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LOS ANGELES UNION PASSENGER TERMINAL ACCESS AND ON-SITE IMPROVEMENT STUDY

LACTC

Caltrans

MARCH 20, 1991

CORDOBA CORPORATION

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LOS ANGELES UNION PASSENGER TERMINAL

ACCESS AND ON-SITE IMPROVEMENTS STUDY

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EXECUTIVE SUMMARY

The purpose of this study is to analyze existing track capacity at Union Station and its approaching routes, and to make recommendations as to the extent and need for improvements to accommodate increased passenger rail traffic. The study defines how commuter and intercity services separately and together require additional facilities and operations improvements. It is the goal of the study to plan routes into Union Station which will give passengers the most direct and speedy access possible.

Assembling rights-of-way for new construction or railroad improvements is very expensive in metropolitan areas such as Los Angeles. All improvements recommended by this study maximize the use of existing railroad and public rights-of-way to minimize land acquisition costs.

Each potential passenger train route into Union Station was examined from the station to the location where trains operate at high speed, with little interference. Vertical and horizontal track geometry as well as track junctions and connections were examined.

Railroad track and property maps were collected and analyzed to determine horizontal and vertical alignments and the location of turnouts and crossovers. Data gathered was reviewed through a limited field survey to verify accuracy. Alternative service level scenarios were modeled with a computer simulation program.

The report is organized into the following sections:

- Introduction
- Existing Conditions
- Network Alternatives and Phasing
- Operations Requirements
- Union Station Design Recommendations
- Potential Station Sites
- Equipment Storage, Servicing, and Maintenance Facilities
- Fixed Facilities Requirements

Introduction -- Chapter 1 provides background on the project, discusses the purpose and defines the approach taken in the analysis and the methods used in determining the recommendations.

Existing Conditions -- Chapter 2 details railroad conditions in the study area including track location, capacity, traffic levels, train schedules and property ownership.

Network Alternatives and Phasing -- Chapter 3 analyzes new commuter rail and expanded intercity passenger services and suggests three possible service scenarios representing start-up, intermediate and high service levels of operation.

Operations Requirements -- Chapter 4 analyzes the requirements for expanded passenger operations and makes recommendations for candidate projects to meet the needs. The projects are categorized according to system-wide, intercity and commuter high-service needs.

Union Station Design Recommendations -- Chapter 5 analyzes the design of Union Station and the trackage and makes recommendations for start-up commuter service, intermediate service and high service.

Potential Station Sites -- In Chapter 6 potential station sites were evaluated using generally accepted transportation industry criteria. Recommendations were made for business district stations, regional stations, and local stations.

Equipment Storage, Servicing and Maintenance Facilities -- Chapter 7 evaluates potential locations and configurations of the facilities required for passenger rail equipment storage, servicing, and maintenance as well as organizational questions relating to the operations of these facilities.

Fixed Facilities Requirements -- Chapter 8 describes the fixed facilities which will be required to accommodate intercity and commuter rail service to the year 2000. Estimates assume a regional system with service throughout the day during intermediate and high service operations.

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1. INTRODUCTION

1.1 BACKGROUND

When the Los Angeles Union Passenger Terminal (Union Station) opened in 1939, it primarily served as the final station for transcontinental and coastal passenger trains, which required a number of days to complete a one-way trip. Tracks leading into the station connected all major passenger railroad lines entering Los Angeles, which was and remains a national transportation hub. Since most of the trains entering Los Angeles had already been in transit for a period of days, the speed of trains into the station was not a critical concern in its design.

In the decades after World War II, rail passenger service and facilities in Los Angeles declined dramatically, while freight service increased and freight tracks and facilities were expanded all around Union Station. As a result, passenger trains entering Los Angeles today operate at high speeds for the majority of their run, only to confront a complex network of in-town tracks, through which they must slowly weave their way into Union Station. For example, trains from San Diego must negotiate around freight yards in Commerce, industrial tracks along the Los Angeles River to the west, then south into the station. Passengers in sight of their final destination move frustratingly slowly for several miles, at speeds of only ten to fifteen miles per hour.

During the time that train service was shifting in orientation from passengers to freight, the emergence of an extensive freeway system became a dominant force in urban and suburban life in Southern California. In recent years, area residents, planners, and elected officials have come to agree that traffic congestion and related air pollution emissions are among the most serious problems facing the region today. Moreover, with continuing high population growth, traffic congestion is expected to significantly worsen by the year 2000.

In response, the Los Angeles County Transportation Commission (LACTC) and transportation commissions serving the surrounding counties have begun to develop and implement a comprehensive program of transportation system improvements, which place renewed emphasis on commuter passenger rail service. Similarly, the California Department of Transportation (Caltrans) is emphasizing increased intercity passenger rail service as a primary means of transportation in the state. The efficiency and effectiveness of service and track conditions at Union Station will directly help or hinder the achievement of the goals of both these programs.

Fortunately, a rare transportation planning opportunity now exists. LACTC has purchased key Southern Pacific rights-of-way and is in negotiations with Santa Fe to acquire additional lines and/or trackage rights in major passenger transportation corridors. These rights-of-way could facilitate increased intercity passenger service and allow the inauguration of a commuter rail system in the Los Angeles Basin.

A separate study, sponsored by Riverside and Los Angeles Counties and LOSSAN, about the ATSF San Bernardino subdivision from Union Station to Fullerton, was also reviewed. The study considers possible and potential regional facilities that would have positive or negative affects on access and track capacity into Union Station. These facilities have a major impact on regional needs as well as specific Union Station access problems.

Each line segment was evaluated for track and signal systems conditions to determine its present capacity to accommodate passenger trains. Basic plans and schematic track charts were prepared to illustrate each line. Alternative routes were examined to provide optimum service flows for commuter, intercity and freight trains.

The LOSSAN I, LOSSAN II, the Consolidated Transportation Corridor, and other on-going, county-sponsored studies were consulted for information regarding track capacities, signal systems, speed of operations, system flexibility and cost of improvements. For service to Orange and Riverside Counties, operating scenarios are as defined by studies conducted in those counties.

Union Station was evaluated for its ability to receive and service trains and to provide efficient passengers flows to and from trains. The analysis of the station area was defined to include all trackage from the rail line at Mission Junction to the station. Special consideration was given to the accommodation of intercity trains, which require engine escape tracks and switcher engines. Existing train and engine service facilities were evaluated for service capacity. As this report was being prepared, LACTC was in active negotiations with SP and ATSF. Some improvements included in these negotiations may not be included in this study.

2. EXISTING CONDITIONS

2.1 INTRODUCTION

This section describes railroad conditions in the study area including track location, capacity, traffic levels, train schedules and property ownership. The discussion makes reference to percent of grade and degree of curvature of lines. These two factors play on important role in train running times, because curves present an absolute speed limitation and grades restrict the ability of a locomotive to move a train.

2.2 REGIONAL RAIL LINES

There are several options available for routes, stations and facilities on rail lines serving the Los Angeles Basin. For example, there are five railroad lines from San Bernardino to Los Angeles which could accommodate projected freight traffic and three routes for passenger train service. Freight traffic is light on lines north and west of Los Angeles and south to Orange County. Some additional trackage and signal improvements could upgrade these lines to support additional passenger and freight service. This section explores the possibilities for designing a passenger rail system on underutilized rail lines in key passenger corridors.

Figure 1 shows potential alignments for five passenger rail lines, which could provide service into Union Station. These proposed passenger lines are composed of segments of existing freight railways. This section describes the physical characteristics of all the segments of each line proposed to terminate at Union Station, as follows:

