel to the US-101 (Hollywood) Freeway easterly to a terminal station at the Los Angeles Union Terminal.

- Alternative LA-2 (Flower Street Subway). From the railroad right-of-way at the southeast corner of downtown Los Angeles, double tracks proceed northwest at-grade in a reserved median in Washington Boulevard, as in Alternative LA-1. From Washington Boulevard, the tracks swing northeast to a reserved median in Flower Street. On Flower Street between 11th Street and 12th Street, the tracks enter a portal in the median to become a subway track. The subway line terminates at the Metrorail station of Seventh Street and Flower.

  The future extension to the Los Angeles Union Station is shown in Figure 3.2. The tracks would continue up Flower to First Street and turn right on First to Main Street. There the tracks again turn north, then east along the Santa Ana Freeway, and finally north into Union Station.

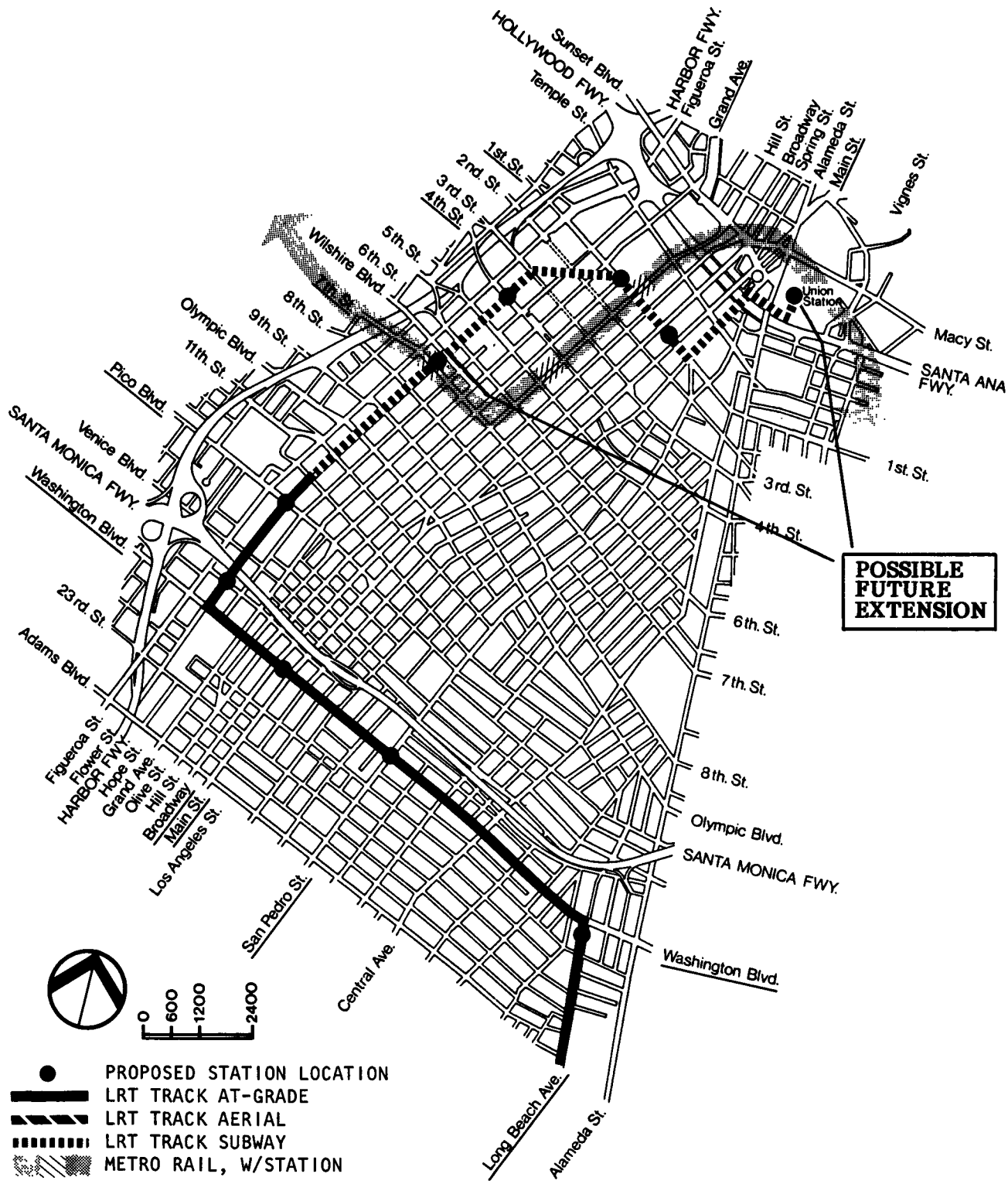
- Alternative LA-3 (Olympic/Ninth Aerial). From the SPTC railroad right-of-way at the southeast corner of downtown Los Angeles, at Washington and



Broadway/Spring At Grade LA-1 **Fig. 3.1**

Long Beach - Los Angeles RAIL TRANSIT PROJECT
LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Downtown Los Angeles Alignment Alternatives
PARSONS BRINCKERHOFF / KAISER ENGINEERS



Flower St. Subway LA-2 **Fig. 3.2**

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Downtown Los Angeles Alignment Alternatives

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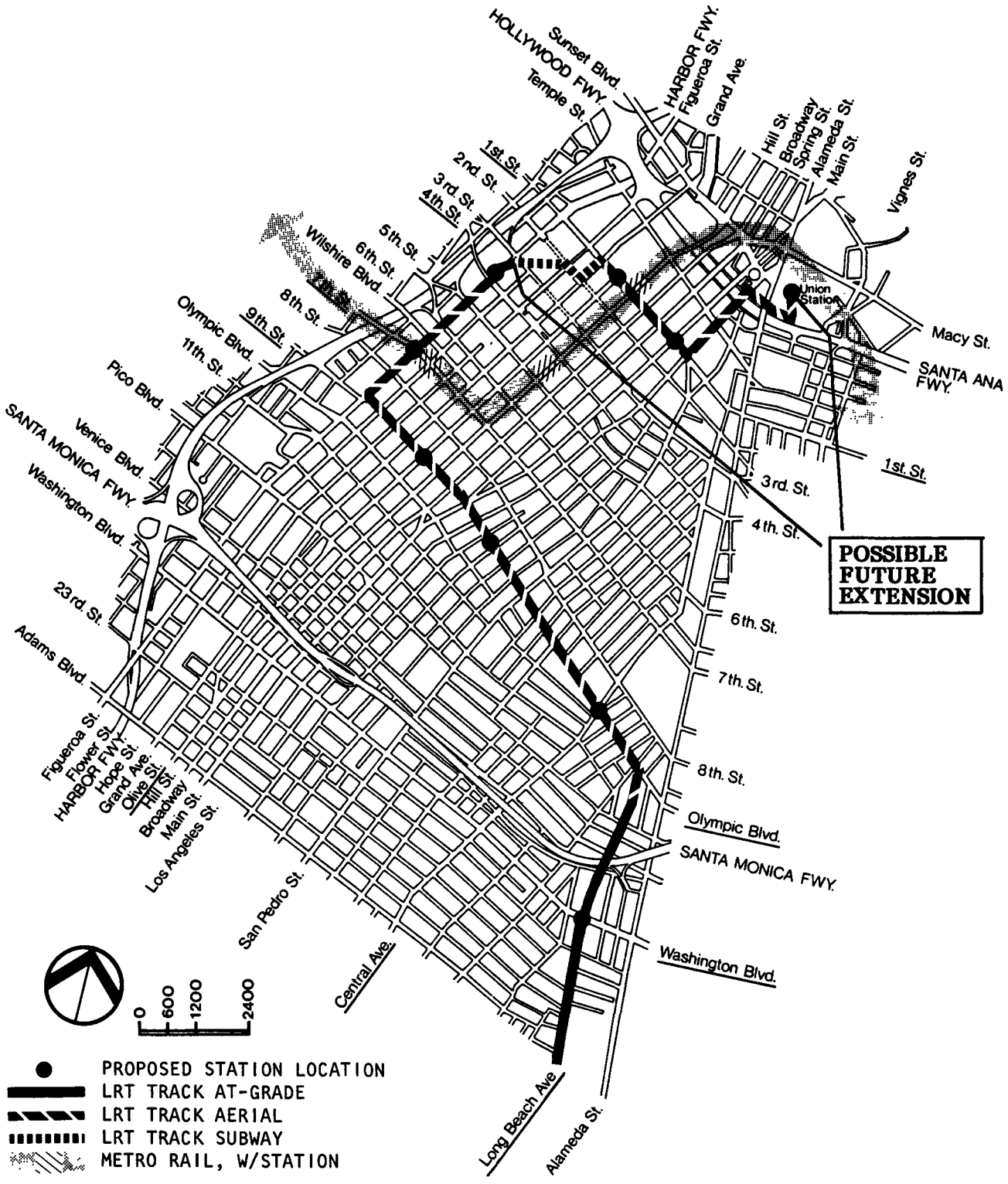


Olympic/Ninth Aerial LA-3 **Fig. 3.3**

Long Beach-Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Downtown Los Angeles Alignment Alternatives

PARSONS BRINCKERHOFF/KAISER ENGINEERS

Long Beach Boulevard, double tracks continue north at-grade in railroad right-of-way to Olympic Street. At Olympic Street the tracks elevate to an aerial guideway in a reserved median and proceed northwest on Olympic/Ninth Street. The Olympic/Ninth line proceeds with a segment (SPTC-Santee) in a reserved median of two-way traffic roadway and a segment (Santee-Figueroa) in the west curb lane of the one-way traffic roadway, to Figueroa where it turns to the northeast to a terminal station south of Third Street.

The future extension would proceed as follows: At Third Street the line turns to the east and goes underground through the Bunker Hill area. The line portals on First Street to an aerial line east of Hill Street. The line proceeds on First Street to Los Angeles Street where it turns north, and proceeds to the Santa Ana Freeway. The line swings to the northeast along the Santa Ana Freeway to a terminal station at the Los Angeles Union Station.

3.3.2 Mid Corridor

At the same meeting in which downtown Los Angeles alternatives were adopted (May 25, 1983), the Los Angeles Transportation Commission reviewed all Mid-Corridor options and selected Baseline "C" for further study. This alternative provides for a double-track rail transit configuration entirely at-grade, except for three grade-separations with railroad mainlines (at Slauson, Dominguez, and Cota) and an existing grade separation at Firestone Avenue. The Commission also adopted, for further study, options for rail line and street grade separations in the Compton City Hall area and (on June 22, 1983) for a Compton Creek rail transit bridge.

A third alternative for the Compton area was added September 14, 1983 for study. In this instance, SPTC rail freight operations would be rerouted from the Wilmington Branch at Watts Junction onto the West Santa Ana Branch to the San Pedro Branch. They would follow the San Pedro Branch to Dominguez Junction. Thus, from Watts Junction to Dominguez Junction, the rail transit system would operate at-grade in exclusive right-of-way. Also, a fourth grade-separation would be built at Watts Junction to allow passage of the re-routed Wilmington Branch traffic under the rail transit tracks (see Figure 7.4).

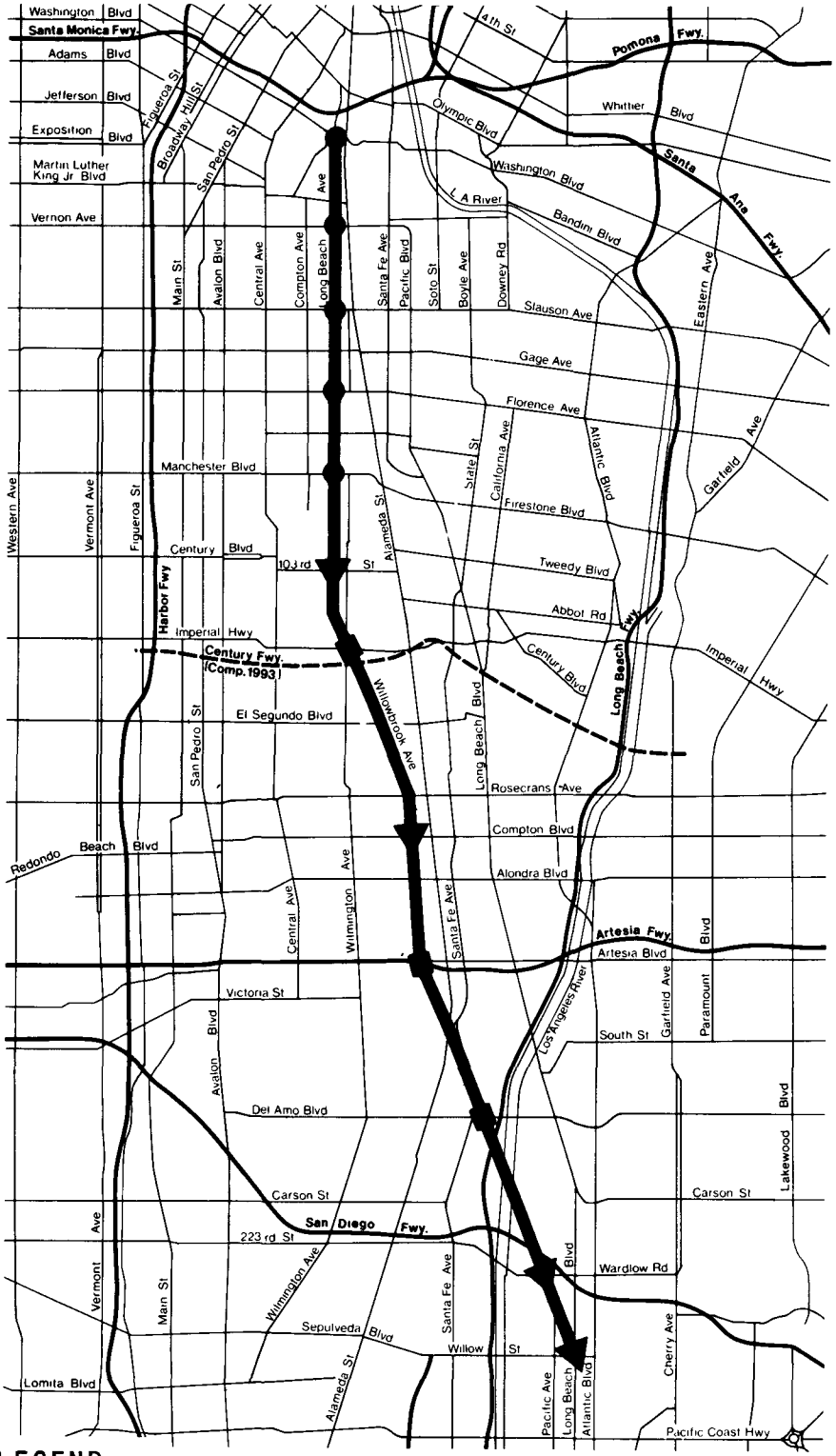
As a consequence of these actions, there are three distinct rail alignment alternatives for the Mid-Corridor segment, though the differences are limited to the Compton area between Watts Junction and Del Amo Boulevard. North and south of these points, only one alignment (horizontal and vertical) is still under consideration. The alternatives have been renumbered, as shown in this table.

New Number	Description	Old Number
MC-1	Rail transit and SPTC railroad at-grade in the Compton area.	Baseline C
MC-2	Rail transit and SPTC railroad grade-separated from roads in Compton area (rail in depressed section).	Option 1
MC-3	SPTC rail operations rerouted off Wilmington Branch between Watts Junction and Dominguez Junction. Rail transit at-grade in Compton area.	—

The full Mid-Corridor alignment is shown in Figure 3.4. The three Mid-Corridor alternatives for the Compton area are shown in Figure 3.5. Plan and profile drawings are available in Volume II for the full Mid-Corridor segment with Alternative MC-1, and for the affected portion of the segment with Alternative MC-2. Preliminary drawings of the SPTC rail relocation (MC-3) are also provided; however, drawings of the rail transit tracks south of Watts Junction are not yet available for this alternative.