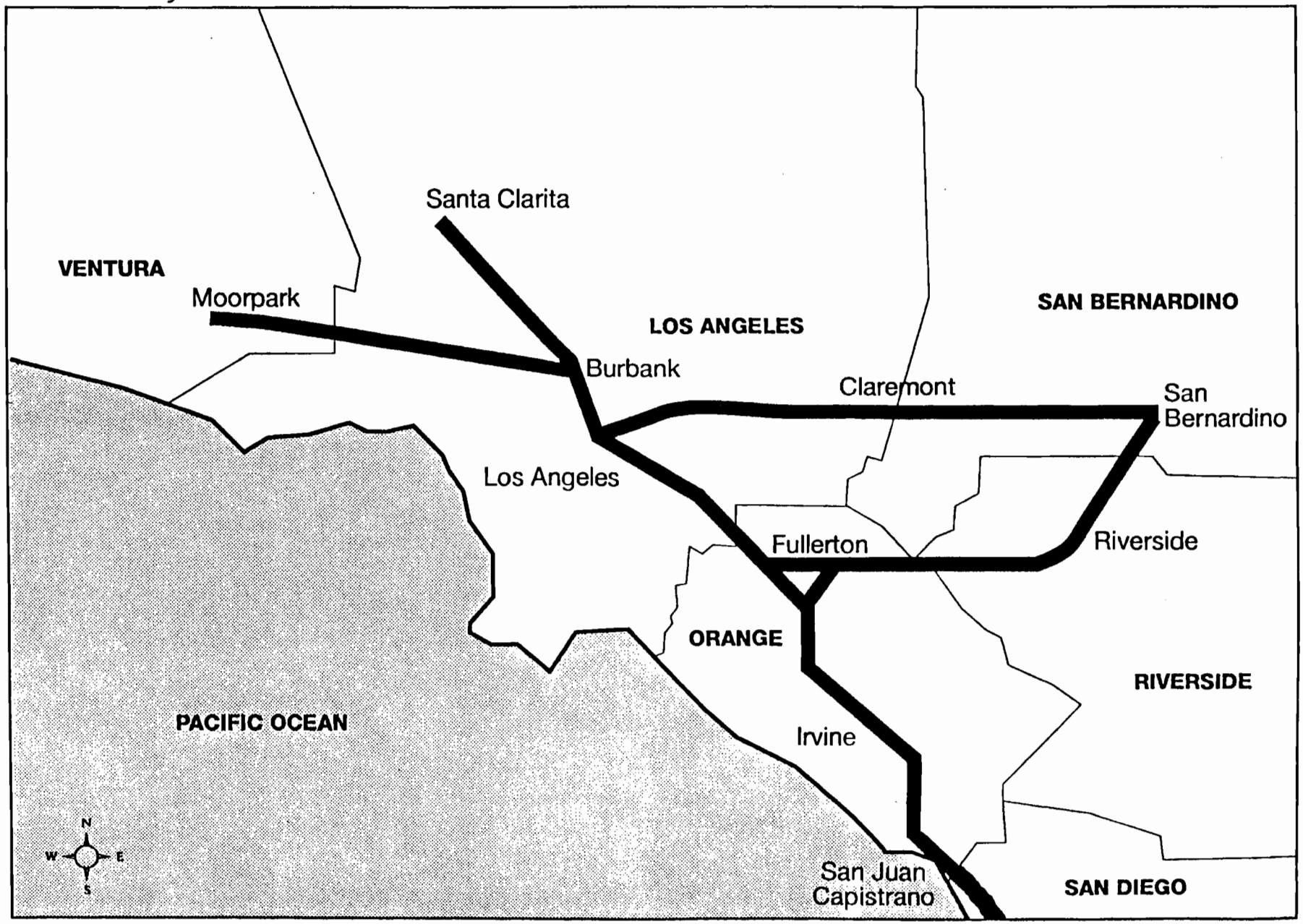
- Ventura County Line
- Santa Clarita Line
- San Bernardino Line
- Riverside Line (including Orange County service)
- Pasadena Line

2.2.1 **Ventura County Line**

The Ventura County line would use part of the Southern Pacific Coast line. The SP Coast line is the single-track main line from San Francisco to Los Angeles, the second SP line to connect those cities. The SP Coast line is double-track from Dayton Avenue Tower at the south end of Taylor Yard to Burbank Junction, approximately 9.0 miles. The main line is parallel to San Fernando Road from Taylor Yard to Burbank Junction. Taylor Yard was the SP Los Angeles terminal yard until West Colton Yard was constructed. At that time, a major portion of Taylor Yard was converted into an intermodal facility. This function was diminished when the new intermodal container transfer facility was constructed, extending approximately 2.5 miles along the Coast line, near the Ports of Long Beach and Los Angeles.

Commuter Rail Routes
in 5 County Area

FIGURE 1



At Burbank Junction the SP Coast line swings to the west leaving the SP Saugus line, which continues straight to the northwest. The SP Coast line is single-track, with passing sidings at Hewitt (0.9 miles), Gemco (2.8 miles), Northridge (1.1 miles), Chatsworth (0.8 miles), Simi Valley (1.4 miles), Moorpark (0.8 miles), Camarillo (1.0 miles), Leesdale (0.7 miles) and Oxnard (1.5 miles). Freight yards are located at Gemco and Oxnard.

In general, the SP Coast line ascends from Los Angeles to the tunnels at Santa Susana Pass. There is a sustained ascending grade of 1.15 percent for 7.0 miles from Dayton Avenue Tower to the Grand Central section of Glendale. There is an ascending 1.0 percent grade for 6.8 miles east of Northridge to the summit in the Santa Susana Pass Tunnel. In general, the grade descends from the Santa Susana Pass to Oxnard, with a sustained descending grade of 1.0 percent for 17.2 miles from the tunnel to west of Camarillo.

The SP Coast line makes wide curves from Dayton Avenue Tower to Burbank Junction. At the Junction, the SP Coast line swings to the west on a 5-degree curve, then straight for 16 miles to Chatsworth. Chatsworth is located on a 1-degree 30-minute curve, where the track swings to the north to the Santa Susana Pass. East of the Pass there are a series of 6-degree curves that carry the Coast line through 538-foot and 923-foot single-track tunnels. The final 6-degree curve ends at the entrance to the 7,369-foot summit tunnel under the Pass. The line descending westward passes through a series of 4-degree, 3-degree and lesser curves to Simi Valley. From Simi Valley to Oxnard the alignment includes many 2- and 1-degree curves, with a 4-degree curve east of Moorpark and a 3-degree curve west of Camarillo. At Oxnard there is a 3-degree curve adjacent to the yard and passenger station.

Improvements to the highway system in the San Fernando Valley, such as freeway crossings and grade separation of surface streets, have been designed and constructed to allow for the installation of a second track from Burbank Junction to Chatsworth. The tunnels through the Santa Susana Pass are single-track. From Simi Valley to Oxnard the embankment is single-track, except for passing sidings. Most of this area is level and would accommodate construction of a second track.

2.2.2 Santa Clarita line

The Santa Clarita Commuter line would use part of the Southern Pacific Saugus line. The Saugus line is a single-track, main line from Burbank Junction to Mojave. The line connects with the Palmdale cut-off at Palmdale and the ATSF at Mojave for the climb over the Tehachapi Mountains to the San Joaquin Valley. The SP Saugus line was the original SP main line from San Francisco via the San Joaquin Valley. There are passing tracks at Pacoima (0.6 miles), San Fernando (0.8 miles), Sylmar (1.2 miles) and Saugus (1.0 miles).

The SP Saugus line ascends from Burbank Junction for 1.6 miles at a 1.32 percent grade, 10 miles at 1.7 percent grade and 5 miles at 2 percent grade, to the north end of the single-track tunnel under San Fernando Pass. The line then descends on at 2.2 percent grade for 5 miles to Saugus.

The SP Saugus line makes wide curves from Burbank Junction to Sylmar, at the entrance of the San Fernando Pass. The alignment runs between the Golden State freeway and the Sierra highway in a series of curves of up to 6-degrees. After passing through a 6,976-foot, single-track tunnel, the line makes a series of curves of up to 5-degrees 38-minutes.

Improvements to the highway system in the San Fernando Valley, such as freeway crossings and grade separation of surface streets, have been designed and constructed to allow the installation of a second track from Burbank Junction to Sylmar. The San Fernando Pass Tunnel is single-track. From south of Newhall to Saugus, a distance of 4 miles, there are side tracks which could be included in a second track.

2.2.3 San Bernardino Line

The San Bernardino Commuter line could include portions of five freight line segments:

- Southern Pacific State Street Line
- Southern Pacific Main Line -- South El Monte to Bassett
- Southern Pacific Baldwin Park Branch
- ATSF Pasadena Subdivision -- La Verne to San Bernardino

This analysis assumes that rights-of-way will be negotiated with both SP and ATSF. If rights-of-way are obtained from only one of these railroads, the analysis will change.

Southern Pacific State Street Line

The SP State Street line was originally constructed as the Pacific Electric Railway main line to the San Gabriel Valley and San Bernardino. When the Pacific Electric system was dismantled, this line was acquired by Southern Pacific as a supplement for the SP main line, which is located just north of the State Street line. In 1959 the San Bernardino freeway was constructed parallel to the State Street line, absorbing much of the original right-of-way. Subsequent freeway widening and the installation of the El Monte busway in 1973 imposed additional significant changes on the original alignment.

The SP State Street line begins at Pasadena Junction, along the east bank of the Los Angeles River. The State Street line is double-track from east of Pasadena Junction to Soto Street, a distance of 1.4 miles. At Soto Street it joins a branch line which serves freight customers. The State Street line enters the center of the San Bernardino freeway at the Long Beach freeway interchange. The busway runs along either side of the single-track main line to South El Monte, follows a viaduct along the east side of Rio Hondo and connects with the main line.

Pasadena Junction connects to the Southern Pacific Transportation Center, a major trailer-on-flatcar (TOFC) facility. This site was previously the maintenance facility and locomotive and coach yard for the former SP passenger service. Nearly all of the SP domestic TOFC service to Los Angeles is now processed here.

SP State Street line grades ascend for 5 miles, then descend for 5 miles to South El Monte. These grades are substantial, with an ascending grade of 1.567 percent and 1.341 percent for 0.7 miles. There is a 1.417 percent descending grade for 0.7 miles. The grades change frequently to follow the profile of the freeway. At South El Monte the line ascends a 1.7 percent grade for 0.21 miles approaching the viaduct along Rio Hondo. The viaduct ascends 1.36 percent for 0.40 miles and 1.60 percent for 0.25 miles before a level connection to the SP main line.