3.3.3 Downtown Long Beach

Hearings by the Long Beach City Council on the alternatives for downtown Long Beach led to adoption on April 26, 1983 of Alternatives 1, 4, 5, 9, and 10. Further refinement of the alternatives since that time has led to the replacement of



LEGEND

- ● STATION
- ■ STATION WITH PARK & RIDE
- ▼ STATION WITH NEIGHBORHOOD PARK AND RIDE

Fig. 3.4

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Mid-Corridor Alignment

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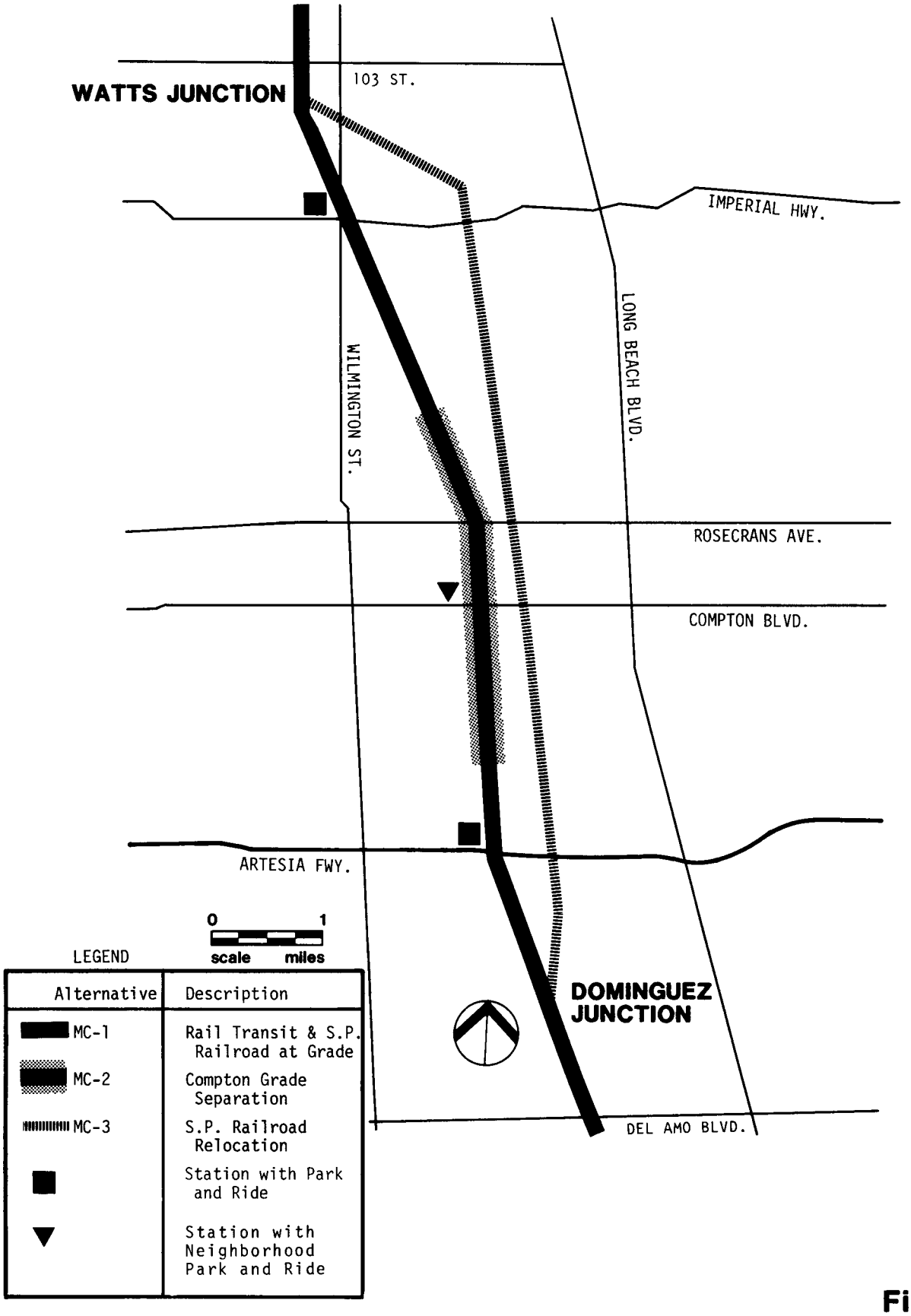

Fig. 3.5

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Mid-Corridor Alternatives

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Alternatives 9 and 10 with a variation of the two, listed as Number 11 in Table 3.3, above. This alternative is the same Atlantic/Long Beach/Pacific Loop, but with one-way movements on 8th and 9th Streets, rather than a two-way movement on Tenth Street. Slight modifications to Alternative 1 ("River Route") have also been made.

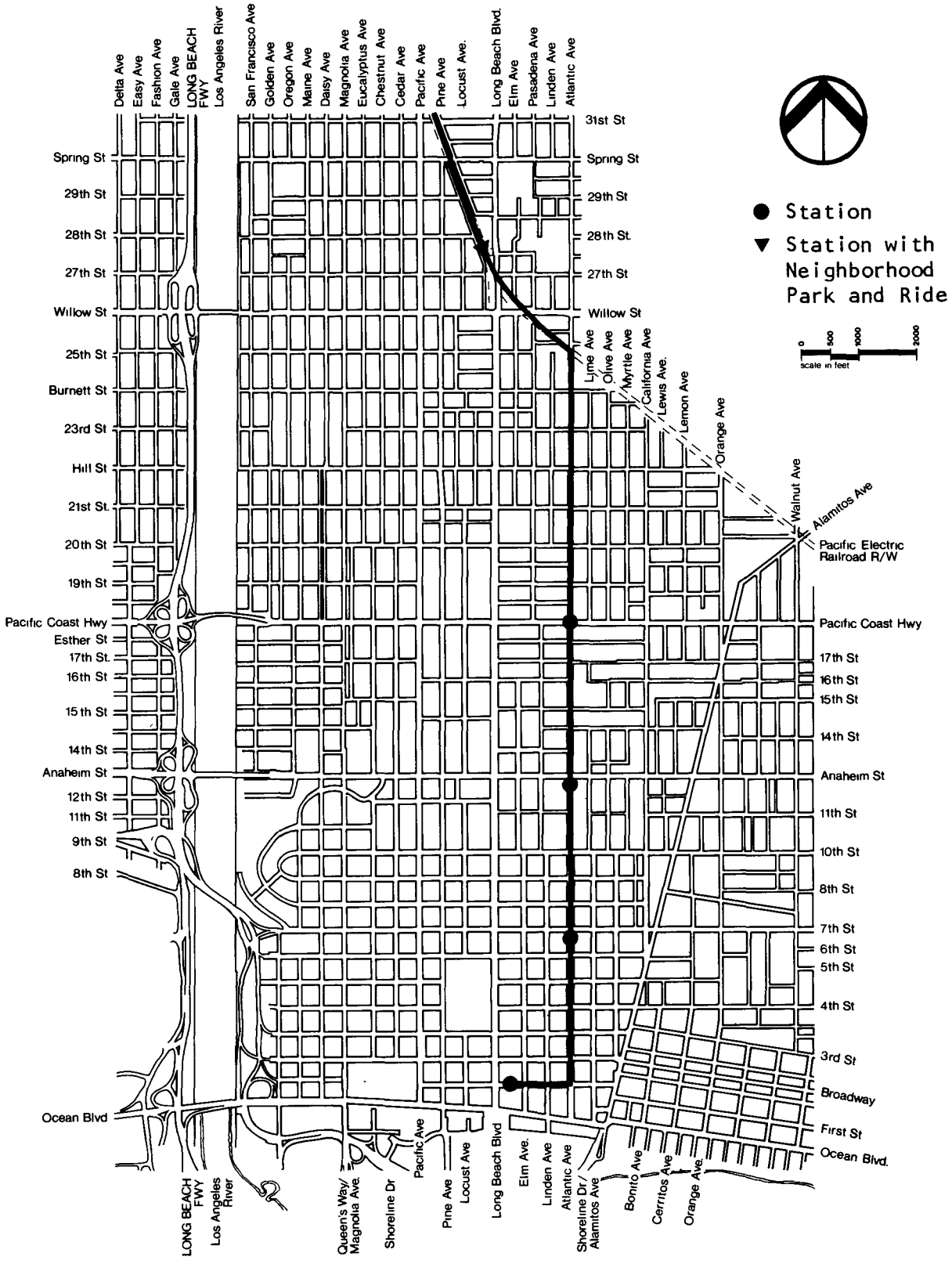
The four downtown Long Beach alternatives which are currently under study are shown in Figures 3.6 to 3.9. As in the case of the other two corridor segments, these alternatives have been renumbered, as shown in the table below. Complete plans and profiles are included in Volume II.

New Number	Name	Old Number
LB-1	Atlantic Avenue Two-Way	4
LB-2	Atlantic/Long Beach Couplet	5
LB-3	Los Angeles River Route	1
LB-4	Atlantic with Pacific Avenue Loop	11

Due to the right-of-way requirements for the Atlantic Avenue Two-Way Alternative (LB-1), two subalternatives for the alignment down Atlantic Avenue are currently under consideration. The first of these places both tracks in a restricted median in the middle of the existing street. Widening of the street on both sides is required. The second subalternative separates the tracks and places them adjacent to the curb or in the first traffic lane. Only the reserved median would require additional right-of-way. Plans of both subalternatives are included in Volume II.

Brief descriptions of the four alternatives are as follows:

- Alternative LB-1 (Atlantic Two-Way). This alternative has two tracks at-grade on Atlantic Avenue to First Street, where the tracks turn west and terminate at Long Beach Boulevard. The terminus is a stub-end station with a tail track. Two subalternatives along Atlantic Avenue are: (1) transit tracks in a reserved median; and (2) separated tracks, one at each curb or outer traffic lane.



Atlantic Ave. Two-way

LB-1

Fig. 3.6

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Downtown Long Beach Alignment Alternatives

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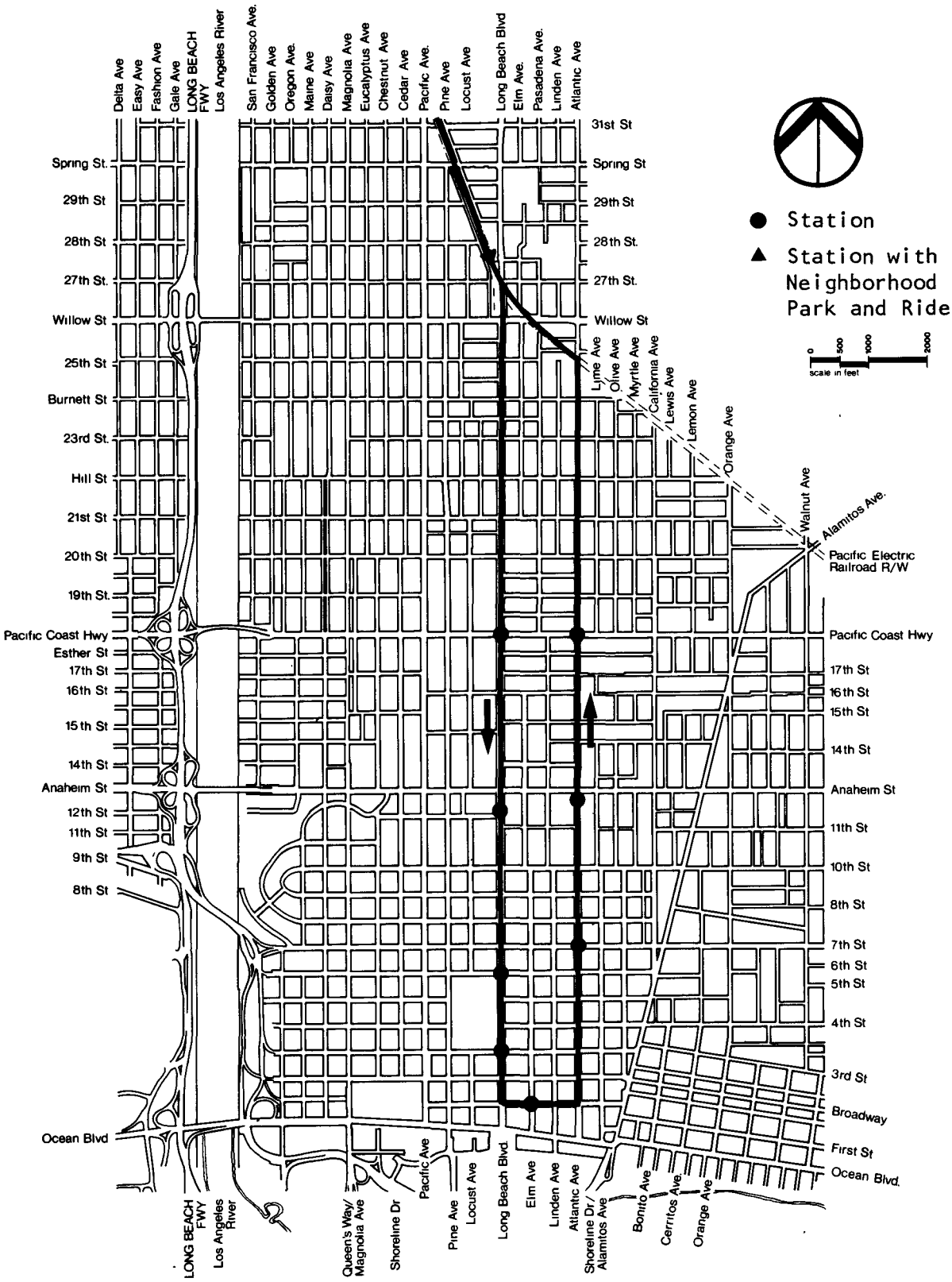

Atlantic / Long Beach Couplet LB-2 **Fig. 3.7**

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Downtown Long Beach Alignment Alternatives

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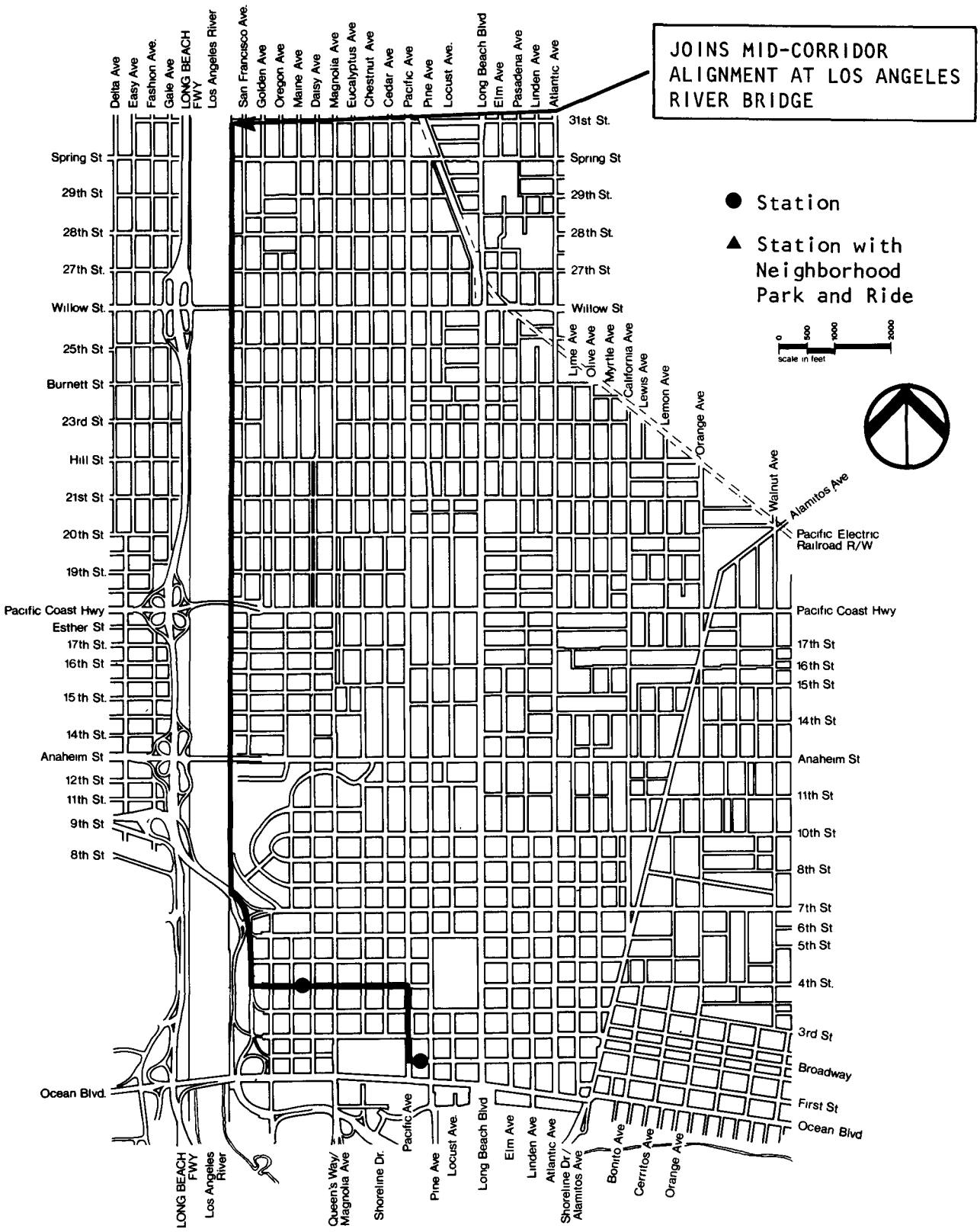

River Route LB-3 **Fig. 3.8**

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Downtown Long Beach Alignment Alternatives

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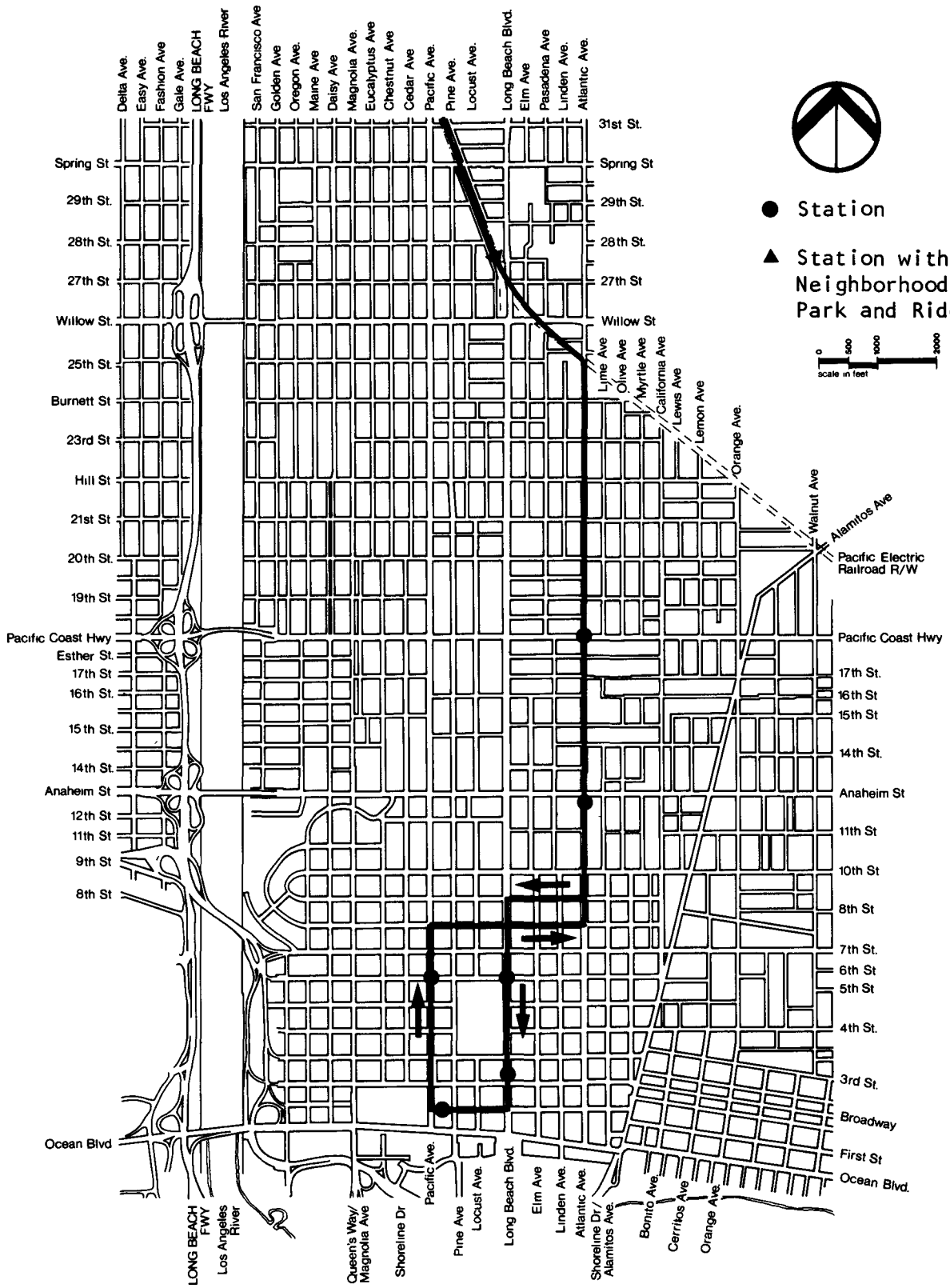

Atlantic with Pacific Ave. Loop

LB-4

Fig. 3.9

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Downtown Long Beach Alignment Alternatives

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- Alternative LB-2 (Atlantic/Long Beach Couplet). Beginning at the SPTC railroad right-of-way at Long Beach Boulevard (near Willow Street), a one-way at-grade couplet is created by a track southbound on Long Beach Boulevard, eastbound on First Street, and northbound on Atlantic Avenue, returning to the SPTC right-of-way.