At the beginning of the SP State Street line there is a 7-degree 30-minute curve, an 8-degree curve, a 7-degree 30-minute curve and a 10-degree curve, as the line passes around the TOFC yard under Mission Road to the right-of-way adjacent to the San Bernardino freeway. In the next mile, the alignment makes several curves of up to 5-degrees before reaching a 2-mile segment with a fairly wide curve. The line swings through a 4-degree 20-minute curve of 0.20 miles and a 3-degree 40-minute curve of 0.25 miles to reach the center of the freeway at the Long Beach freeway interchange. There is 3-degree curve of 0.30 miles before the line reaches a 10.5 mile segment with a few short, 1-degree curves and a 30-minute curve. The SP State Street line has a 6-degree curve for 0.15 miles at the south end of the El Monte viaduct and a 7-degree 30-minute curve for 0.22 miles at the north end of the viaduct and the connection to the SP main line.

Part of the SP State Street line right-of-way was used to construct the San Bernardino freeway and the El Monte busway. The double-track at the west end of the line could be extended east about 0.5 miles, to near the Evergreen Avenue pedestrian overhead bridge. This area could accommodate a continuous double-track if the Del Mar Avenue busway exit ramps were reconstructed. The elimination of 7.5 feet from the breakdown/safety lane between the busway and the freeway would allow the construction of a second track from the Long Beach freeway interchange to the Del Mar Avenue busway exit ramps and from east of the exit ramps to 0.5 miles west of the El Monte viaduct.

Southern Pacific Main Line (South El Monte to Bassett)

The SP main line originates at Mission Tower. It consists of double-track to Alhambra and single-track to a passing siding at South El Monte. The east end of this siding is on a 30-minute curve, where the SP main line is joined by the SP State Street line from the south, about 0.4 miles from the east end of the siding and curve. The line is single-track for 2 miles to the siding at Bassett. The SP Baldwin Park branch leaves the SP main line to the north, about 0.5 miles east of the west end of the siding.

The SP main line ascends at 0.31 percent grade for 0.3 miles from the junction with the SP State Street line, descends 0.22 percent for 0.4 miles, ascends 0.31 percent for one mile, descends 0.20 percent for 0.6 miles and ascends 0.27 percent to the east past the junction of the SP Baldwin Park branch. With the exception of the curve at South El Monte, the line is straight.

The SP main line crosses the San Gabriel River on a 573-foot plate girder bridge. It passes over Peck Road on a 103-foot bridge and under several streets, including the San Gabriel River freeway and the San Bernardino freeway. It is approximately three miles from the SP State Street line junction to the SP Baldwin Park branch junction.

Southern Pacific Baldwin Park Branch

The Southern Pacific Baldwin Park branch is a single-track line from Bassett to its junction with the SP Palmdale-Colton main line at Rialto (Palmdale cut-off). The segment from Bassett to La Verne was constructed by Southern Pacific. The segment from La Verne to Rialto was constructed by the Pacific Electric Railway, as its main line to San Bernardino. The segment from Baldwin Park to La Verne was assigned by SP to the Pacific Electric Railway.

The SP Baldwin Park branch begins at a connection to the main line at Bassett. There is a 0.5-mile siding at Bassett, a 0.28-mile siding at Baldwin Park and a 0.4-mile siding about one mile east of the Baldwin Park siding. The SP Azusa branch diverges to the north at the Orange Avenue junction. There is a 0.48-mile siding at Covina. Just west of La Verne, a connection could be constructed by crossing Arrow highway to the ATSF Pasadena subdivision. This location would be the easterly limit for the SP Baldwin Park branch, according to present operating plans.

The SP Baldwin Park branch was connected to the ATSF Pasadena subdivision through Claremont and on to the existing connection, approximately 4.70 miles east of Claremont. If the SP Baldwin Park branch east of Claremont were used, this connection would eliminate 3.65 miles of track requiring major rehabilitation.

The SP Baldwin Park branch follows the San Gabriel River upgrade from Bassett through Baldwin Park. The branch includes ascending grades of 0.435 percent for 3.4 miles, 0.70 percent for 3.0 miles and 1.433 percent for 5.7 miles.

The SP Baldwin Park branch is connected to the SP main line on a 7-degree curve. The branch is nearly straight for 3.5 miles, with a 20-minutes curve near the San Bernardino freeway overcrossing. Just north of Baldwin Park, the branch changes from a northeasterly direction to an easterly direction on a 3-degree curve. There are two additional 3-degree curves between Covina and La Verne. At the proposed connection to the ATSF Pasadena subdivision, there is a 1-degree curve.

ATSF Pasadena Subdivision -- La Verne to San Bernardino

The ATSF Pasadena subdivision--La Verne to San Bernardino was the original ATSF trackage to Los Angeles, constructed due west from San Bernardino for 27 miles to La Verne. From La Verne, the Pasadena subdivision swings northwest through Glendora, west to Pasadena and southwest to Los Angeles. The curves and grades east of La Verne give way to limiting grades and speed-restricting curves.

From La Verne east, the Pasadena subdivision is a single-track line with passing sidings. There is a 0.6-mile siding at Pomona and, following 1.0 miles of single-track, a 0.6-mile siding at Claremont. There is a 0.5-mile siding at Upland, a 0.6-mile siding at Cucamonga and a 2.4-mile siding at Fontana, formerly the site of the Kaiser steel mill. The Pasadena subdivision joins the San Bernardino subdivision west of San Bernardino, where there is a double-track line to the east. The ATSF yards and shops are in San Bernardino.

The Pasadena subdivision ascends from La Verne to a summit near Upland on an average grade of 0.65 percent. There are approximately 0.8 miles of 1.10 percent grade between Pomona and Claremont. The line descends through Upland on an average grade of 0.8 percent, with a sustained grade of 1.00 percent for 1.9 miles. From a low point near Cucamonga, the line again ascends a moderate grade to Fontana, with the steepest assent of 0.73 percent for 1.1 miles. The line then descends through Rialto on light grades. Approaching San Bernardino, the Pasadena subdivision descends about 0.8 miles at 1.10 percent grade.

The Pasadena subdivision includes few curves between La Verne and just west of San Bernardino. All curves in this area are of 1-degree 8-minutes or less. There is a 4-degree 3-minute curve just before the beginning of the double-track at San Bernardino, and several curves of up to 6-degree 5-minutes before the passenger station at San Bernardino.

2.2.4 Riverside Line

The ATSF San Bernardino subdivision -- Los Angeles-Fullerton-San Bernardino -- begins at Mission Tower and proceeds south along the west bank of the Los Angeles River, as described earlier. It is single-track from Mission Tower to Redondo Junction, where it becomes double-track through Fullerton to east of Atwood. The passenger line connects to San Diego at Fullerton. The Olive subdivision connects at Atwood. The passenger line and the Olive subdivision join at Orange. There is a passing siding at Prado Dam and a 2.1-mile passing track and yard at Corona. There is a 0.7-mile passing siding at Arlington. The San Bernardino subdivision becomes double-track at the junction with the Union Pacific Railroad, west of Riverside. The San Bernardino subdivision joins the Pasadena subdivision west of the San Bernardino passenger station.

The San Bernardino subdivision crosses other rail lines at Redondo Junction, SP Hobart Tower, UP Dayton Tower Junction, SP Los Nietos, the SP west of Fullerton, the UP Colton, and the SP main line. In addition to those described previously, there are ATSF branch connections at Corona to the remnants of the Elsinore subdivision and at Highgrove to the San Jacinto subdivision.

The ATSF Los Angeles terminal yard is Hobart Yard, just east of Redondo Junction. Since the construction of the large classification yard at Barstow, Hobart Yard has been converted to serve primarily as an intermodal facility. Bandini Yard, which has an automobile unloading facility, is located about four miles east of Hobart Yard. There are also several small local switching yards located along the San Bernardino subdivision.

The San Bernardino subdivision descends from Mission Tower to a location between Hobart and Bandini Yards. The steepest grade in this segment is 0.83 percent for 0.6 miles south of Mission Tower. The line remains fairly level, dropping only 55 feet in 10 miles, then rising 65 feet in the next seven miles to Fullerton. Short grades of 0.60 percent are encountered, but are not the restricting grades on the line. East of Fullerton, the San Bernardino subdivision begins to climb through the Santa Ana River Canyon on grades of up to 1.0 percent, which extend for sufficiently long to control the motive power requirement for freight trains. There are several 1.0 percent grades along the line, the longest is 3.0 miles from east of Highgrove to the San Bernardino yards.

The alignment of the San Bernardino subdivision along the Los Angeles River within the first mile south of Mission Tower includes several curves of 6-degrees to 7-degrees 30-minutes. There is a 6-degree curve at Redondo Junction to the right, followed by a 10-degree curve to the left, with a central angle of 120-degrees. Between Redondo Junction and Fullerton there are several curves reaching 2-degrees, which will restrict passenger train speeds on the line. From Fullerton to the end of the double-track, no curve is more than 1-degree 7-minutes. The alignment through the Santa Ana River Canyon requires curves of up to 2-degrees 40-minutes. Near Arlington there are several curves greater than 3-degrees.