- Alternative LB-3 (River Route). This alternative is located just outside the levee on the east side of the Los Angeles River. The line proceeds from the SPTC bridge crossing the river on retained embankment to Seventh Street, then along the Long Beach Freeway right-of-way at-grade to Fourth Street, eastbound on Fourth, south on Pacific Avenue to First Street, and then east to a stub-end terminus at Elm Avenue.

- Alternative LB-4 (Atlantic with Pacific Loop). This alternative has two tracks on Atlantic Avenue from the SPTC right-of-way near 25th Street to Ninth Street. There, the southbound track swings west to Long Beach Boulevard, then south to First Street, west to Pacific Avenue, north to Eighth Street, east back to Atlantic Avenue, and finally north to the SPTC right-of-way.

3.3.4 Baseline System

A baseline system has been defined for the purposes of comparing and evaluating the performance, cost, and impact characteristics of each of the alternative rail transit systems. The Baseline System, also described in the Executive Summary of this report, includes the following at-grade alternatives which, taken together, constitute a minimum-cost system:

New Number	Name	Location
LA-1	Broadway/Spring Couplet, At-Grade	Los Angeles
MC-1	Rail Transit and SPTC Railroad At-Grade	Mid-Corridor
LB-4	Atlantic with Pacific Avenue Loop, At-Grade	Long Beach

existing building might be required at the turn made at Ninth and Figueroa Streets, as well as the World Trade Center Building on Figueroa between Third and Fourth Streets, the latter which has been designed for the purpose of accommodating a turn back facility. The future extension of the alternative would also pass under a section of Bunker Hill, which will require that a subsurface easement be obtained from the Community Redevelopment Agency (CRA), which has jurisdiction. No significant problems in obtaining necessary easements are anticipated.

Right-of-way in the Union Station area will be acquired from either the Union Station Terminal Company, which currently owns the site, or from Caltrans, which has been negotiating to purchase the site for use as a multimodal transportation terminal.

3.4.2 Mid-Corridor

The Mid-Corridor segment of the rail transit line will be aligned entirely within the existing SPTC right-of-way. Acquisition of private property will be limited to small parcels at the Del Amo park-and-ride facility, and small strips of property at various points to accommodate the rail transit and SPTC track configurations, road crossing gates, substations, etc. It is anticipated at this time that no structures will be affected by any of the three Mid-Corridor alternatives, and virtually all of the acquisitions will involve strips of a few feet in depth.

3.4.3 Downtown Long Beach

Three of the four Long Beach alternatives lie within city streets, with tracks and stations located in the public right-of-way. Two of these alternatives--Atlantic/Long Beach Couplet (LB-2) and Pacific Loop (LB-4)--will require no direct acquisition of private property. If the Atlantic Avenue Two-Way Alternative (LB-1) is built with a reserved transit median, however, a strip of private property on both sides of Atlantic Avenue from Willow to Anaheim Streets will be needed to accommodate the approximately 22 feet of additional street width required (more at intersections). Numerous structures will be affected, most of which will require outright purchase and demolition. Some, but not all, of this impact will be mitigable by eliminating parking lanes or narrowing sidewalks at critical points.

(Anticipated right-of-way requirements on Atlantic Avenue are shown in Volume II, sheets 67 through 69.)

The fourth Long Beach alternative (LB-3, River Route) will be just outside the flood control levee on the east side of the Los Angeles River. Placement of the rail line adjacent to or actually on the levee will require an easement from the Los Angeles County Flood Control District and the approval of the Army Corps of Engineers. Several private parcels will also be affected by this alternative, as well as a portion of the SCRTD bus yard, north of Seventh Street. Engineering is not sufficiently advanced at this time to allowing determination of the precise number of parcels potentially affected. (See sheets 61 and 62 in Volume II.)

3.5 BUS ALTERNATIVE

To develop a bus alternative for the purpose of comparison with the various rail alternatives, alternative bus alignments were developed within the Los Angeles, Mid-Corridor, and Long Beach segments of the Long Beach-Los Angeles rail transit corridor. In conformance with the evaluation procedures established for the rail alternatives, potential bus alternatives were evaluated for each of the three segments. The results of the evaluation process and identification of the candidate bus alternatives were presented in a workshop session, held on July 25, 1983, to participants from the project team agencies (LADOT, LA City Planning, SCAG, SCRTD, CRA, Caltrans, City of Long Beach, and Los Angeles County Road Department), LACTC and the rail transit consultant (PB/KE). Bus alternative alignments in each segment were presented. Comments from interested agencies were received and incorporated into the final selection of the bus alternatives.

Figure 3.10 presents the bus alternative recommended for further analysis and comparison to the rail alternatives and the No-Build Alternative in the Draft Environmental Impact Report. The alignment is as follows:

- Los Angeles Segment (Broadway/Spring Couplet via Olympic Boulevard). Starting at Washington Boulevard the bus alignment proceeds north on Alameda Street to Olympic Boulevard; west on Olympic Boulevard to Spring Street; north on Spring Street to Macy Street and access to the Union Station; southbound on Broadway to Olympic Boulevard; and east on Olympic Boulevard to Alameda Street.

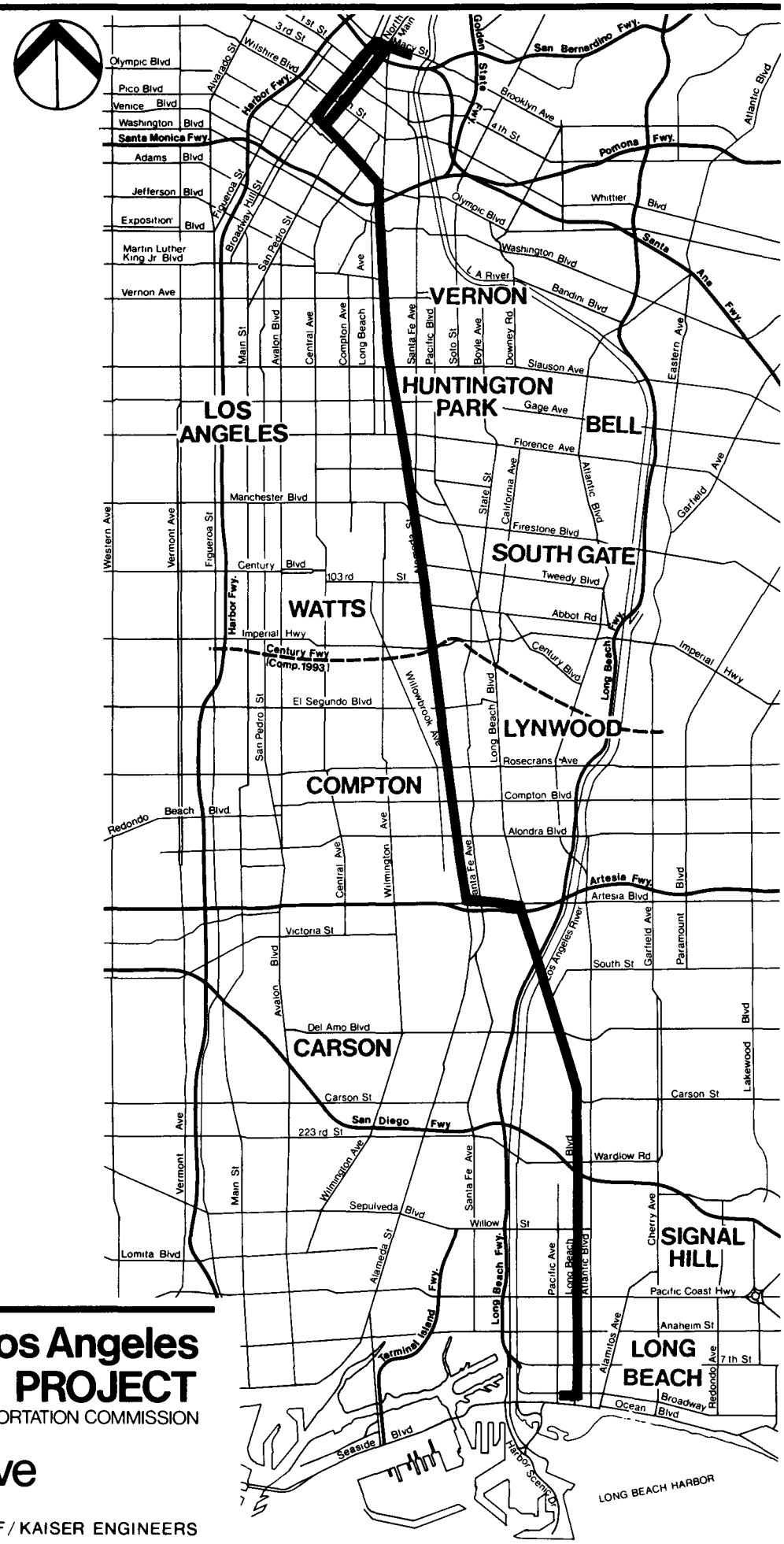

Fig. 3.10

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LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Bus Alternative

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- Mid-Corridor Segment (Alameda/Artesia/Long Beach). The alignment proceeds north on Long Beach Boulevard to Artesia Boulevard; west on Artesia Boulevard to Alameda Street; and north on Alameda Street to Washington Boulevard.

- Long Beach Segment (Long Beach Boulevard Two-Way). The bus alignment proceeds southbound on Long Beach Boulevard to First Street/Transit Mall where it would turn west and terminate.

4.0 STATIONS

4.1 INTRODUCTION

As part of the ongoing definition and refinement of rail transit alternatives for the Long Beach-Los Angeles Corridor, and to provide input into the alternative analysis/environmental input process station locations have been identified for each of the candidate alignments. The preliminary screening of station locations which has occurred to date has involved close coordination with agencies of the cities involved and community organizations.

Station concept plans for various prototypical station conditions have been prepared and are presented at the back of this section. The prototypes cover a variety of design treatments found throughout the corridor: at-grade in mixed traffic, at-grade in reserved right-of-way, aerial, subway, etc. A set of 18 station concepts (including alternate versions for two stations) is included in Volume II of the report, which cover the full range of station types considered. For those stations for which concept plans are not provided, reference is made in this section to drawings which are of a similar station type.

4.2 EVALUATION METHODOLOGY

Selecting station locations requires a delicate balance between competing objectives, particularly between the desire to provide frequent stops for the sake of passenger convenience against the need to achieve relatively high speed operation to attract riders. To assist in screening potential station locations a preliminary set of criteria were developed which include:

- Operating Speed. To maintain a reasonable operating speed station spacing should be approximately 1.5 miles apart in mid-corridor, and approximately one-half mile apart in the Long Beach and Los Angeles CBD.

- Proximity to Generators. Stations should be located to conveniently serve major ridership generators in the corridor.

- Passenger Security and Safety. Stations should occur in locations highly visible to passing motorists and/or neighbors.

- Feeder Bus Connections. Stations should be located on or near streets with cross-corridor feeder bus service.

- Ridership Potential. Station locations should be responsive to anticipated ridership forecasts.

- Relative Capital Costs. Inclusion of a station should take into account the relative capital costs per passenger served.

- Traffic Impacts. Stations should be located at places where access by automobile will not be a constraint.

- Land Availability. Land acquisition for park-and-ride sites should minimize the displacement of residences and businesses.

- Neighborhood Boundaries. Station locations should be mindful of neighborhood boundaries, in that certain stations may be characterized as belonging to specific neighborhoods and therefore perceived as being not available to "outsiders".

- Development/Redevelopment Impact Potential. Station locations should be compatible with community plans and development policies, and encourage where applicable, development adjacent to the station.

- Environmental Impacts. Stations should be located away from environmentally sensitive areas, and should minimize negative impacts on adjacent neighborhoods.

As an initial step in identifying candidate station stops, a review was conducted of prior studies in the corridor and of the former Pacific Electric Long Beach line stops. These and other stops identified through field reconnaissance and discussions with staff from the cities in the corridor were evaluated using the above criteria. The resultant station locations selected for each of the alignments under consideration are described in this section of the report.

4.3 DOWNTOWN LOS ANGELES STATIONS

Three alternative alignments are being considered for the Los Angeles CBD:

- An at-grade one-way couplet on Broadway and Spring/Main Streets (LA-1);
- A short subway alignment along Flower Street (LA-2); and
- A predominately aerial structure along Olympic Boulevard/9th Street, and Figueroa Street (LA-3).

Recommended stations for each of the above alignment options, including possible future extensions for the two grade separated alternatives, are listed in Table 4.1 and shown in Figures 3.1, 3.2 and 3.3. These recommended stops will: (1) provide good coverage of existing major generators along each option (i.e., almost all significant ridership generators will be within a 5 minute walk of a station); (2) provide transfer opportunities to Metro Rail; and, (3) are spaced to maintain a reasonable operating speed, with relatively low station development costs.

With the at-grade alternative the passenger boarding areas along Broadway would be designed as extensions of the sidewalk which meet the LRT tracks in the second lane from the curb. This approach to station development will still permit truck servicing, bus loading, and parking at curb side between light rail stops without disruption to light rail operations.

The prototypical light rail stop along Spring Street would occur in the contra flow transit lane, whereas the recommended station treatment along Washington Boulevard (at San Pedro and at Main Streets) would have platforms in the middle of the street since the light rail line would be operating at-grade in an exclusive center median. With this latter prototype, station platforms would be staggered to permit left turn lanes for autos.

Except along Ninth Street where the stations would be next to the north curb, the aerial stations would be located in the center median of the street. Access to the platform would occur by escalators, stairs and elevators located in the sidewalk

TABLE 4.1

DOWNTOWN LOS ANGELES STATIONS AND STOPS
(Refer to Figures 3.1, 3.2 and 3.3)

At-Grade (LA-1)	Subway (LA-2)
(Baseline System)	Long Beach-Los Angeles Rail Project
	Seventh Street[3] (7)
Union Station (10)	Pico Boulevard[3] (9)
Temple Street[1] (1,5)	North of Washington Boulevard[3] (9)
Between First and Second Streets[1] (1,5)	Between Broadway and Main Street[4] (9)
Fourth Street[1] (2,5)	San Pedro Street (9)
Seventh Street[1] (3,5)	
Olympic Boulevard[2] (4,5)	Possible Future Extension
North of Washington Boulevard[2] (4,5)	Union Station
San Pedro Street and Washington Boulevard (9)	Between Main and Spring Streets (7)
	Olive Street[5] (7)
	Fourth Street[3] (7)

Aerial (LA-3)

Long Beach-Los Angeles Rail Project

Fourth Street[6] (8)

Seventh Street[6] (8)

Olive Street[7] (6)

Between Maple and Santee Streets[7] (8)

Central Avenue[8] (8)

Possible Future Extension

Union Station (10)

Main Street[5] (6)

Olive Street[5] (6)

Notes:
1. Broadway and Spring Streets (2 stops)
2. Broadway and Main Streets (2 stops)
3. At Flower Street
4. At Washington Boulevard
5. At First Street
6. At Figueroa Street
7. At Ninth Street
8. At Olympic Boulevard

Numbers in parentheses refer to station concept figure numbers in Volume II. Refer to Section 4.6 of this volume.

area. Subway stations would also have side platforms, with street level access via escalators, stairs, and elevators in the sidewalk area.

4.4 MID-CORRIDOR STATIONS

As indicated in Figure 3.4, proposed Mid-Corridor stations are as follows (north to south). Note that the numbers in parenthesis refer to station concept figure numbers in Volume II (see Section 4.6 of this volume for a discussion).

Washington Boulevard (12)
Vernon Avenue (12)
Slauson Avenue (10)
Florence Avenue (12)
Firestone Boulevard (11)
103rd Street (12)
Imperial Highway (13)
Compton Boulevard (14,15)
Artesia Boulevard (16)
Del Amo Boulevard (17)
Wardlow Road (12)
Willow Street (12)

In general, the proposed station locations have been chosen because they, (1) occur at major cross-streets and as a result will provide good vehicular access and visibility; (2) are served by at least one cross-corridor bus route; (3) offer good station spacing; and/or (4) are near a significant existing or proposed ridership generator. A brief description of each proposed station follows:

- Washington Boulevard Station would occur just south of the turn from/to Washington Boulevard on the SPTC right-of-way. It would be an at-grade station with a center platform. This station would generally serve as a transfer station for Washington Boulevard buses and walk-on patronage from the surrounding industrial and residential areas.