2.2.5 Pasadena Line

ATSF Pasadena Subdivision -- Los Angeles to La Verne

The ATSF Pasadena subdivision, Los Angeles to La Verne, begins at Mission Tower and runs north along the west bank of the Los Angeles River. The line is double-track from Mission Tower to North Broadway, where it crosses the Los Angeles River on a single-track bridge. The line climbs and turns as it follows the Arroyo Seco through Highland Park, where it crosses a 711-foot steel bent-trestle bridge to South Pasadena. The line climbs 540 feet in eight miles to reach Pasadena. There is a short passing siding at Pasadena Station. At 0.75 miles north of Pasadena Station, the Pasadena subdivision passes through a short tunnel to the median of the Foothill freeway.

West of Arcadia, the ATSF Pasadena subdivision crosses over the eastbound lanes of the freeway and returns to a separate right-of-way. There is one short siding at Arcadia and another siding at Butler. The line crosses the San Gabriel River on a 705-foot bridge and enters a 1.2 mile siding at Irwindale, followed by a short siding, with less than 0.1 miles between siding turnouts. There is a short siding at Azusa, a 0.5-mile siding at Glendora and another short siding at San Dimas. The SP Azusa branch crosses under the Pasadena subdivision at Irwindale. Irwindale provides the only significant freight activity on the west end of the subdivision.

Pasadena subdivision grades average 1.3 percent ascending from the Los Angeles River to Pasadena. There are several one-mile segments of grades in excess of 1.7 percent, with several locations of grades greater than two percent. In the median of the Foothill freeway the subdivision descends eastward on a 0.037 percent grade for one mile, then ascends for 0.5 miles with a 1.31 percent grade for 0.25 miles. The subdivision then descends with

grades up to 1.74 percent for 0.9 miles, 1.18 percent for 1.50 miles and 1.40 percent for 1.40 miles. The grades descend to Monrovia, remain nearly level to Duarte, then ascend through Irwindale and Azusa to Glendora. There is a 1.42 percent descending grade for 0.5 miles, 1.1 miles of ascending grade of 1.12 to 1.15 percent and a one-mile, 1.2 percent grade ascending on this segment. The subdivision then continues to climb with a one mile, 1.2 percent grade through San Dimas toward La Verne.

The track from Los Angeles to Pasadena contains a series of curves of up to 6 degrees. The curve at the west end of the Los Angeles River Bridge is 6-degrees 20-minutes. The curve in the tunnel onto the Foothill freeway is 9-degrees 30-minutes. The curves in the first three miles of trackage in the freeway median are very slight. There is a reverse curve of 2-degrees 4-minutes followed by a curve of 2-degree 23-minutes. The exit from the freeway median is on a double-track bridge, with only one track in place on a 2-degree 10-minute curve east of Irwindale, and three curves of 1-degree each between Irwindale and east of Azusa. There is a 2-degree curve east of Glendora. There is a long 2-degree 45-minute curve followed by a 2-degree curve, which turns the subdivision south through San Dimas to La Verne.

The width of Pasadena subdivision right-of-way is restricted from Los Angeles to Pasadena. By contrast, the median of the Foothill freeway is designed to allow the construction of a second track. The newer overhead bridges on the Foothill freeway would allow the construction of a second track, but the adjacent embankment and railroad bridges are built for a single track, east of the freeway.

Azusa Branch -- Irwindale to Baldwin Park

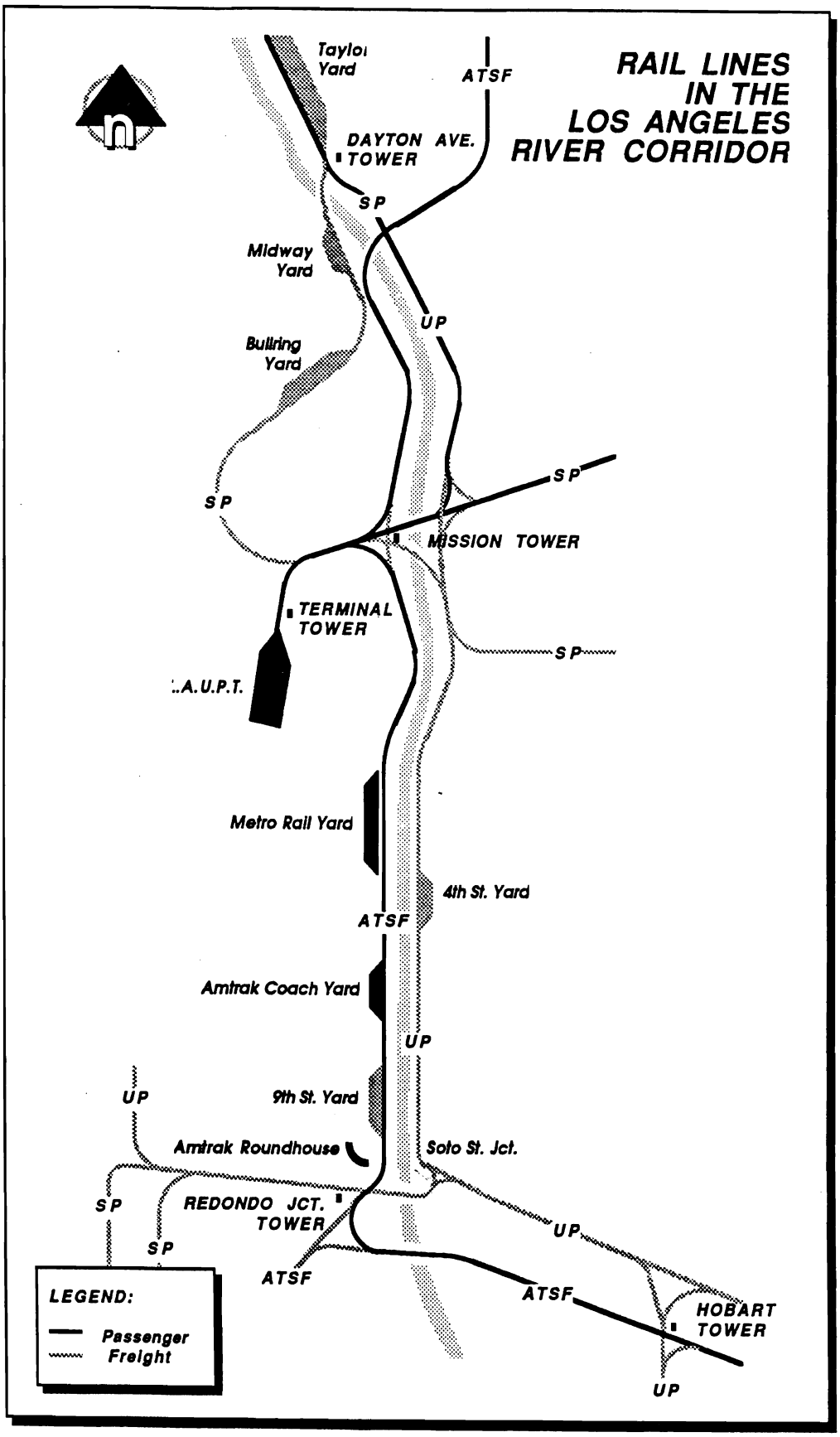
The Azusa branch is a 5.3-mile industrial track, which turns north from the SP Baldwin Park branch at Orange Avenue Junction. The branch passes under the ATSF Pasadena subdivision, 2.8 miles north of the Junction. The Azusa branch includes a small yard 0.25 miles north of Orange Avenue Junction, as well as several industrial spurs to reach shippers in the Irwindale area.

The Azusa branch climbs a 1.0 percent grade from Orange Avenue Junction to the crossing under the ATSF Pasadena subdivision. The line contains several curves; the tightest is a reverse curve including two curves of 7-degrees 30-minutes each. The Azusa branch runs near the Santa Fe Flood Control Basin to the north. Some realignment of the branch may be possible in this area.

2.3 LOS ANGELES RIVER CORRIDOR LINES

The Los Angeles River Corridor contains a complex web of track and facilities, which will provide the basis for new passenger service access to Union Station (Figure 2). A thorough understanding of the current configuration is the key to an optimum design of an efficient new system. The following sections describe the physical characteristics and conditions of these rail lines.

Figure 2


RAIL LINES IN THE LOS ANGELES RIVER CORRIDOR
Taylor Yard
ATSF
DAYTON AVE. TOWER
SP
Midway Yard
UP
Bulring Yard
SP
SP
MISSION TOWER
TERMINAL TOWER
SP
L.A.U.P.T.
Metro Rail Yard
4th St. Yard
ATSF
Amtrak Coach Yard
UP
UP
9th St. Yard
Amtrak Roundhouse
Soto St. Jct.
SP
REDONDO JCT. TOWER
UP
SP
ATSF
ATSF
HOBART TOWER
UP
LEGEND:
Passenger
Freight

2.3.1 Hobart Junction

Figure 3 shows the Hobart Tower area. Intercity passenger trains which currently run between San Diego and Los Angeles operate over the ATSF Railway from Fullerton through Hobart Junction and Redondo Junction, and along the west bank of the Los Angeles River to Union Station. The ATSF tracks at Hobart Junction cross the UP San Pedro branch at grade. The western end of the ATSF Los Angeles terminal freight yard, Hobart Yard, is located here. The UP branch proceeds north several blocks, where it meets the UP main line at the west end of the UP Los Angeles terminal yard.