- Vernon Avenue Station would occur just south of Vernon Avenue in the SPTC right-of-way. It would be an at-grade station with a center platform. It

would serve the Vernon industrial area to the east and residential neighborhood to the west.

- Slauson Avenue Station would be an aerial station on structure south of Slauson Avenue but north of the Slauson Junction and where the SPTC tracks are relocated from the east side to west side of the right-of-way. This site would serve the surrounding residential, commercial and industrial areas. Even though this site is one block away from the Pueblo Del Rio Housing Project it is considered a better location for a station than 55th Street, because it would be served directly by feeder buses, and is visible from a highly traveled street (Slauson Avenue). The proposed location offers better areawide accessibility and provides better passenger security.

- Florence Avenue Station would be an at-grade, center platform station just south of Florence Avenue. It would serve the Florence commercial district and surrounding residential area.

- Firestone Boulevard Station would occur on the embankment just south of Firestone Boulevard. There are already stairs leading up to the overcrossing at all four corners of the intersection. Retaining walls will have to be heightened to accommodate the proposed station.

- 103rd Street Station would occur south of 103rd Street and serve the existing and proposed retail and institutional uses adjacent to the site as well as surrounding residences. There is the opportunity to provide park-and-ride facilities on both sides of the tracks, and potentially to re-use the existing historic station building for commercial or community purposes.

- Imperial Highway Station would be a major park-and-ride station adjacent to the proposed Century Freeway. The park-and-ride lots would serve both light rail passengers as well as Century Freeway express bus riders. The station would be at-grade with provision for convenient feeder bus interface for rail transit and freeway express bus passengers.

- Compton Boulevard Station would be on the north side of Compton Boulevard in either an at-grade or a below grade configuration. The City of

Compton has plans for a multi-modal transportation center, which would be an integral part of this station. The Civic Center and retail area next to the site already serves as a hub for a number of RTD and City of Gardena bus routes. The transit center would serve to reinforce this role.

- Artesia Boulevard Station would be a park-and-ride station for residents of North Long Beach, Compton and Carson. The parking lot would occur on vacant City of Compton property to the west of the SPTC tracks. Access to the site would be via Acacia Avenue.

- Del Amo Boulevard Station would be a major park-and-ride site with nearby access from the Long Beach Freeway. There are several candidate sites for the park-and-ride facility on either side of the tracks. Use of the triangular parcel west of the station (Phase II) would require displacement of a truck rental firm, whereas the site between the SPTC and the storm channel (Phase I) would not involve any displacement.

- Wardlow Road Station would be just south of Wardlow Road, at-grade along the existing embankment. Local park-and-ride facilities would be provided in the existing right-of-way. This station would serve the adjacent neighborhood which includes a number of residential developments and senior-citizen housing units.

- Willow Street Station would be an at-grade center platform station located slightly north of Willow Street between 27th and 28th Streets where Long Beach Boulevard crosses the SPTC tracks. This station would serve the surrounding commercial and residential uses, as well as Long Beach Memorial and Pacific Hospitals. Local park-and-ride facilities would be provided in the railroad right-of-way.

4.5 DOWNTOWN LONG BEACH STATIONS

Four alternative alignments, all at-grade, are being considered for downtown Long Beach. These are:

- Two-way operation along Atlantic Avenue;

- Long Beach Boulevard/Atlantic Avenue one-way couplet;
- A Los Angeles River route; and,
- Atlantic Avenue two-way with a Long Beach Boulevard/Pacific Avenue loop.

Figures 3.6 through 3.9 show the recommended station locations associated with each of the alternatives, which are listed in Table 4.2. In general these stations are recommended because, (1) they provide reasonable station spacing for balancing service coverage with operating speed; (2) provide cross-corridor bus connections; (3) serve major generators; and (4) are for the most part in highly visible locations.

The city of Long Beach has requested that a station be placed at the terminus of the River Route Alternative (LB-3) on First Street between Long Beach Boulevard and Elm Avenue. The LACTC has studied this option and does not consider it viable at this time, since this area would be needed for end of line layover and for short term storage of a non-operative vehicle.

Two alternative station treatments are being considered for Atlantic Avenue with two-way operations; (1) with tracks in the center median, or (2) with tracks in the second lane from the curb. Locating the stations in the median would require widening of the right-of-way, whereas locating stations in the parking lane by extending the sidewalks in the station area would not. However, light rail operations would be better and traffic impacts would be lessened with the exclusive median operation.

4.6 STATION CONCEPT PLANS

To assist in establishing station locations and preliminary costs for concept planning and environmental impact purposes, an array of station concept plans were developed. Rather than include plans for each site in this document, the following plans reflect generic station prototypes for different right-of-way conditions (i.e., in-street vs. in exclusive right-of-way); different vertical alignment possibilities (i.e., aerial, at-grade; and below grade); different horizontal alignments (i.e., in median, at curb, etc.); and various platform configurations (i.e., center island, side, or staggered).

TABLE 4.2

DOWNTOWN LONG BEACH STATIONS AND STOPS
(Refer to Figures 3.6 through 3.9)

	Atlantic Avenue Two-Way (LB-1)	Atlantic/Long Beach Couplet (LB-2)	River Route (LB-3)	Atlantic with[3] Pacific Loop (LB-4)
Atlantic Avenue/Pacific Coast Highway	X[1] (19,20)[2]	X (3)		X (3)
Atlantic Avenue/Anaheim Street	X[1] (19,20)	X (1)		X (1)
Atlantic Avenue/Seventh Street	X[1] (19,20)	X (3)		
First Street/ Long Beach Boulevard	X[1] (20)			
First Street/Elm Avenue		X (1)		
Long Beach Boulevard/ Third Street		X (18)		X (18)
Long Beach Boulevard/ Sixth Street		X (18)		X (18)
Long Beach Boulevard/ Twelfth Street		X (3)		
Long Beach Boulevard/ Pacific Coast Highway		X (3)		
Fourth Street between Maine & Daisy Avenues			X[1] (19)	
First Street between Pacfic & Pine Avenues			X[1] (19)	X (2)
Pacific Avenue/Sixth Street				X (1)

Notes:
1. Two-way.
2. Numbers in parathensis refer to station concept figure numbers in Volume II. See Section 4.6 of this volume.
3. Baseline system.

The following features are incorporated into the station plans:

- For aerial stations, a 270 foot long platform is assumed in order to accommodate a three-unit train. For at-grade stations, 180 foot long platforms are assumed (two-car train), with expansion potential to 270 feet.

- Parking lots and access ways to stations will be planned with full provisions for elderly and handicapped patrons. Parking spaces for the handicapped will be integrated into the overall development of parking lots.

- Stations and their equipment will be designed to function without a station agent on duty with any station; any necessary control of the station or essential contact with a patron being accomplished using video, public address, and other electronic communication and monitoring systems.

- In all aerial or depressed stations, the means of vertical transportation will be escalators, elevators, stairs, ramps, and walks as appropriate.

- Public restrooms will not be provided at stations.

- Because of the good weather conditions in the Los Angeles-Long Beach area, passenger waiting facilities will not be fully enclosed or air-conditioned. Where practicable, waiting areas will protect waiting passengers from driven rain, and will be shaded for protection against the sun.

- Landscape buffers will be provided between parking areas and abutting residential properties.

Presented in Volume II are concept plans for 18 of the candidate stations, including two versions for two of the stations, or a total of 20 drawings. (The concepts included in Volume II are listed here in Table 4.3.) In the preceding sections, each candidate station has been listed along with the figure number of an appropriate station concept plan. In 18 cases, the concept plans are for the station indicated. In the case of stations for which concept plans have not been included in Volume II, the figure number of the plan most similar to the station in question has been given.

TABLE 4.3

STATIONS CONCEPT PLANS INCLUDED IN VOLUME II

	LOS ANGELES
1.	Broadway between First Street and Second Street.
2.	Broadway/Fourth Street.
3.	Broadway/Seventh Street.
4.	Broadway/Olympic Boulevard.
5.	Spring/Fourth Street.
6.	Olive/Ninth Street.
7.	Flower/Seventh Street.
8.	Figureoa/Seventh Street.
9.	San Pedro Street/Washington Boulevard
	MID-CORRIDOR
10.	SPTC R.O.W./Slauson Avenue.
11.	SPTC R.O.W./Firestone Boulevard.
12.	SPTC R.O.W./103rd Street.
13.	SPTC R.O.W./Imperial Highway.
14.	SPTC R.O.W./Compton Boulevard (At-Grade).
15.	SPTC R.O.W./Compton Boulevard (Grade-Separated).
16.	SPTC R.O.W./Artesia Boulevard.
17.	SPTC R.O.W./Del Amo Boulevard.
	LONG BEACH
18.	Long Beach Boulevard/Sixth Street.
19.	Atlantic Avenue/Pacific Coast Highway (Version I).
20.	Atlantic Avenue/Pacific Coast Highway (Version II).

Six of the concept plans are included here as Figures 4.1 through 4.6. They have been selected to illustrate all of the basic station prototypes required for the various alignment alternatives:

At-Grade Stop in Mixed Traffic (Figure 4.1). This prototype would occur along Broadway in downtown Los Angeles (one side only) and/or along Atlantic Avenue and other streets in downtown Long Beach. Stations would comprise extensions of the sidewalks with modest canopied waiting areas. (Volume II, Figure 20.)

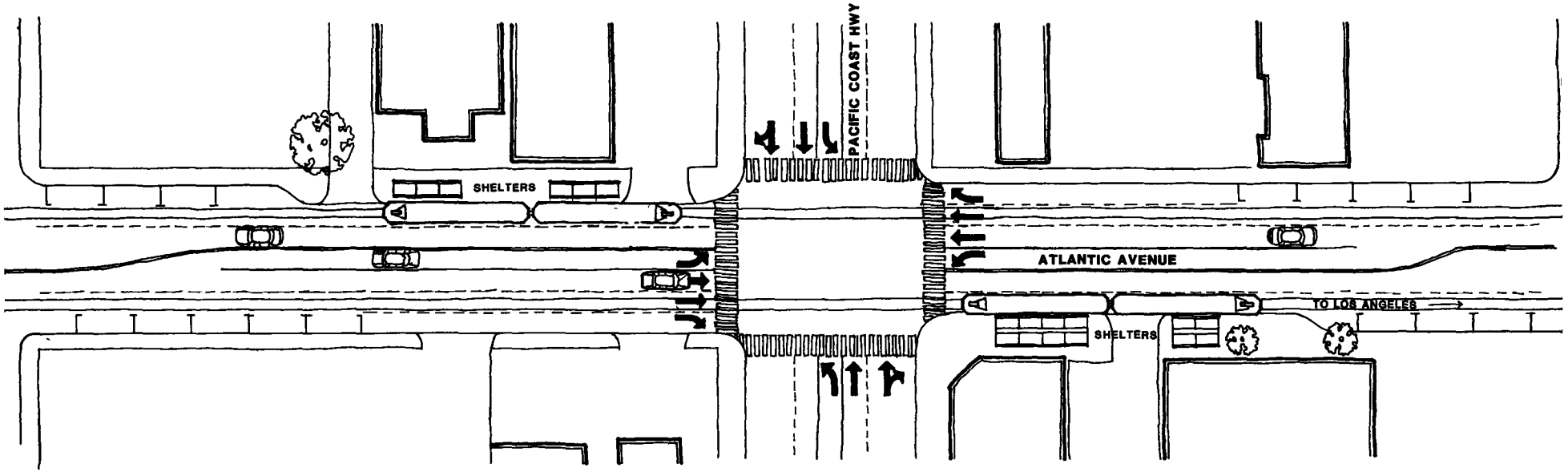
At-Grade Stop in Median (Figure 4.2). This potential treatment would apply to Washington Boulevard in downtown Los Angeles and/or as an alternative to the previously described prototype for Atlantic Boulevard in Long Beach. Platforms would be low-level raised islands in the street median. (Volume II, Figure 9.)

At-Grade Stop in R.O.W. (Figure 4.3). This concept plan typifies the at-grade treatment in Mid-Corridor where the light rail line would be sharing the right-of-way with the Southern Pacific Railroad. Platforms would be in a center island configuration with modest canopies. (Volume II, Figure 12.)

Aerial Station At-Curb (Figure 4.4). This type of station would occur where the alignment is in a one-way street, such that the guideway is at one side next to the sidewalk. There would be an island platform with this scheme. (Volume II, Figure 6.)

Aerial Station in Median (Figure 4.5). This prototype is the more typical aerial station with the guideway in the street median, and side platforms. (Volume II, Figure 8.)

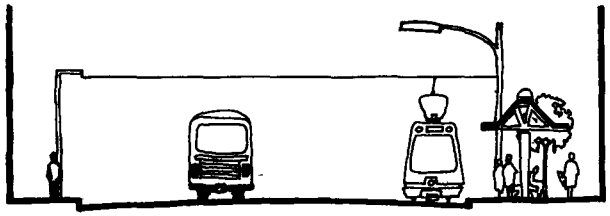
Subway Station (Figure 4.6). This prototype would occur in the Los Angeles CBD along Flower Street. There would be side platforms with escalators and stairs for vertical circulation. In addition, an elevator would be provided for use by handicapped passengers. (Volume II, Figure 7.)



PLAN

0 10 25 50

NORTH



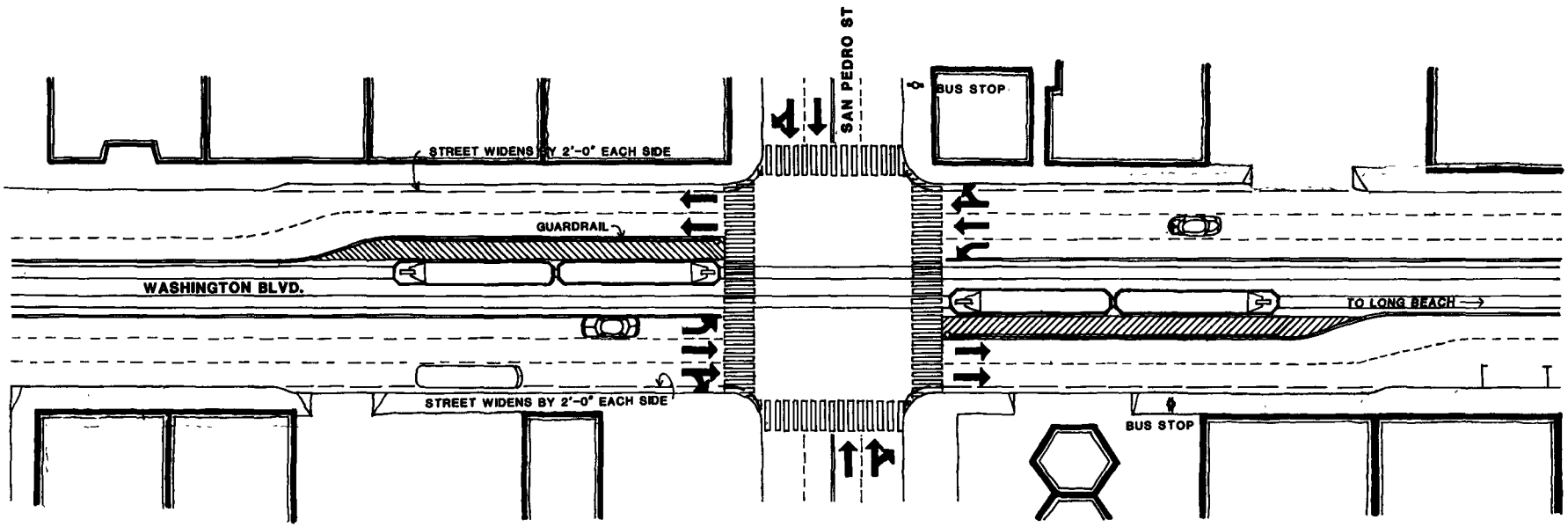
SECTION

0 4 10 20

STATION CONCEPT

Figure No. 4.1

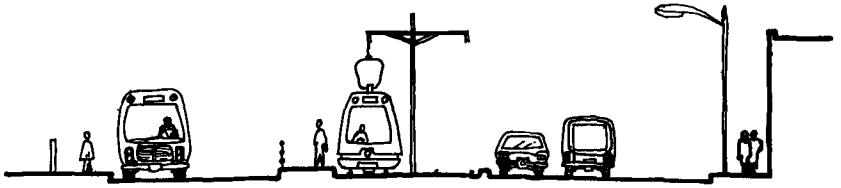
Atlantic Avenue at Pacific Coast Hwy
At Grade In Downtown Long Beach