2.3.2 Soto Junction

Soto Junction is a complete "Y," with two UP main line tracks turning from the east to the north. The south side of the "Y" is single track, which crosses the Los Angeles River to Redondo Junction. The remaining leg of the "Y" connects the Los Angeles River Bridge to the UP main line to the north.

At present, UP operates only a few trains west of Hobart Junction. These trains mainly serve local shippers along the east bank of the Los Angeles River. The major train operations through Soto Junction are the SP trains from the Ports of Long Beach and Los Angeles to their main line at Mission Junction to the north. These trains cross the Los Angeles River Bridge, then turn north along the river.

The proposed Consolidated Transportation Corridor would combine freight trains serving the Ports on the SP line through Redondo Junction. UP would also use this route to serve the Ports. UP and SP trains would run north to their present routing and UP trains would run east to their terminal yard and main line.

2.3.3 Redondo Junction

Figure 4 shows the Redondo Junction Tower area. Redondo Junction is located at the southern end of the trackage along the west bank of the Los Angeles River. The ATSF tracks run west from Hobart Junction across the Los Angeles River bridge as a double-track main line. The main line swings to the north as the northeast side of the "Y." The single-track on the south side of the "Y" meets the single-track of the northwest side and proceeds west and south to El Segundo and the Ports of Los Angeles and Long Beach.

Just north of the "Y," the ATSF double-track main line crosses the UP line from Soto Junction. The ATSF main line becomes single-track north of the UP crossing. A parallel track is used for local switching and access to the yards along the west bank of the Los Angeles River.

Figure 3

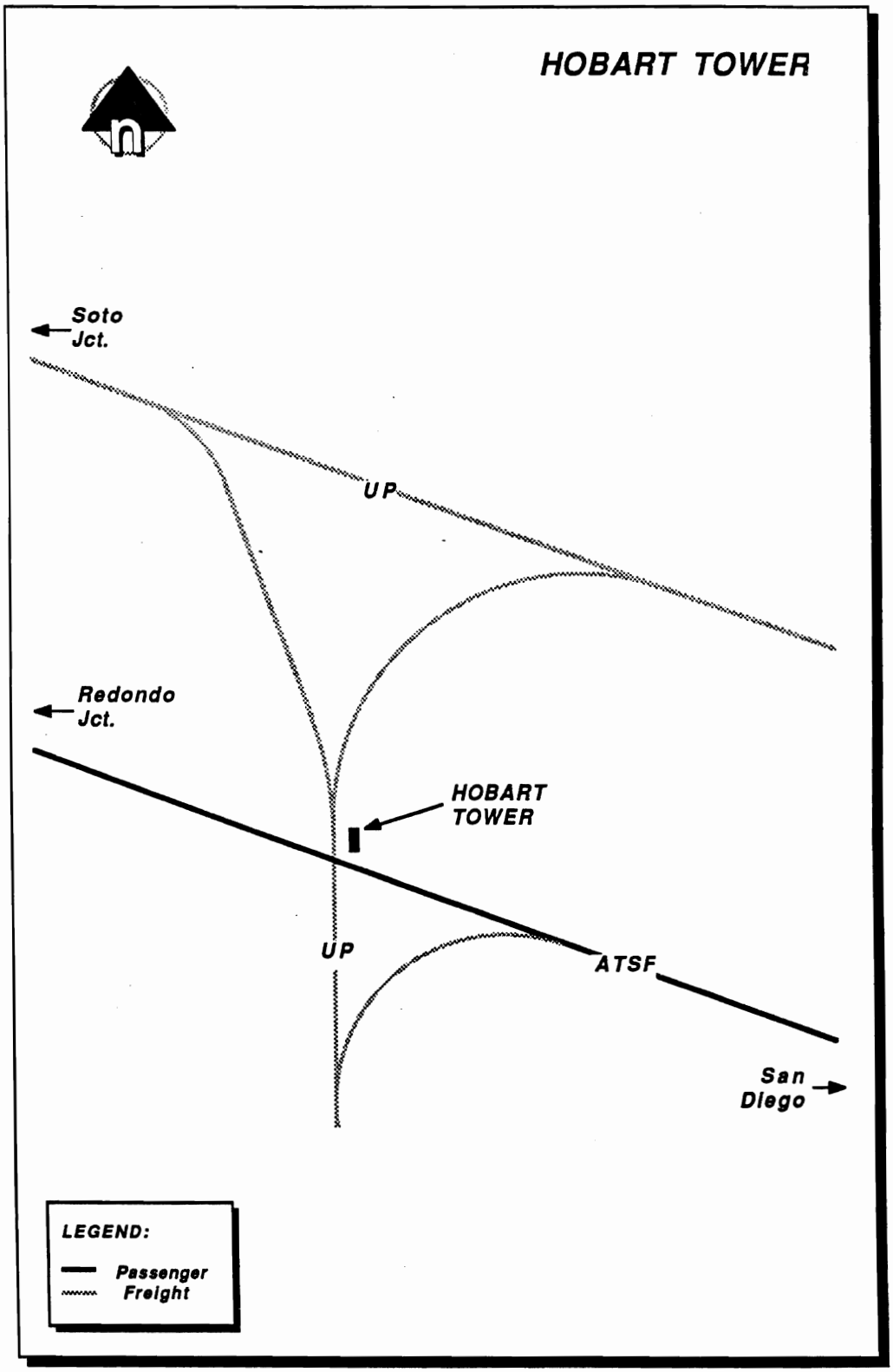
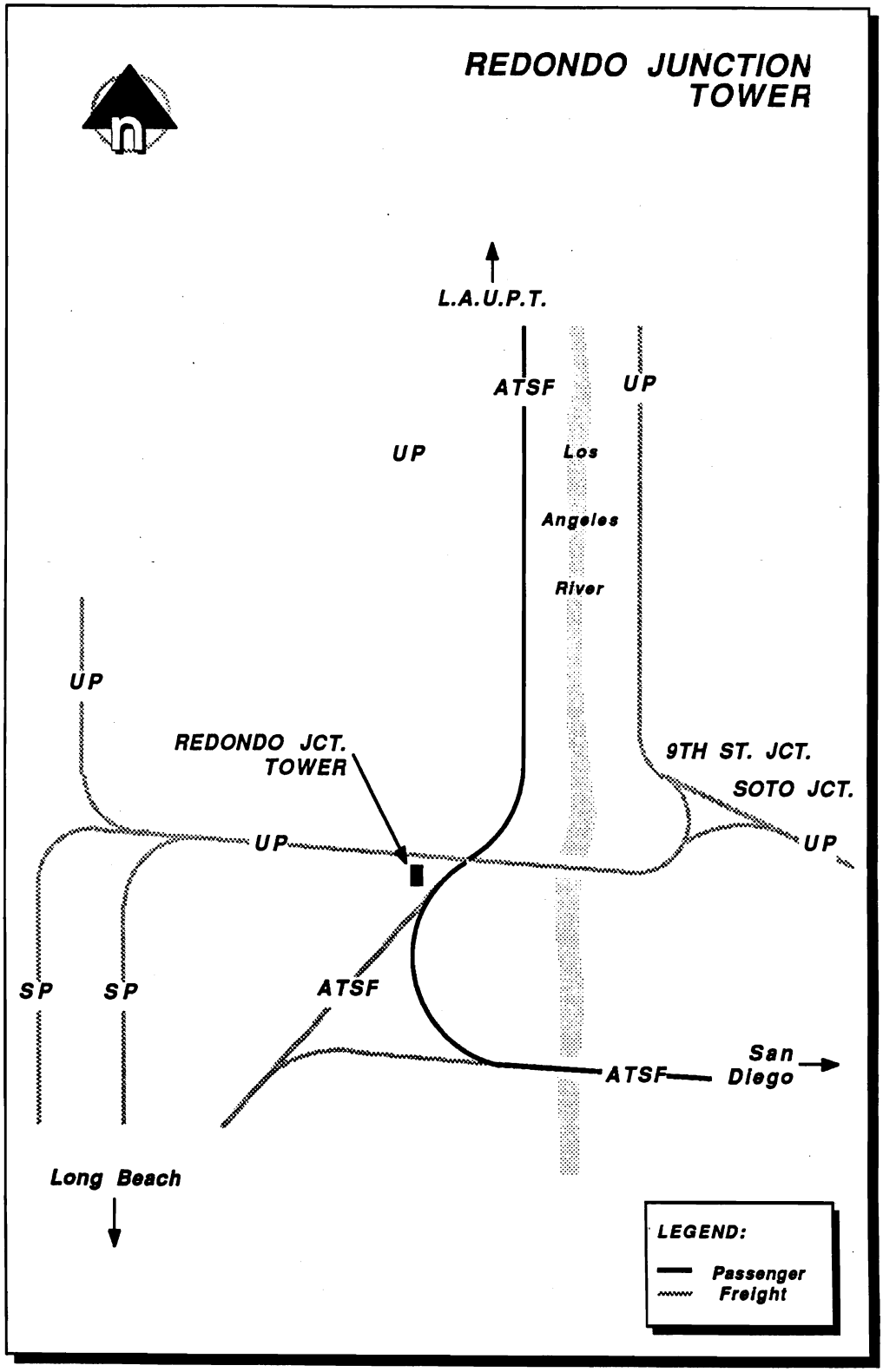