PLAN

0 10 25 50

NORTH

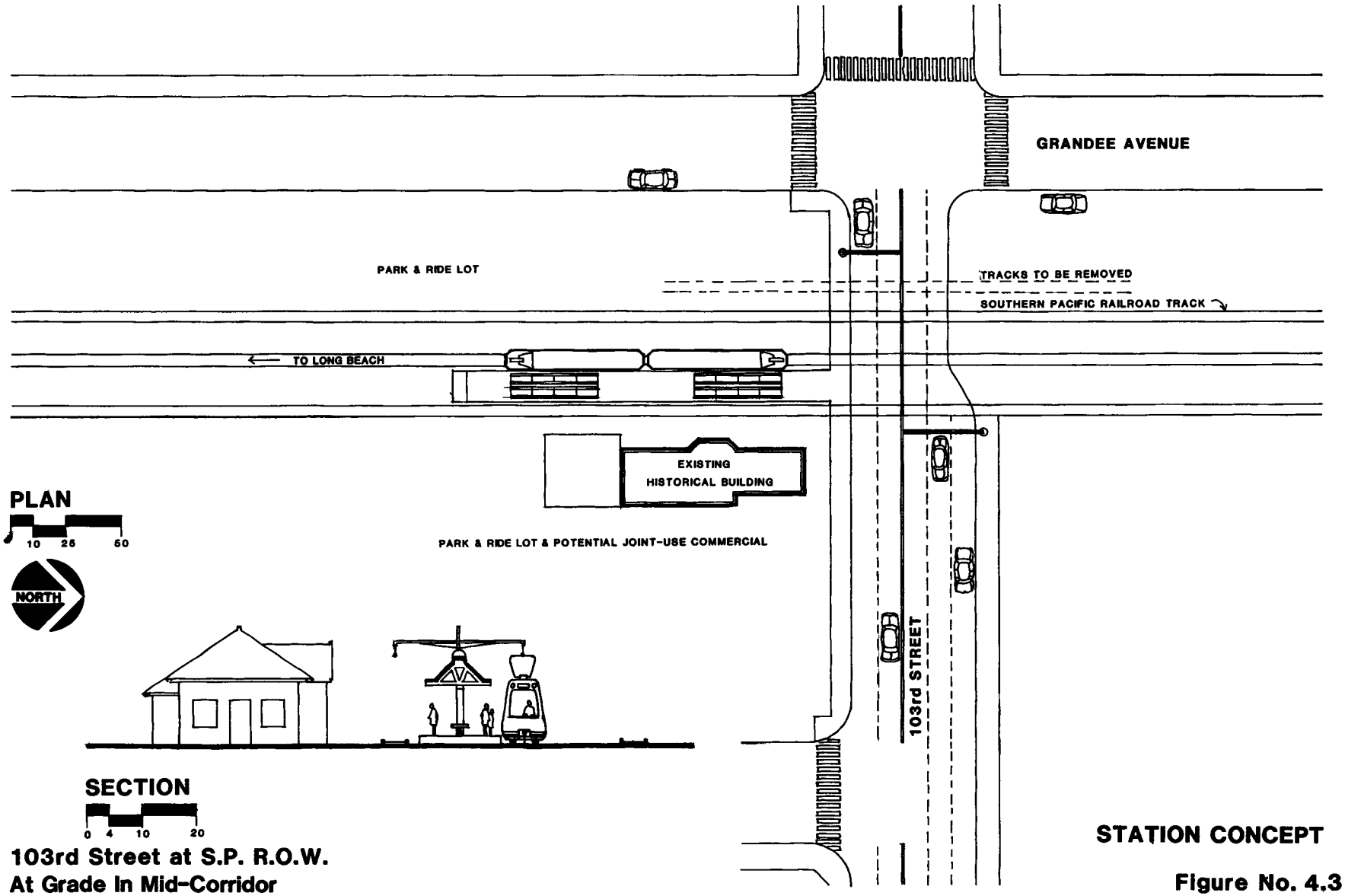


SECTION

0 4 10 20

Washington Blvd. at San Pedro St
At Grade In Downtown Los Angeles

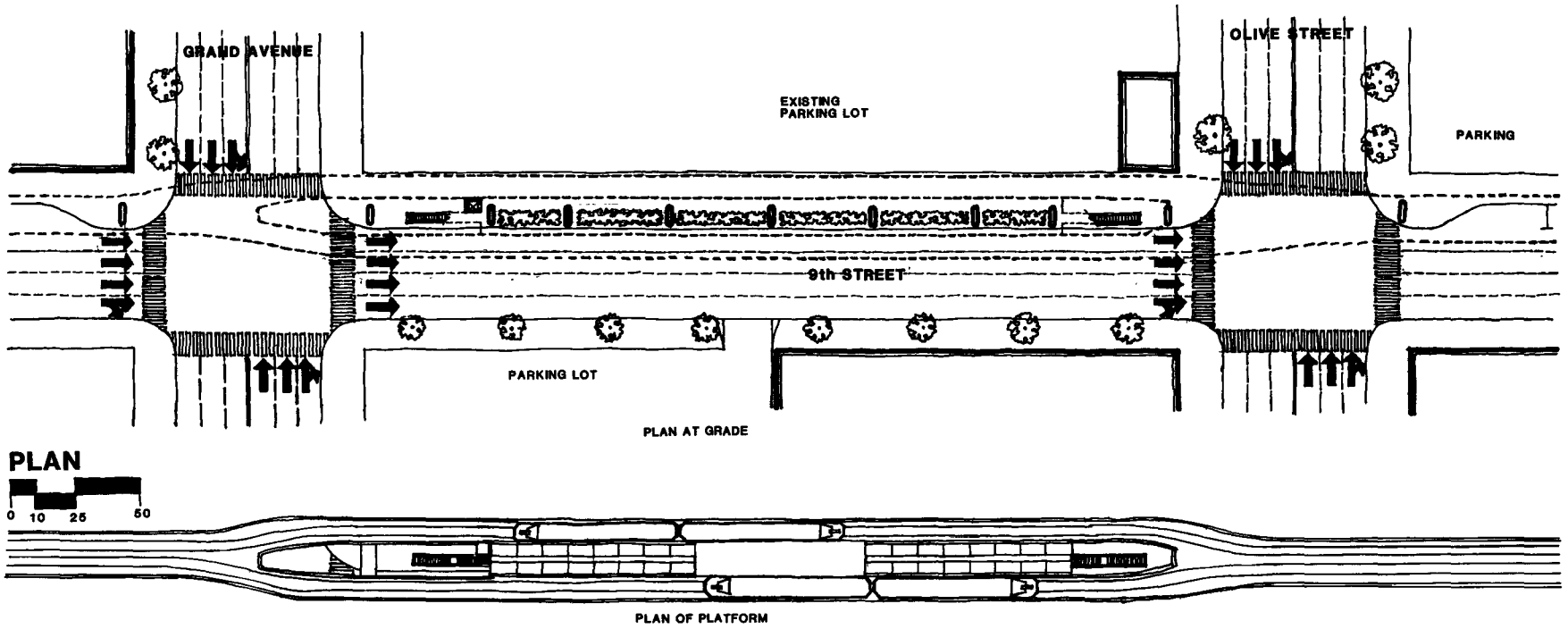
STATION CONCEPT
Figure No. 4.2



103rd Street at S.P. R.O.W.
At Grade In Mid-Corridor

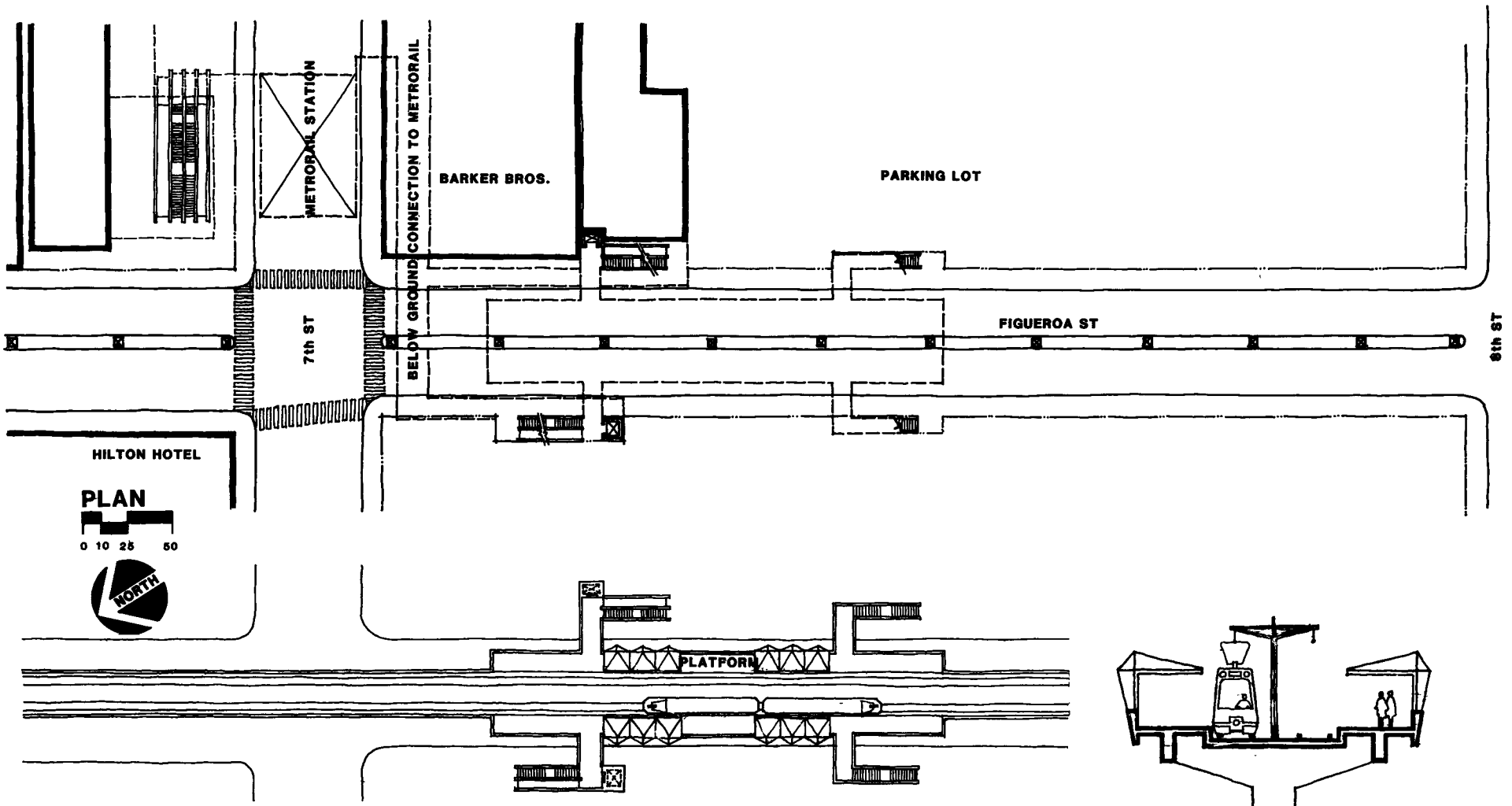
STATION CONCEPT

Figure No. 4.3



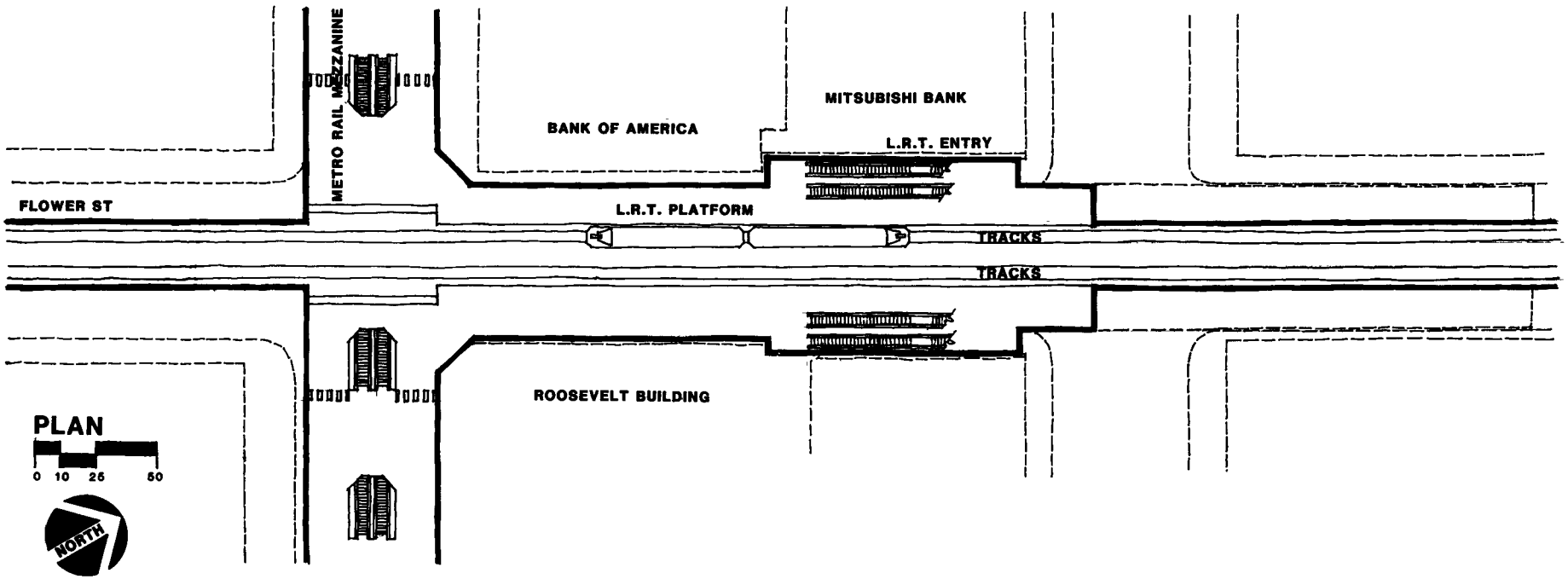
9th Street at Olive Street
Aerial At Sidewalk In Downtown Los Angeles

Figure No. 4.4



Figueroa Street At 7th Street
Aerial Station In Downtown Los Angeles

STATION CONCEPT
Figure No. 4.5



Flower Street At 7th Street
Below Grade In Downtown Los Angeles

STATION CONCEPT

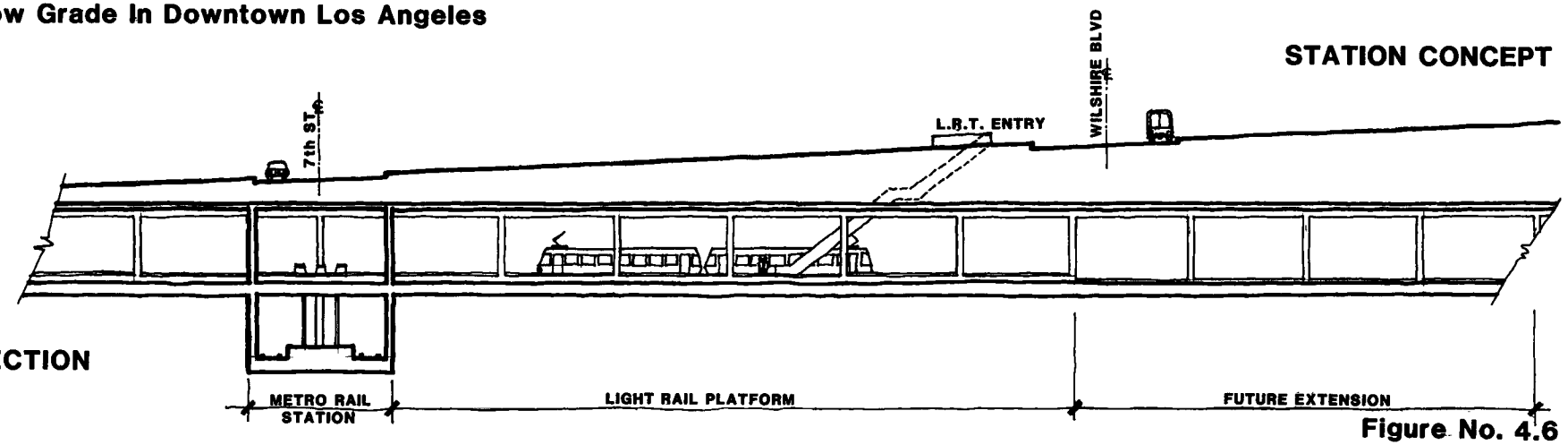


Figure No. 4.6

5.0 SYSTEM OPERATIONS

Work to establish future system patronage (ridership) level, develop an operations plan for linehaul service, and integrate the linehaul operation with a feeder, or complementary, bus system is in progress at the time of this writing. This section provides a brief summary of findings to date and outlines future work to be accomplished.

5.1 PATRONAGE

Two estimates of Long Beach-Los Angeles corridor patronage have been prepared for prior feasibility studies. A figure of 21,000 average daily boardings was estimated as part of the Los Angeles to Long Beach Light Rail Project (Working Paper No.7, "Investigation of Potential Ridership," Parsons Brinckerhoff Quade & Douglas, Inc., and Kaiser Engineers, February 2, 1982). This figure represented approximately 17,900 riders transferred from parallel bus service, and an additional 3,100 new trips induced by the rail system, and is not considered representative of the more frequent, and shorter travel time rail system now in development for this corridor.

The Southern California Association of Governments (SCAG) prepared an estimate for the Baseline System in December, 1982. At that time, 27,800 daily riders were forecast, based on the assumed implementation of the full Year 2000 Regional Transportation Program (RTP) as defined in 1980. Subsequent modifications to the RTP significantly increased the ridership estimates, and showed system patronage to be quite sensitive to the effects of other corridor projects.

Formal patronage modeling for the Baseline System (described in the Executive Summary and Introduction of this report) has been started by SCAG and is scheduled to be completed in late 1983. When completed, a conceptual operations plan for the Baseline System will be developed based on a variety of projected demand measures, including:

- Corridor Ridership - average daily and peak hour boardings.
- Regional Mode Spilt

- Corridor Mode Split
- Station Access Mode Split
- "On" and "Off" Station Volumes

Background travel figures will be supplied for the current year, for a future (design) year without the project, and for the same year with the project. In addition to the Baseline Alternative, estimates will be prepared for seven "build" alternatives, including the linehaul bus alternative, for comparison purposes.

5.2 PRELIMINARY SYSTEM OPERATING CHARACTERISTICS

Under the assumed Year 2000 average daily ridership of 27,800 presented in Section 5.1 of this report, it is expected that two-car trains will run approximately every 12 to 15 minutes during normal service hours. With a peak-hour patronage estimate of 12 percent of the daily total (3,340 riders), six-minute interval service will be required during the AM and PM commuting periods. It is anticipated that reduced service (15 to 20 minute intervals) will be offered at night, and on holidays and weekends. At full operation the system will provide service 20 hours a day, 365 days a year.

As patronage estimates and the physical characteristics of the proposed system are refined, a conceptual operations plan will be developed, including such items as: peak and off-peak headways (length of time between trains); car capacities and loading standards; number of cars per train; night, holiday, and weekend service; running speeds; crew requirements; operating hours; fleet sizes; and annual vehicle-miles and vehicle-hours.