HOBART TOWER
Soto Jct.
UP
Redondo Jct.
HOBART TOWER
UP
ATSF
San Diego
LEGEND:
Passenger
Freight

Figure 4


REDONDO JUNCTION TOWER
L.A.U.P.T.
ATSF
UP
UP
Los
Angeles
River
UP
REDONDO JCT. TOWER
9TH ST. JCT.
SOTO JCT.
UP
UP
SP
SP
ATSF
ATSF
San Diego
Long Beach
LEGEND:
Passenger
Freight

2.3.4 Lower West Bank of the Los Angeles River

Figure 5 shows the Terminal and Mission Tower areas. West of the ATSF main line and north of the UP trackage at Redondo Junction are the ATSF passenger train yards, now used by Amtrak. This facility was built to serve the ATSF passenger station at the Los Angeles River near Fourth Street, prior to the construction of Union Station. At the south end of the facility is an aging steam engine roundhouse, now used for Amtrak locomotive service. The coach service and storage yards extend north to Seventh Street. The area inland from the Los Angeles River between Fourth and Seventh Streets is the site of the Metro Red Line storage and maintenance facility.

The ATSF has reconstructed four long yard tracks and a lead track to the Amtrak facilities between the Metro Red Line and the main track. The main track, a second track and the Amtrak lead track run north from Mission Tower.

2.3.5 East Bank of the Los Angeles River

Figure 6 shows the Dayton Avenue Tower area. The UP main line is double-track from Soto Junction to Dayton Avenue Tower, which is at the south end of Taylor Yard. UP has a small freight yard between Sixth and Fourth Streets. The former UP Pasadena branch leaves the main line north of North Broadway.

The UP main line crosses the SP State Street line on double-slip switches at Pasadena Junction. The single-track to the west of the main line at this crossing and the bridge across the Los Angeles River are owned by UP and provide its access to Union Station.

Pasadena Junction is part of the East Bank Junction of Mission Tower. North of Pasadena Junction, the double-track SP main line to Union Station crosses the double-track UP main line at grade. There is a single-track connection from the northbound UP to the eastbound SP, a double-track connection from the south bound UP to the eastbound SP, and a single-track connection from Union Station to the northbound UP. The latter connection begins at a turnout on the Los Angeles River Bridge, crosses the UP and connects to the east double-track connection.

2.3.6 Upper West Bank of the Los Angeles River

The ATSF main line along the west bank of the Los Angeles River crosses the single-track UP line to Union Station and the double-track SP main line. The ATSF has a single-track connection to Union Station from both north and south of Mission Tower. The ATSF main line becomes double-track at the south end of Mission Tower and continues to the ATSF Los Angeles River Bridge north of North Broadway. The only highway grade crossing along the Los Angeles River is at North Main Street on this double-track segment. There is a connection to Midway Yard near North Spring Street, which connects to the SP main line to the north. The ATSF crosses the Los Angeles River and the UP main line on the east side of the River on a single-track bridge.

Figure 5

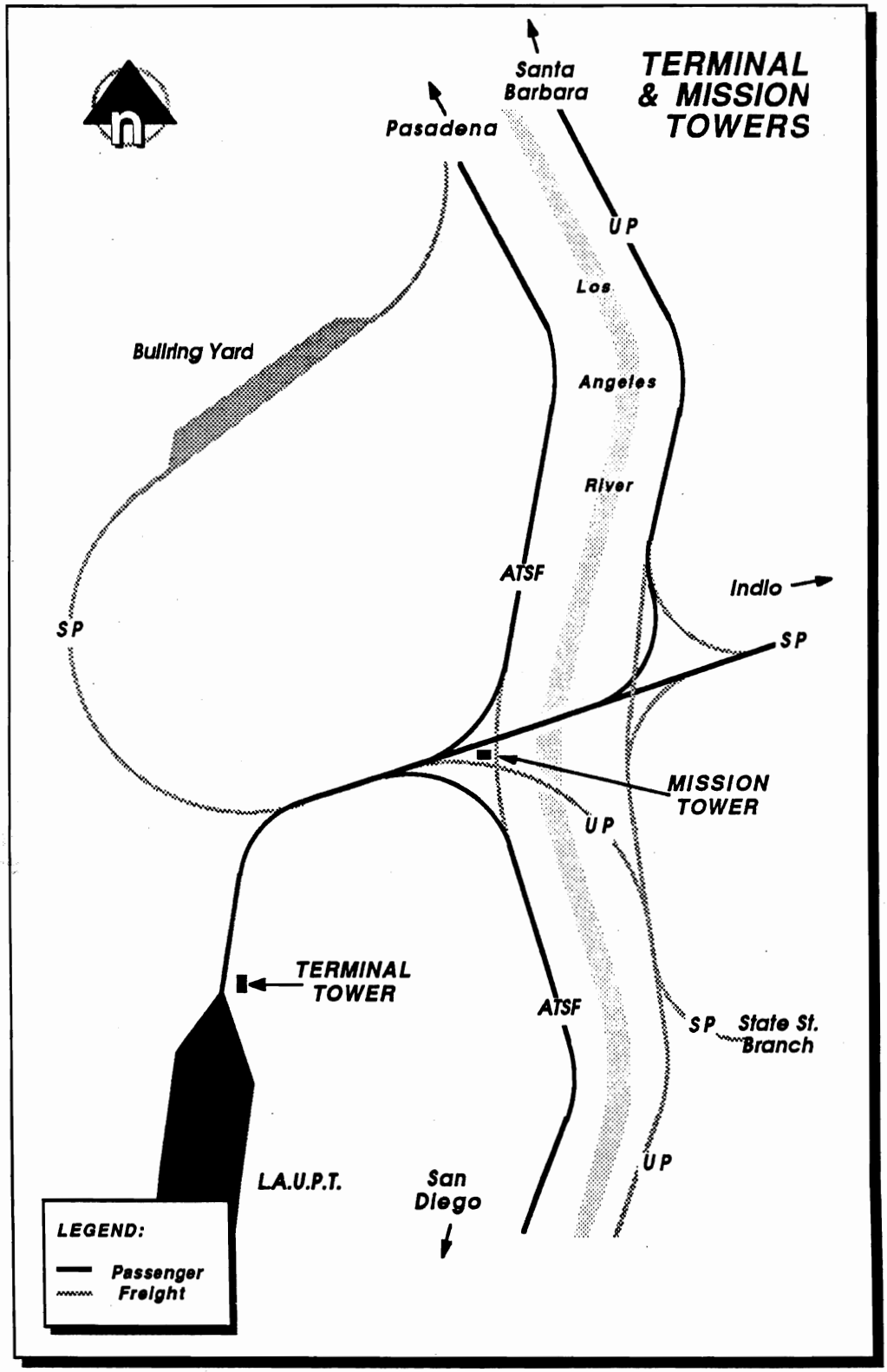
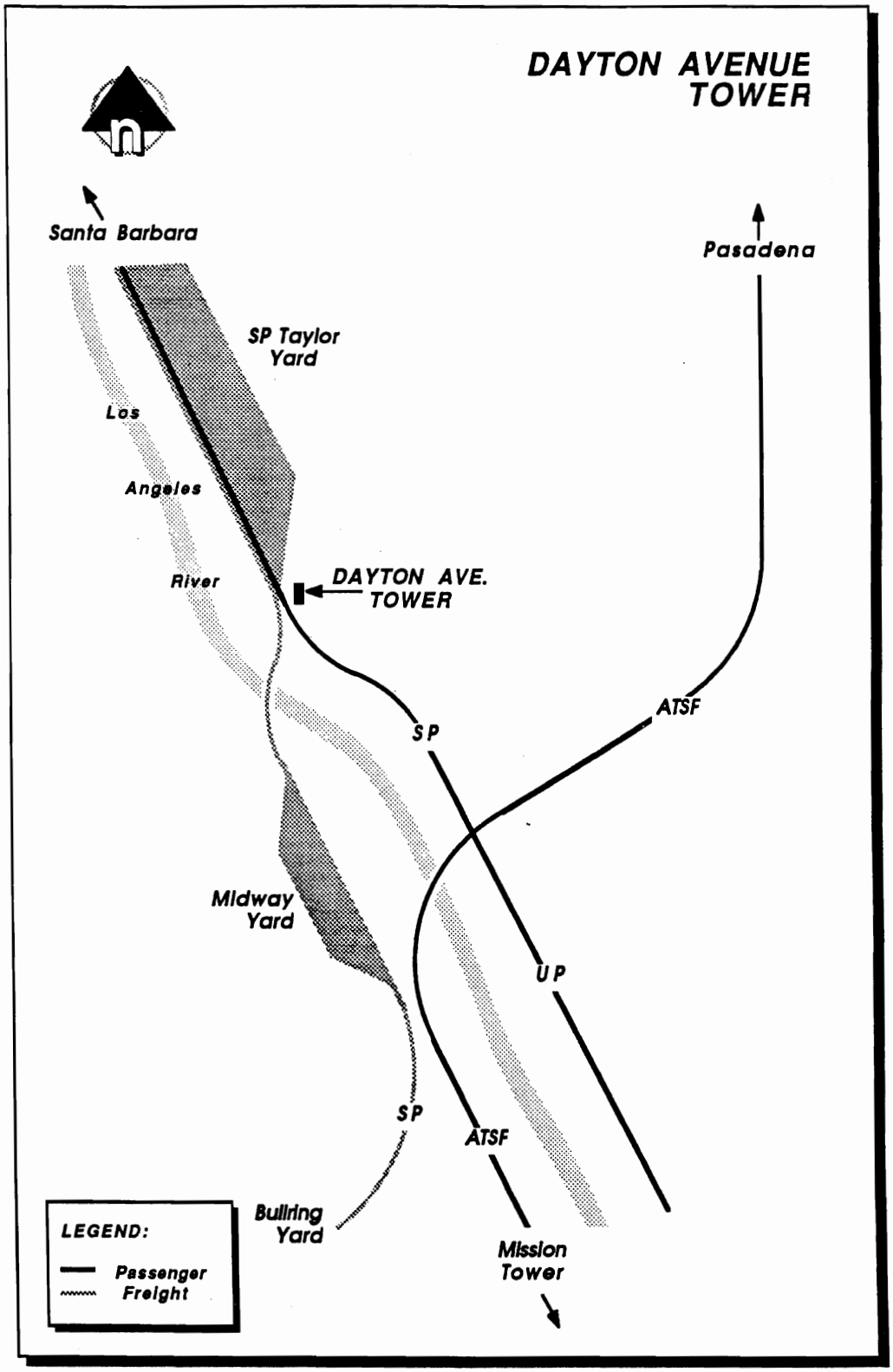