5.3 COMPLEMENTARY BUS NETWORK

The development of a complementary bus network supporting each of the rail alternatives for the Long Beach to Los Angeles Light Rail Transit Project will play a key role in the effectiveness and success of the new rail facility. An intent in providing a new rail transit operation will be to increase the operating efficiency of the total system (bus and rail) by re-orienting existng bus lines to collect and distribute riders to and from rail stations, while eliminating bus routes which parallel the rail transit alignment. Overall bus miles per passenger will decrease, while more riders will be served due to the attractiveness of the rail facility.

A key concern will be to avoid disruption of large numbers of bus riders whose travel requirements are not conveniently served by the new rail system.

5.3.1 Methodology

Development of the complementary bus services plan for the new rail system involved (1) the review of existing bus services of the SCRTD and Long Beach Transit; (2) study of service objectives and constraints of the affected transit agencies; and (3) the provision of service to achieve maximum ridership and convenience in travel to the user. Proposed service modifications were revised and modified based on discussions and comments from the affected transit agencies.

Frequency modifications of the existing bus lines which intersect the proposed rail transit stations were determined based on preliminary analysis of patronage and existing capacity/load factors. Bus lines currently operating at or above capacity near the rail transit alignment would have service increased to facilitate added feeder bus demand. Lines operating below capacity would require no change in frequency to facilitate the additional feeder service demand. Intersecting (east-west) routes in the Mid-Corridor segment which did not directly serve a LRT station were rerouted to a nearby station to provide additional bus connections to the rail transit system.

5.3.2 Existing Route Modifications

Few modifications will be necessary for bus routes operating in the rail transit corridor. The distribution of existing local bus services operating in downtown Long Beach and Los Angeles are such that most local lines will either provide direct access to a rail transit station or operate within close proximity of a station. In the Mid-Corridor section, major east-west lines will intersect the rail transit right-of-way providing potential transfer points at the proposed rail transit stations.

To accommodate feeder bus requirements, the supporting bus plan will entail a few route modifications to the basic bus route network in order to achieve convenient bus-rail transfer points. Supplemental bus service will be operated over bus routes which directly connect to rail stations or rerouted to connect to

rail stations, scheduled on a demand basis to handle projected feeder bus ridership passenger loads. A feeder bus system completely separate from the areawide network of local and express buses is not proposed.

Proposed bus route and frequency modifications for local and express services are summarized below for each of the rail transit alternatives in the Los Angeles, Mid-Corridor and Long Beach segments. Detailed information regarding the proposed changes can be obtained in the memorandum titled "Design of Complementary Bus Network" (Task 7.7), dated August 24, 1983.

Los Angeles

Broadway/Spring Couplet Alternative (LA-1)

- RTD Lines 55 and 56 - change service frequencies during peak periods.

Flower Street Subway and Olympic/Ninth Aerial Alternatives (LA-2, LA-3)

- No bus route modifications for local and express services are proposed for these alternatives.

Mid-Corridor (all alternatives)

- RTD Lines 55, 56, 105, 115, and 117 and LBTC Line 15 - change service frequencies during peak periods.
- RTD Lines 107, 110, 119, 125, and 457 - reroute to or terminate at nearest LRT station during peak periods.
- RTD Lines 358, 360, and 456 - eliminate service.

Long Beach

Atlantic Two-Way, Pacific Avenue Loop, and Atlantic/Long Beach Couplet Alternatives (LB-1, LB-2, LB-4)

- LBTC Lines 5, 8, 15 and 16 - change service frequencies during peak periods.

- LBTC Lines 16 and RTD Line 457 - terminate service at Del Amo Station.

- RTD Lines 360 and 456 - eliminate service.

River Route Alternative (LB-3)

- LBTC Lines 8, 9, 15, 16 and 17 - change service frequencies during peak periods.

- LBTC Lines 16 and RTD Line 457 - terminate service at Del Amo Station.

- RTD Lines 360 and 456 - eliminate service.

Bus Alternative

A supporting bus network to complement the Long Beach to Los Angeles Bus Alternative was also developed. The proposed bus route modifications for local and express services are summarized below:

- RTD Lines 55, 56, 60, 119, 360, 456 and 457 - change service frequencies during peak periods.

- RTD Line 119 - extend service during peak hours south on Atlantic Avenue to terminate on Alondra.

- RTD Line 358 - eliminate service.

6.0 VEHICULAR TRAFFIC

6.1 DESIGN ISSUES

The Long Beach-Los Angeles rail transit alternative alignments have segments which are within existing roadway sections in Los Angeles and Long Beach CBD's, and within the SPTC right-of-way in the Mid-Corridor. As such, they raise several design issues concerning impact of rail transit operations on traffic circulation, roadway capacity, parking and loading, and traffic safety. To address the design issues and identify mitigation measures for areas with unacceptable design conditions, a traffic impact analysis was conducted for the study area.

The study area incorporates four jurisdictions including the City of Los Angeles, County of Los Angeles, City of Compton and City of Long Beach. The methodology and findings of the traffic impact analysis were discussed with each of the involved agencies in an effort to resolve issues prior to the formulation of this report, and coordination for this traffic impact analysis is being maintained with key representatives of each of the affected agencies.

6.2 DOWNTOWN LOS ANGELES

The Broadway/Spring Couplet at-grade alternative (LA-1) at the Washington Boulevard section of the Los Angeles CBD area will utilize an at-grade dedicated median to facilitate the rail transit operation (see Figure 3.1). Two parallel tracks will service the east and west bound rail transit operations, and utilize the "far side" passenger loading concept at intersections in an attempt to reduce intersection delays and conflicts with the existing vehicular traffic.

Normal signal operations with minor adjustment in relocating some signal furniture should satisfactorily facilitate the rail transit, pedestrian and vehicular operations along this section of the downtown area.

The Broadway segment to the Broadway/Spring Street couplet will service the southbound rail transit operations in the downtown area, utilizing a curbside vehicular lane at the passenger loading and unloading stations. This narrowed

street width within the station block areas will require normal vehicular traffic to share the right-of-way with the rail transit operations. This may increase the potential of rail transit/auto conflicts and cause delay to both train and vehicular movements. Conflicts between the rail transit, pedestrian and vehicular movements could occur at the terminus to this southbound segment at Washington Boulevard.

Spring Street, the northbound segment to the Broadway/Spring Street Couplet, shall service the northbound operations within the existing transit contra-flow lane along the east curb line. Although no additional conflicts between auto and rail transit are expected (over and above any existing transit to auto conflicts) the major impacts will surface in the form of conflicting movements and increased delays to both existing bus transit and the new rail operations at common bus and rail transit stops.

Traffic impacts with respect to the Downtown Aerial Alternative (LA-3) should be minimal; however, specific consideration concurrent with the structural design of the facilities should address not only the necessary traffic control planning during construction but also any visual obstructions to the motorist caused by the support columns to the rail transit platform at the completion of construction. The support columns may narrow the existing surface street travel lanes and consequently increase the potential for pedestrian/auto conflict conditions.

Specific traffic impacts relative to the Subway Alternative (LA-2) should not impact the existing traffic operation other than during construction where specific traffic control operation must be addressed. An analysis of the traffic impact of placing a subway portal on Flower Street indicates that the block between 11th and 12th Streets is the most northerly feasible location north of Pico Boulevard. Traffic flow will not be unduly affected by a portal in that location.

6.3 MID-CORRIDOR

The Mid-Corridor segments of the rail transit alignment traverses the SPTC right-of-way between Washington Boulevard in the City of Los Angeles and Willow Street in the City of Long Beach. A traffic study was conducted to determine whether the 18 specific intersection locations on major east-west streets (identified in Figure 6.1) can accommodate the rail transit operations in the year 2000 without

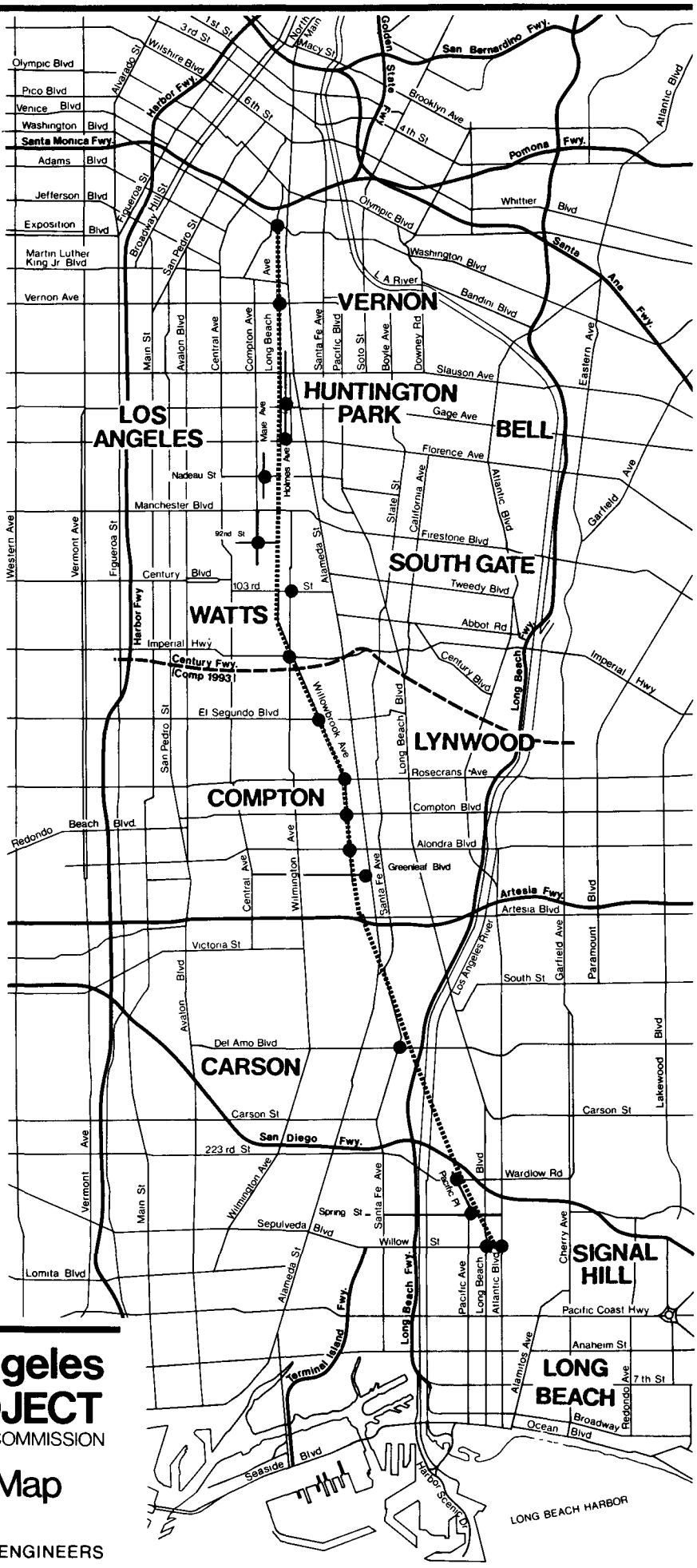


Fig. 6.1

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Traffic Impact Location Map

PARSONS BRINCKERHOFF / KAISER ENGINEERS

significant disruptions or delays to the vehicular traffic crossing the rail transit tracks. Solutions were identified for those intersections unable to handle the added impacts due to rail transit operations. (A full discussion of traffic impacts in the Mid-Corridor segment of the Long Beach-Los Angeles Rail Transit Project is presented in a memorandum titled "Analysis of Traffic Impacts at Grade Crossings, Mid-Corridor," dated September 9, 1983.)

In the study, each intersection was analyzed to determine the acceptability of particular characteristics, including length of traffic signal cycle time, roadway geometry, and resulting auto queue length. Further, volume-to-capacity ratios were calculated for the Year 2000, with and without the rail transit project. This was done with and without assumptions of total signal preemption by passing transit cars. The volume-to-capacity ratios generally assumed 1 percent annual traffic growth, and the "no build" case assumed no changes in existing physical conditions.

The results of this analysis indicate that, with the project, all intersections will operate at acceptable levels of service, with the exceptions of Del Amo Boulevard at Santa Fe Avenue and Long Beach Boulevard at Willow Street which will have unacceptable service levels. (Changes in lane configurations at these two intersections were then assumed to bring them up to acceptable service levels.) The analysis also indicates that, without signal preemption, a 90-second signal cycle time at all intersections will be necessary to allow a sufficient "window" for transit train movements across intersections (which require only ten seconds of the 90-second cycle to complete).

Rail Transit Operations. The effect on queueing of operating rail transit service at 6-minute headways in each direction during year 2000 peak hour conditions was analyzed. The analysis was based on the proposed 90-second cycle length and assumed that freight traffic did not operate during peak hours. The resulting numbers of vehicles per lane in queue ranged from 6 to 15. Based on each intersection projected volume/capacity ratios, the time to dissipate each queue length ranged from 1.5 to 3 minutes. Since these queues usually would be able to clear before the next transit trains arrival, transit crossings usually would not impact traffic on the adjacent streets and would not delay crossing traffic for more than 2 cycles.

Traffic Signal Program for the Rail Transit System. A concept was developed to establish a north-south progression for transit service with respect to the north-south signal phases for key intersections in the corridor. In order to maintain the progression for transit trains, all designated intersections within the affected areas of the city and county of Los Angeles and the cities of Compton and Long Beach would need to be synchronized to one reference time; otherwise, as each intersection serviced the specific traffic demand at that location, an interruption in the progression could occur as early as three complete cycle lengths.

Minor delays to transit vehicles would occur at the following intersections, primarily because of the attempt to average the progression continuously over the approximate 16-mile Mid-Corridor segment:

- Vernon Avenue - once every five cycles the LRV will approach Vernon Avenue at the wrong phase for its northbound progression.

- El Segundo Boulevard - once every five cycles the LRV will experience minor delays of approximately 10 seconds in both directions.

- Rosecrans Avenue - once every five cycles the LRV will approach Rosecrans Avenue at the wrong phase for its southbound progression.

- Compton Boulevard - once every five cycles the LRV will experience minor delays of approximately 10 seconds in both directions.

- Wardlow Road - once every five cycles the LRV will experience minor delays of approximately 10 seconds in both directions.

- Spring Street - once every other cycle at five cycle intervals the LRV will be delayed approximately 25 seconds in the northbound direction.

- Willow Street - once every five cycles the LRV will approach Willow Street at the wrong phase for its northbound progression.

Five intersections were identified where transit vehicles would "wait their turn" with auto traffic. These are: Florence Street, Imperial Boulevard, Greenleaf

Avenue, Del Amo Boulevard, and Willow Street. Under this assumption, it appears that average speeds are as follows:

- Washington Boulevard to 103rd Street - 35 mph
- 103rd Street to Compton Avenue - 42 mph
- Compton Boulevard to Wardlow Road - 35 mph
- Wardlow Road to Willow Street - 28 mph.

Freight Operations. To determine the feasibility of operating freight trains during the peak period in the year 2000, a queue analysis was performed based on 90-second cycle lengths and projected year 2000 traffic volumes.

The queue analysis was based on the following assumptions:

- a 4,700-foot freight crosses during the peak hour;
- the freight train crossing speed is approximately 15 mph;
- existing lane configurations and signal green time for east-west movements.

Excessive queueing will occur at over half of the crossings, (queue length of over three minutes) whether or not there is rail transit service in the corridor. This condition will create continued blockages of vehicular movements on the adjacent streets, causing additional vehicular delay not directly related to the rail transit operation.

6.4 DOWNTOWN LONG BEACH

The downtown Long Beach at-grade alternatives for the rail transit operations (specifically addressing the dedicated median and the curbside lane considerations) involve similar traffic impacts as previously mentioned for the downtown Los Angeles areas.

In addition, the downtown Long Beach Alternative LB-4 (Pacific Loop) introduces conflicting movements between both the rail transit and vehicular operations (similar to Broadway and Washington Boulevard in downtown Los Angeles) and the rail transit conflicting left turn movements specifically at Ninth Street and Long Beach Boulevard and at Eighth Street and Atlantic Avenue (see Figure 3.9). Also,

a specific right-of-way assignment must be maintained at the crossover location to this alternative which would occur at the intersection of Eighth Street and Long Beach Boulevard.

Specific traffic control devices (i.e., 4-way stop or traffic signal) should be properly investigated to establish and maintain the right-of-way assignment at these locations.

7.0 SYSTEM DESIGN CONSIDERATIONS

The design of an efficient, reliable, and cost-effective rail transit system to service the Long Beach-Los Angeles Corridor will require that careful attention be given to a variety of design elements in addition to the basic considerations discussed in early sections of this report. This section discusses four key design considerations, presenting what information has been developed to this point in the study. These considerations are:

- yard and shop facilities;
- operating systems;
- streets and utilities;
- railroad freight operations.

It is anticipated that the preliminary and conceptual material provided here will be refined during the latter part of the current study.

7.1 YARD AND SHOP FACILITIES

7.1.1 Description of Facilities

Operation of the Long Beach-Los Angeles rail transit system will require a major facility for performance of scheduled and unscheduled maintenance on transit vehicles and for storage of trains when not in service. In addition to the primary facility, a second "satellite" yard is highly desirable to provide a secondary storage area (to reduce vehicle movement when not in service) and facilities for light maintenance at the opposite end of the rail line from the primary facility, thus reducing operating costs.

The facilities will be designed to provide all levels of maintenance and repair of all transit vehicles, and to serve as a base of operations for maintenance-of-way activities. Design of the primary and satellite facilities will be guided by the general considerations of system operations and maintenance efficiency, and site access geometry and topography.

In particular, the following functions will be needed at the primary yard and maintenance shop and will be housed in separate areas:

- Service and Inspection - light maintenance, routine inspection, and vehicle testing. Non-routine activities as time and space permit.