TERMINAL & MISSION TOWERS
Santa Barbara
Pasadena
UP
Los Angeles River
Bulring Yard
ATSF
Indio
SP
SP
MISSION TOWER
UP
TERMINAL TOWER
ATSF
SP State St. Branch
UP
L.A.U.P.T.
San Diego
LEGEND:
Passenger
Freight

Figure 6


DAYTON AVENUE TOWER
Santa Barbara
Pasadena
SP Taylor Yard
Los
Angeles
River
DAYTON AVE. TOWER
SP
ATSF
Midway Yard
UP
SP
ATSF
Bulring Yard
Mission Tower
LEGEND:
Passenger
Freight

The SP main line crosses the Los Angeles River at Mission Tower and runs west a short distance before making a nearly 180-degree turn to the north. The main line runs northeast through Cornfield Yard to the west bank of the Los Angeles River, where it connects to the ATSF main line from the south. The SP runs north along the Los Angeles River through Midway Yard. At the north end of Midway Yard, there is a single track bridge across the Los Angeles River to Dayton Avenue Tower at the south end of Taylor Yard. The UP main line along the east side of the River ends beneath the ATSF Pasadena bridge and directly connects, rails to rails, to the Southern Pacific ownership, where it runs north to Dayton Avenue Tower and beyond.

2.3.7 Union Station

Figure 7 depicts a plan for the reconstruction of the tracks and platforms at Union Station, proposed as part of the Metro Red Line project. Figure 8, which was supplied by Amtrak, depicts Amtrak track occupancy at Union Station as of July 1990.

Union Station trackage connects with the three freight railways serving Los Angeles at Mission Tower. At present, there are two tracks from the SP main line, a single track from the UP, and the north and south ATSF connection tracks. The two SP tracks, the UP track and the southern ATSF track consolidate into two tracks from Mission Tower to Terminal Tower, at the throat of the station tracks.

The north ATSF connection is a single-track connected to Mission Tower by another single-track, which allows SP trains to cross over from the main line to the Cornfield Yard. At Terminal Tower, three entrance tracks are connected to eight platform tracks and three engine escape tracks. The most easterly track is used for mail cars.

At present, the station tracks have been cut short to allow the construction of the Metro Red Line subway station. Originally, Union Station was constructed with six tracks from Mission Tower, two tracks from the ATSF line from the south, two tracks from the SP main line across the Los Angeles River Bridge, two tracks from the ATSF from the north, and 22 platform tracks.

Figure 7

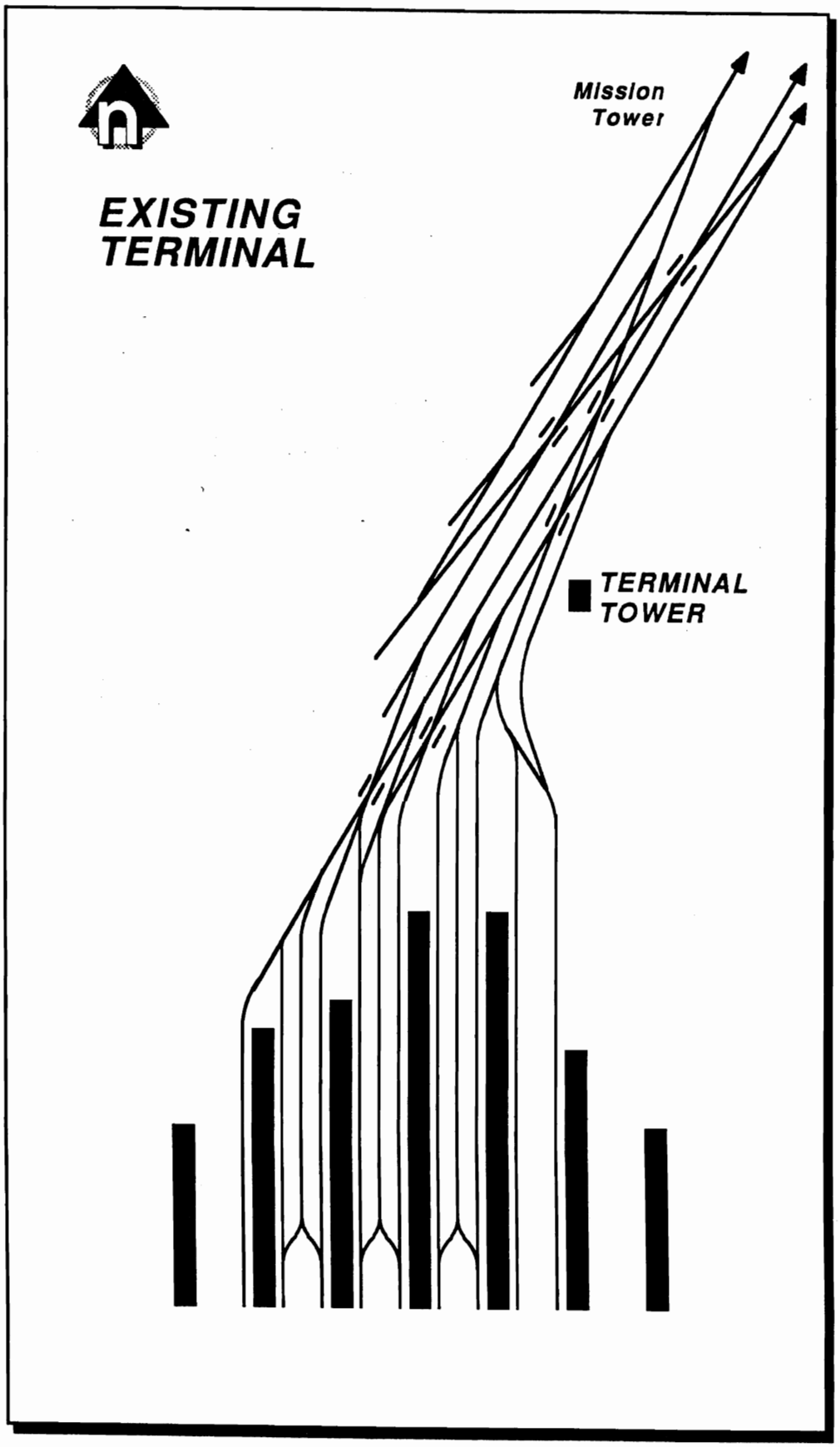
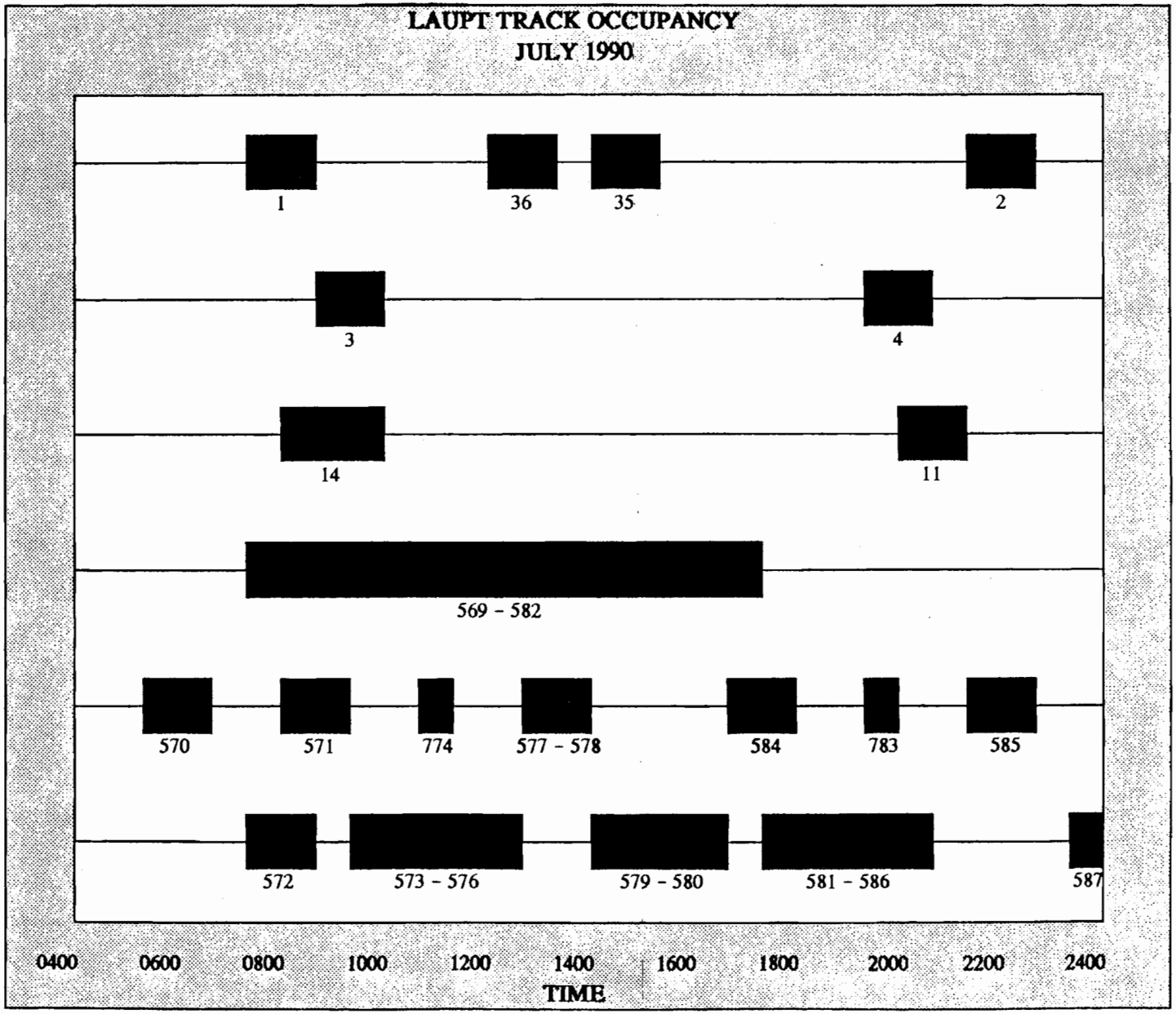