- Heavy and Component Repair - scheduled and unscheduled heavy maintenance activities, generally requiring long periods of time to perform.

- Vehicle Cleaning - interior and exterior cleaning, including undercarriage blowdown of dust and dirt.

- Wheel Truing - wheel grinding to restore profile to original contour.

- Support Shops - testing, fault diagnosis, repair and rebuilding of vehicle components, modules and assemblies.

- Maintenance-of-Way Facilities - support facilities for maintenance of track, powersystem, signals, it includes areas for maintenance vehicle repair, adminstration, mobile crew dispatch, and equipment and tool storage.

Both facility locations will have extensive security features, including high fencing and clear areas, closed-circuit television monitoring, and various intruder alarms. This will be particularly necessary for the satellite yard, which will not be staffed at all times.

7.1.2 Candidate Sites

Two candidate sites have been identified in the corridor using basic screening criteria:

- Size and topography
- accessibility to the system
- location within the system
- compatibility with adjacent land uses

The two sites are as follows (refer to Figures 7.1 and 7.2):

- Site 1. Located in the city of Los Angeles, this site is bounded by Hooper Street, Long Beach Avenue, and 16th Street. The size of the site is only 10.3 acres, sufficient only for use as a satellite yard.

- Site 2. This site (23.4 acres) is in the city of Long Beach and is bounded by the San Diego Freeway (I-405), the Los Angeles River, and the existing SPTC tracks. The land is currently used by an oil company and various oil-related installations occupy portions of the site. Site 2 is large enough to provide storage for the entire railcar fleet and can be used without a satellite yard if desired. (See Figure 7.3 for a conceptual plan.)

Several other sites have been identified as having the appropriate size or location, but have been rejected due to conflicting plans for their use, and/or potential cost.

7.1.3. Site Selection

The project team is currently investigating the availability of additional sites for acquisition and use as yard and shop facilities. Following completion of this investigation, criteria will be developed to further evaluate all remaining sites and select that site or sites which will best serve the needs of the rail transit system. The evaluation criteria will cover such items as general location, onsite and surrounding land use, geometry and topography, operational layout, room for expansion, environmental impacts, interaction with other SCRTD operations, and cost.

7.2 OPERATING SYSTEMS

Successful operation of the rail transit system will require design of efficient, flexible, and cost-effective systems for various functions. Design considerations preliminary concepts, and criteria are now discussed for: electrification, signaling and communications, safety, security, and fare collection.

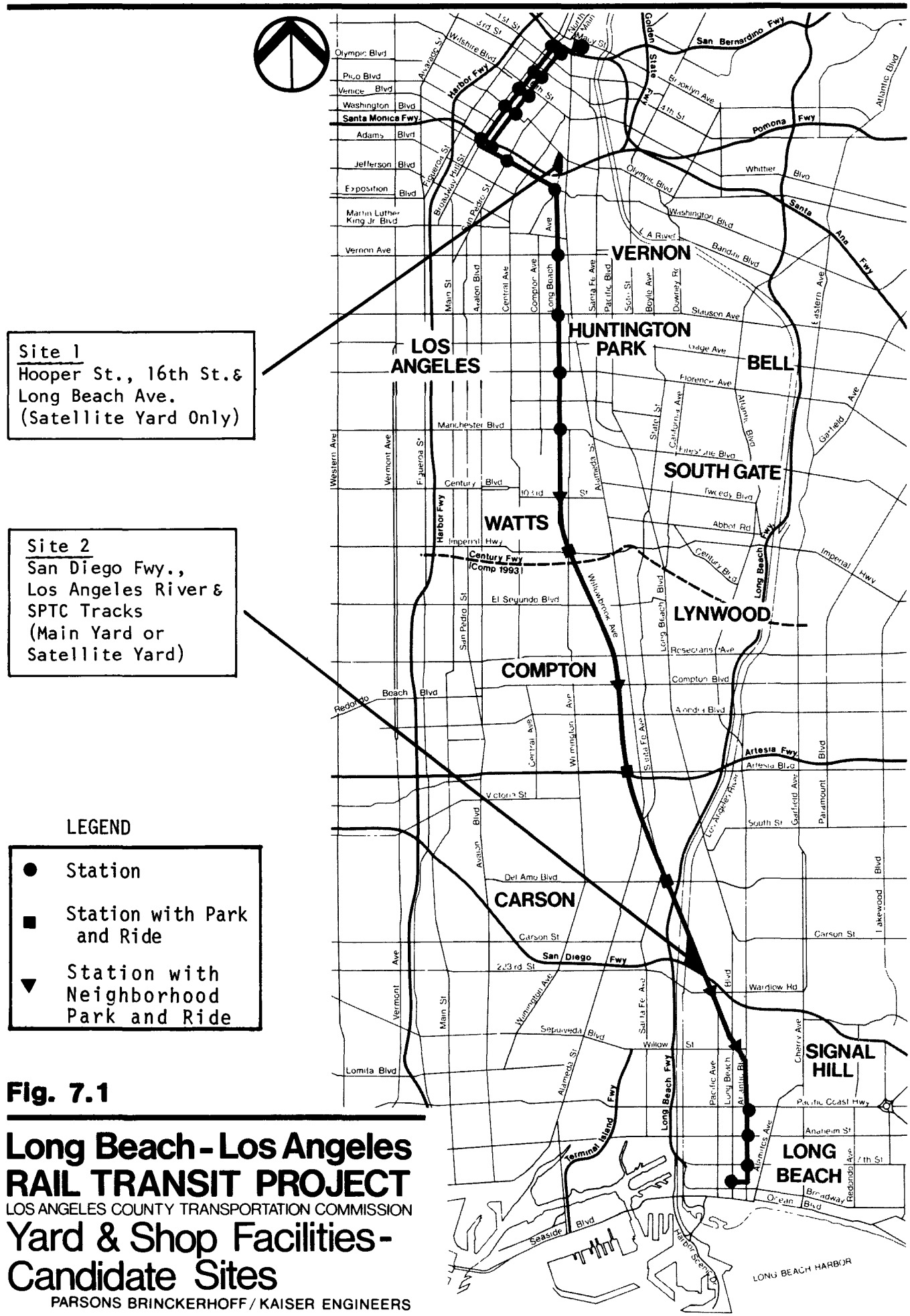


Fig. 7.1

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Yard & Shop Facilities - Candidate Sites

PARSONS BRINCKERHOFF / KAISER ENGINEERS

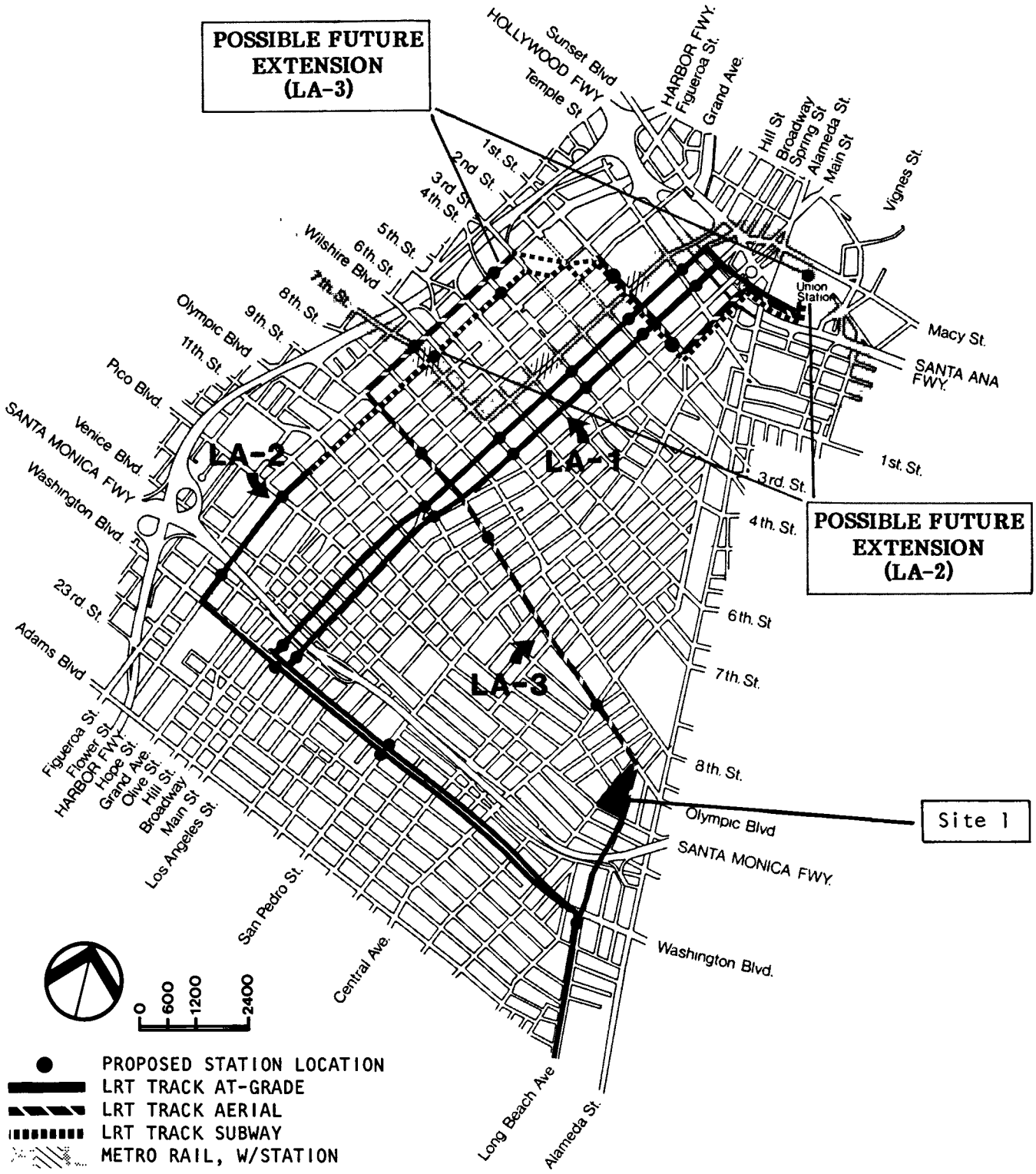


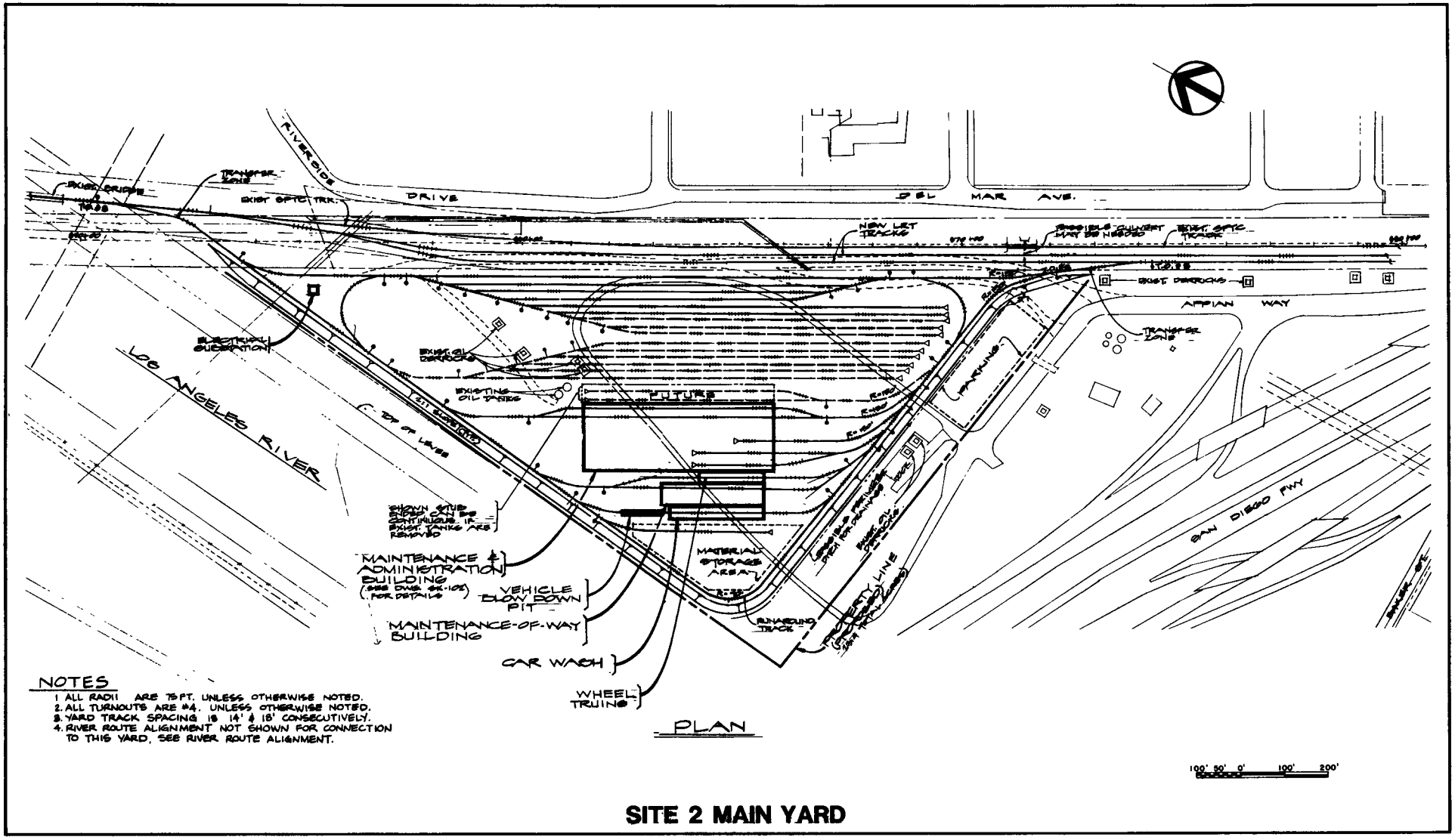
Fig. 7.2

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Yard & Shop Facilities Los Angeles Locations

PARSONS BRINCKERHOFF / KAISER ENGINEERS



SITE 2 MAIN YARD

Long Beach - Los Angeles RAIL TRANSIT PROJECT

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

Plan
Yard and Shops

Figure **7.3**

PARSONS BRINCKERHOFF/KAISER ENGINEERS

7.2.1 Electrification

The electrical system will supply the power to provide safe, efficient, and continuous operation of the transit system. It will provide power for two major types of electrical usage. The first type of use--vehicle propulsion and auxiliary systems--will be serviced by the traction power system, which will provide direct current (DC) propulsion power to each vehicle and low-voltage (AC) power to other onboard electrical systems, such as lighting, control, communications, and ventilation. The second use will be the power required to operate the passenger stations and the maintenance facility.

Power will be supplied directly by the city of Los Angeles Department of Water and Power and the Southern California Edison Company. Equipment housed in approximately 18 traction power substations along the route will transform and convert the high-voltage AC power provided by the utility companies into power suitable for operation of the system. An overhead distribution system will collect power from the traction power substations and deliver it to the vehicles. The elements that comprise the overhead distribution system are the catenary system, the power feeder cables, and the poles that support them.

In the downtown areas, a single-contact-wire type of catenary will be used. It is suitable for speeds of up to 35 mph and can be supported by crossarms or crosspans that are attached to poles on both sides of the tracks. The feeder cables will be underground and will be concealed inside the hollow galvanized steel poles that support the contact wire.

In the Mid-Corridor section a simple catenary system will be used, suitable for speeds of up to 70 mph. It consists of a contact wire suspended from a messenger wire by means of hangers spaced about 30 feet apart. The feeder cables will be carried on top of the poles, permitting the use of wide-flange poles, which are stronger and easier to maintain than the hollow poles used in downtown areas.

Several design features will help ensure a high degree of service reliability during both normal and abnormal operating conditions. Each traction power substation will have two primary service feeders from the utility companies, and each catenary section will be fed simultaneously from two traction power substations. The

overhead power distribution system will also be sectionalized to allow power to be removed from track zones for maintenance and emergency purposes, and for possible future expansion.

7.2.2 Signaling and Communications

The control center will be the focal point of system operations and security functions. It will be unified with the Metro Rail system control center and will be operated by the Southern California Rapid Transit District. It will contain controls, consoles, communications equipment, and operating personnel, and may contain display boards that indicate train positions, route alignments, electrification status, and appropriate supervisory indicators. The computer, the alarm monitoring system, emergency controls, and the digital data transmission center will also be located at the control center.

The signaling system will consist of the equipment, operations, personnel, and procedures necessary to control and monitor vehicle operation to maximize the safe movement of trains and to enhance train operation. This will include controlling track switching arrangements, protecting highway crossings, controlling bi-directional train operation on single-track sections and controlling the separation of trains operating on normal double-track sections. The type and amount of signaling necessary for a given track section will be determined by the specific requirements for that section.

The train operator will have the primary responsibility for train protection functions in mixed traffic. The detection of vehicles in mixed traffic, if provided, will be accomplished by presence detectors, which may preempt traffic signals. The presence detection circuits will be the only track circuits in downtown at-grade sections and will be used to convey train location to the control center.

A block detection system may be used in the Mid-Corridor section and will be evaluated at the end of the current engineering phase. The tracks would be divided into blocks, with the block length determined by the average speed of trains for that section, the number of trains being projected, and the grade or curve of the track. Stop signals would indicate the presence of a train in the next block and would be enforced automatically.

All road crossings will have automatic gate protection. A fence and curb will be provided for the sections between road crossings, and major railroad crossings will be grade-separated, with other crossings having either manual or automatic protection.

The communications system will provide the means for exchange of information among passengers; train operators; and security, emergency, control center, administrative, and maintenance personnel. It will include radio, telephone, public address, closed circuit television, cable transmission, and digital data transmission. Specifically:

- Four separate radio channels will be used for voice communications for vehicle, maintenance, security, and emergency operations.

- Three types of telephone service will be provided: adminstrative, maintenance, and emergency.

- A public address system will be located at selected passenger stations and at maintenance facilties and will permit announcements to be made from the control center.

- A closed circuit television system will allow control center personnel to view selected portions of passenger stations, platforms, fare collection equipment, and the maintenance facility.

- The digital transmission system will provide full exchange of data between the control center and the remote stations. It will transmit controls from the control center and receive status and alarms at the control center from the traction power and ventilation systems and from the mechanical equipment. It will also receive fire and intrusion alarm signals.

The cable transmission system will be the backbone of the communications system and will provide signal paths for the other communication systems. All communication signals will be transmitted by light waves over optical fiber cables, which are much smaller than paired copper or coaxial cables. Using such a system, it should be possible to combine the operations communications cable system with the security cable system.

7.2.3 Safety

Passenger and personnel safety will be of paramount importance in system design and operation. All dynamic system elements will be designed to be fail-safe--that is, the system will revert to a safe condition whenever a single failure or a reasonably likely combination of undesirable events could result in critical hazard. Facilities and procedures will be provided to permit the safe, timely, and unsupervised evacuation of passengers and personnel from all fixed structures. In general, vehicle evacuation due to conditions that do not pose an immediate threat to the health, safety, and security of the patrons or staff will be accomplished only under the supervision of emergency forces or system personnel. However, design features, equipment, and instructions will be provided to allow unsupervised vehicle evacuation in emergency conditions.

7.2.4 Security

The security of passengers, employees, and the general public will be a primary consideration in the design and operation of the system; high levels of perceived as well as actual security will be provided. Enforcement will be the responsibility of both the transit police (SCRTD police) and the law enforcement organizations of the communities through which the system will operate. Although the security program will continue to evolve through future design stages, the following paragraphs present a conceptualization of a typical security plan.

- Stations will feature as much open space as possible and will be well-lighted, especially at fare machines and exit routes. All stations will have at least one closed circuit television camera (CCTV), which will be monitored at the control center. Traction power substations will be equipped with intrusion detection alarms.

- The maintenance facilities will have intrusion detection alarms and CCTV and will be enclosed in security fencing with a 20-foot clear zone on each side of the fence. To deter the dropping or throwing of objects at passing trains, fencing will also be provided along all at-grade sections of exclusive rights-of-way and on all structures that pass over or are adjacent to and higher than the tracks.

- The vehicle windows will be made of impact-resistant, hard-surfaced material to afford protection to passengers without presenting unacceptable hazards in case of fire.

- Seating and interior finish materials will be vandal-resistant. Silent alarms will be provided between the vehicle operator and the control center. Windows at both ends of each vehicle will provide visibility between the cars that make up a train.

Inspectors and armed transit police will ride the trains, and transit police will be available to be stationed at potential high-crime locations throughout the system. Monitor screens for the CCTV cameras will be staffed 24 hours a day at the control center, and control center personnel will report any security violations to appropriate local and transit police for rapid response.

7.2.5 Fare Collection

Alternative methods for setting and collecting fares on the proposed rail transit system were explored for the current project in a working paper on the subject completed in March, 1983. In that study, goals and standards were established, evaluation criteria were defined, methods used at other systems were examined, and a variety of approaches for the Long Beach-Los Angeles system were defined and evaluated. The following generic options for fare collection were addressed:

- Full Barrier - entry and exit fully controlled.
- Entry Barrier - control at point of entry only.
- Vehicle Collection - all collections made on vehicles.
- Bus Barrier/No Rail Barrier - collection at bus boardings, but not at rail boardings.
- No Barrier - a self service system, with fare inspectors.

A variety of fare systems were explored, including flat system-wide fares, fare zones, and point-to-point fares. As the SCRTD would be the system operator, intermodal transfers (between light rail, heavy rail, and bus) special users, and peak/off-peak systems were also considered. Evaluation criteria were developed which addressed the general areas of: equipment requirements, degrees and

complexity of interaction with the public, interface requirements with other modes, and cost.

Major findings of the fare collection study were:

- Due to design requirements in downtown segments of the corridor, the full barrier system should be eliminated as an option.

- The presence of a number of center-platform stations would make use of conventional fareboxes on-board the vehicles difficult if not impossible.

- Provision of transfers to and from the Metro Rail system would require the use of magnetically-encoded tickets (necessary for passage through Metro Rail turnstiles).

- Extensive use of transit passes (exceeds 50 percent today) would simplify fare collection on the combined system of buses, light rail transit, and Metro Rail.

Based on the March 1983 investigation and continuing coordination with the SCRTD, a conceptual fare collection system may be described as follows:

- Self-service for pre-purchase of fares at light rail transit stations (except for pass-holders);

- Zone fare system (likely to have three zones);

- Fare enforcement by inspectors who would patrol trains and station areas;

- Transfers to and from Metro Rail via either: (1) issuance of magnetically-encoded tickets (for passage through Metro Rail turnstiles) by light rail transit ticket machines, and issuance of tickets by Metro Rail ticket machines good for proof-of-fare on the Long Beach-Los Angeles system, or (2) use of "transfer attendants" at the light rail transit/Metro Rail interface station, or (3) a combination of the two methods;

- The system will include provisions for peak/off-peak and regular/reduced fare categories;

- Credits or discounts will be offered for bus use to or from rail transit stations; and

- Transit passes will be used to simplify combined bus/rail transit/Metro Rail operations.

7.3 STREETS AND UTILITIES

Construction of any of the at-grade alternatives will require extensive modifications to and, in some cases total reconstruction of, city streets and the utility systems underneath them in all three corridor segments, but particularly in downtown Los Angeles and Long Beach. Both the aerial and subway alternatives in Los Angeles will have somewhat less impact--much of the subway boring will be at a level below existing utilities, while the aerial configuration will create problems only at pylon locations. However, even these alternatives will require significant amounts of street and utility work. The Compton grade-separation alternative in the Mid-Corridor segment will require major utility relocation (particularly storm and sewer mains) in the area around Compton Boulevard to accommodate the depressed rail section in that area, if that alternative is chosen.

7.3.1 Streets

City streets are generally crowned (higher at the center than at the curbs) in order to provide effective drainage during storms; the streets in downtown Los Angeles have particularly steep center-to-curb slopes. This sloped street section is incompatible with the requirements of a rail transit line, which can tolerate only minimal side-to-side sloping and very modest forward grades (no more than 6 percent).

In most locations, city streets will be rebuilt to provide the flat section required by the rail transit line. Street intersections will be modified to allow transit vehicles to cross intersections and make turns at a relatively constant grade. In those cases where transit vehicles will be operated in the outside lane adjacent to

the curb, drainage facilities will be required to keep the trackway free of runoff water that concentrates in the street gutter. Relatively less modification will be required where tracks will go down the center of a street; a small slope will be required to drain the track area. If the dedicated transit median is built on Atlantic Avenue in Long Beach, greater modifications to the street will be required, in the form of different elevations for the transit median and traffic lanes, barriers, or both. In all corridor locations, loop type traffic detectors for traffic signal systems will be modified to accommodate the rail transit system and its operation. (Further discussion of the impact of the transit system on traffic in the corridor, and ways of addressing certain problems, is provided in Section 6.0.)

7.3.2 Utilities

Virtually all utility lines in major urban areas are located beneath city streets—outer traffic and parking lanes have been popular locations for all types of utilities. Placing rail transit tracks in the streets of Los Angeles and Long Beach will require relocation of electric and telephone lines, gas mains, sewer lines, storm drains and, to a lesser extent, water mains. This will be necessary to prevent accidental damage during construction, but more importantly, to provide service access once the tracks are in place.

In general, utilities that cross the tracks perpendicularly will not require relocation or modification. Thus, minimal impact will occur in the Mid-Corridor segment. However, major relocations will be required in the vicinity of Compton Avenue in the event that Alternative MC-2 (Compton Grade-Separation) is implemented.

Utility relocation will be greatest in Los Angeles due to the greater density of utilities in that area. While the at-grade alternative (LA-1) will require the greatest amount of utility work, some relocation will be needed for the subway alternative (in station areas) and the aerial alternative (in the area of pylon footings).

Some overhead utility wires, street lights, and traffic signals will require modification and/or relocation at various points throughout the corridor.

7.4 RAILROAD FREIGHT OPERATIONS

All of the proposed rail transit alignment alternatives described in Section 3.0 will share right-of-way with freight operations of the Southern Pacific Transportation Company (SPTC) along its Wilmington and East Long Beach Branches between downtown Los Angeles and Long Beach. The transit line will join the SPTC right-of-way at Washington Boulevard in Los Angeles, and leave it at Willow Street in Long Beach. While there is sufficient room at virtually all points to accommodate the two-track rail transit system and the single-track SPTC line, several branch line junctions and industrial spur turnouts along this route will necessitate either construction of structures to grade-separate the lines, or have the two operations--one passenger and one freight--cross at-grade.

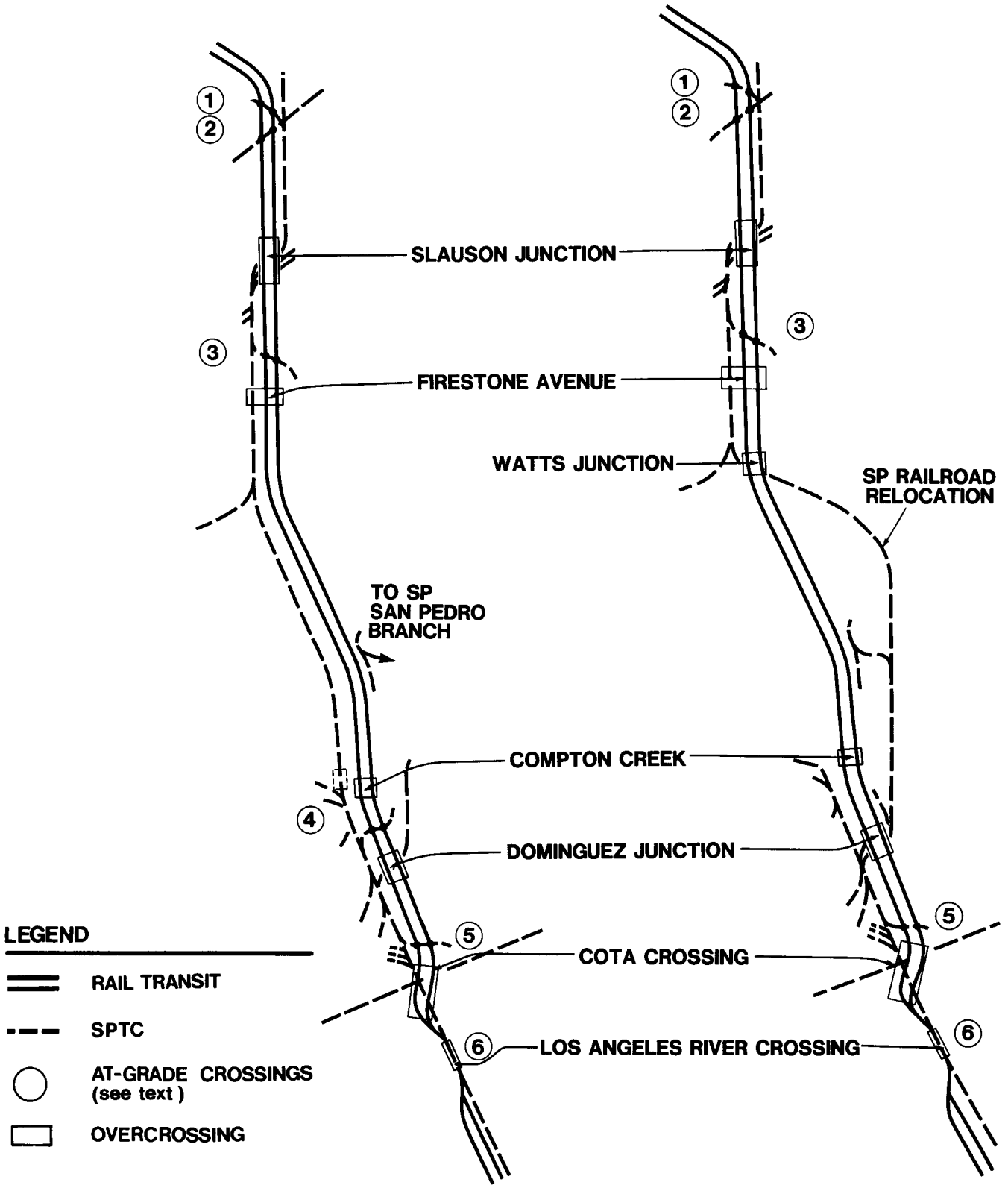
Schematic maps showing the rail transit/SPTC track configurations for the three Mid-Corridor alternatives are presented in Figure 7.4. Three grade separations are planned over rail lines where there is considerable rail freight traffic. These will be needed for all three of the Mid-Corridor alternatives:

- At Slauson Junction, the rail transit tracks will cross over the SPTC Wilmington Branch track from the west side north of that point to the east side south of that point. In addition, the transit line will cross over the AT&SF track, Slauson Avenue, and tracks of the SPTC Randolph Street "La Habra" Branch Line.

- The rail transit tracks will cross over the SPTC San Pedro Branch Line at Dominguez Junction, as well as Alameda Street and Santa Fe Avenue. The transit line will stay on the east side of the Wilmington Branch Line.

- At Cota Crossing, the rail transit tracks will cross over the UP track as well as the SPTC East Long Beach Branch track, returning to the west side of that line.

A fourth grade separation will be built at Watts Junction if Alternative MC-3 (SP Railroad Relocation) is implemented, in order to pass over the rerouted Wilmington Branch traffic.



MC-1 COMPTON AT GRADE
MC-2 COMPTON GRADE SEPARATION
MC-3 SP RAILROAD RELOCATION

Fig. 7.4

Long Beach - Los Angeles RAIL TRANSIT PROJECT
LOS ANGELES COUNTY TRANSPORTATION COMMISSION

RAIL TRANSIT/SPTC TRACK CONFIGURATION
PARSONS BRINCKERHOFF / KAISER ENGINEERS

In addition to mainline crossings in the Mid-Corridor area, there are almost twenty active spur lines serving industries located along the Wilmington and East Long Beach Branch Lines. Due to present and anticipated levels of freight rail traffic on those spurs, crossings with the rail transit tracks will be made at-grade. Figures from the Southern Pacific Transportation Company for early 1983 show approximately seven (7) round-trip boxcar train movements weekly on the Wilmington Branch, most less than twenty cars in length. Forecasts of future traffic indicate that the majority of any growth in traffic on the line will be unit trains operating between switching yards in Los Angeles and the ports of Los Angeles and Long Beach. These unit trains will not utilize the industrial service spurs, and proposed grade separations will remove all conflicts between them and rail transit operations.

Anticipated at-grade rail transit/SPTC spur crossings are listed below. The numbers are keyed to those shown in Figure 7.4.

1. Industrial spur at 22nd Street

2. Clement Junction to Santa Monica Spur

3. Cross to drill track at Nadeau Street

4. Industrial spur of Artesia Freeway

5. Industrial spur south of Del Amo Boulevard

All at-grade crossings will be protected with fail-safe interlocking signals to prevent collisions. Given the anticipated level of rail freight traffic and the average (short) length of trains using the spurs, no significant effect on the operation of either system is anticipated.

The rail transit and SPTC systems will share one other facility in the Long Beach-Los Angeles corridor—current design calls for joint operations over the single-track Los Angeles River Bridge of the East Long Beach Branch (location No. 6 in Figure 7.4). Present use of this bridge by the SPTC is approximately four trains per month, all short in length and occurring late in the evening. The SPTC is now

planning to abandon the line south from Cota Crossing, leaving exclusive use of the bridge to the rail transit system. Until that occurs, however, rail transit operations will be protected by fail-safe signal and track interlockings, and SPTC would be asked to make their infrequent freight movements late at night as at present, without appreciable disruption to transit service.

Rail freight service will be maintained throughout construction of the rail transit system. "Shoo-flies," or temporary tracks, will be provided as necessary to maintain service. In the event Alternative MC-2--grade separation of the SPTC railroad and the rail transit system through Compton-- is implemented, temporary rail track relocation and/or track support structures in the area of the open cut will be required and provided as necessary.

8.0 EMPLOYMENT AND TRAINING

In conjunction with engineering development of the Long Beach-Los Angeles rail transit project, LACTC is addressing ways to ensure that affirmative action in employment will be addressed in contracts for final design and construction of the project. The Commission will particularly like businesses and residents of the Mid-Corridor communities to have full access to construction work on the project.

The policies LACTC may adopt in this area are restricted by provisions of law, labor union agreements, the specialized nature of rail transit construction, and the need to limit project costs. The Commission is currently studying provisions in this area required by the U.S. Department of Transportation for rail transit projects financed with federal assistance (the Long Beach-Los Angeles Rail Project does not involve federal funds), as well as requirements of the State of California and Los Angeles County. The following program components are being considered (none have been adopted as of this report date):

- Provisions for Affirmative Action/Equal Employment Opportunity (AA/EEO) in hiring on the part of firms bidding on contracts for final design and construction.

- Procedures for implementing Minority Business Enterprise (MBE) set-asides.

- Procedures to seek affirmative action on MBE/WBE (Woman Business Enterprises) participation in sub-contracting.

- Labor agreements to provide access to apprenticeship and trainee positions.

- A limited youth training program as an element of architectural and engineering contracts utilizing existing referral networks of area high schools.

9.0 ECONOMIC DEVELOPMENT

As the Long Beach-Los Angeles Rail Transit Project nears construction, LACTC desires that the development community (business and redevelopment agencies) become fully aware of the transportation and urban design benefits to be provided by the project, so that the project will provide maximum benefit to economic development in the service area, particularly around stations.

The Commission is in the process of defining an appropriate role to be assumed during construction of the rail project to maximize the project's potential for impact on economic development. The Commission intends to work closely with redevelopment and planning agencies throughout the project corridor, to coordinate redevelopment programs with the location and design of stations.

The Commission welcomes interest from these agencies, and developers, in consideration of the joint-development potential of station sites.