FIGURE 8



SOURCE: AMTRAK

2.4 TRAIN OPERATIONS

The following section describes the schedules and capacities of the passenger and freight trains currently using facilities in the vicinity of Union Station.

2.4.1 Amtrak Intercity Passenger Service

Amtrak currently provides all passenger rail service in the Los Angeles area. Amtrak provides four long-haul passenger trains each way from Seattle - Oakland, Chicago - Salt Lake City, Chicago - Flagstaff and New Orleans - Phoenix. Amtrak also provides eight intercity trains, each way, between San Diego and Los Angeles. Two of these trains in each direction operate through Los Angeles to and from Santa Barbara. Four of the eight San Diego - Los Angeles trains, each way, and all Santa Barbara trains receive financial support from Caltrans. Amtrak operates and Orange County funds a commuter train from San Juan Capistrano to Los Angeles in the morning and returning in the evening.

The San Diegan service operates on ATSF tracks from San Diego through Orange County to Fullerton. From Fullerton the trains operate on the ATSF San Bernardino subdivision existing terminal through Hobart Tower, Redondo Junction, along the west bank of the Los Angeles River to Mission Tower and Union Station. Orange County commuter trains use the same route, but originate and terminate at San Juan Capistrano.

Amtrak Desert Wind trains #35 and #36 arrive in Los Angeles at 2:55 p.m. and depart from Los Angeles at 12:00 noon, respectively. These trains follow the same route as the San Diegan to Fullerton. They use the ATSF San Bernardino subdivision from Fullerton through Riverside to San Bernardino, then on the ATSF to Barstow and Daggett. From Daggett, trains to Salt Lake City use UP tracks.

Amtrak Southwest Chief trains #3 and #4 arrive in Los Angeles at 8:10 a.m. and depart at 8:30 p.m., respectively. These trains run north from Union Station on the west bank of the Los Angeles River on the ATSF Pasadena subdivision. They pass through Pasadena, San Bernardino and Barstow en route to Chicago.

Amtrak Sunset trains #1 and #2 arrive at Los Angeles at 7:00 a.m. on Mondays, Wednesdays and Fridays and depart Los Angeles at 10:50 p.m. on Sundays, Tuesdays and Fridays, respectively. From Union Station they use the SP main line east through Colton.

Amtrak Coast Starlight trains #11 and #14 arrive at Los Angeles at 7:30 p.m. and depart at 9:55 a.m., respectively. These trains leave from Union Station across the SP Bridge and turn north to the UP tracks on the east bank of the Los Angeles River. At Dayton Avenue Tower they return to the SP tracks through Burbank at a port beneath the ATSF overpass and south of the junction to the Coast line to Oxnard, Santa Barbara and Oakland.

Two Amtrak San Diegan trains operate in each direction through Los Angeles to Santa Barbara. The #774 and #784 southbound trains arrive in Los Angeles at 10:30 a.m. and 6:00 p.m., respectively. The #771 and #783 northbound trains depart Los Angeles at 8:20 a.m. and 8:00 p.m., respectively. These trains follow the same route as the Coast Starlight to Santa Barbara.

2.4.2 ATSF Freight Service

ATSF freight service arrives and departs the Los Angeles Basin through its double-track, centralized traffic control line through the Cajon Pass. From San Bernardino, two ATSF lines connect to Los Angeles: the single-track Pasadena subdivision through Pasadena and the San Bernardino subdivision, which is single-track from west of Riverside to east of Atwood, a distance of 28.5 miles. UP uses the San Bernardino subdivision from San Bernardino to the end of the double-track west of Riverside.

According to studies conducted by Riverside and Orange County, ATSF operates approximately 15 trains, each way, on a normal peak day. Typically, eight westbound trains operate on the Pasadena subdivision, with all remaining trains on the San Bernardino subdivision. Two through-trains operate from Barstow to San Diego, leaving the San Bernardino subdivision at Atwood. One train, each way, operates from Barstow to Long Beach. One train, each way, operates to and from Bandini Yard. All other trains use Hobart Yard.

Trains on the Pasadena subdivision operate through Pasadena, down to the west bank of the Los Angeles River, through Mission Tower and Redondo Junction to Hobart Yard. Long Beach trains typically operate on the San Bernardino subdivision through Hobart Yard and Redondo Junction to the Harbor subdivision. There is local switching service on both lines. Local work on the Pasadena subdivision is concentrated east of Irwindale, where the Miller Brewery requires two switches per day. On the San Bernardino subdivision, local switching is performed from San Bernardino to Corona and Atwood to Hobart Yard. There is little local work at other locations, including the west bank of the Los Angeles River.

2.4.3 UP Freight Service

UP typically operates nine freight trains, each way, through San Bernardino and west of Riverside on the ATSF San Bernardino subdivision, then on UP tracks to Los Angeles. They operate two unit trains and one general freight train, each way, to Long Beach. These trains, plus several locals, operate over the UP San Pedro branch and cross the ATSF San Bernardino subdivision at Hobart Tower. UP provides local switching on the east bank of the Los Angeles River and on the UP line crossing the ATSF at Redondo Junction.

2.4.4 Southern Pacific Freight Service -- Coast and Saugus Lines

After Rio Grande Industries acquired SP in 1988, major changes occurred in train traffic routing. Previously, most traffic from the San Francisco Bay Area and the Pacific Northwest was routed through Southern California, maximizing the use of SP track. Since the acquisition, traffic from these areas is routed through Salt Lake City and on the Rio

Grande Railroad to Kansas City, a much shorter route. Previously, SP had used the Coast and Valley lines through Bakersfield to move traffic south from the San Francisco Bay Area. At present, traffic to the south has been reduced. The Coast line is not used for through freight service, but is operated as two branches. Train service operates south from the Bay Area to as far as San Miguel, round-trip, and from Los Angeles to San Luis Obispo, round-trip.

There is a significant amount of traffic generated on the southern portion of the Coast line. Perishables from Guadalupe, sugar beets from Betteravia, coke from Callendar and automobiles from Port Hueneme require several freight trains daily south of Oxnard on the Coast line. Also, the General Motors Assembly Plant in Van Nuys requires at least one switcher service, daily, for time-sensitive deliveries.

The primary SP north-south freight route in California runs through the San Joaquin Valley to Bakersfield, over the Tehachapi Mountains to the Mojave Desert, south through Palmdale and east and south through the Cajon Pass to the SP Classification Yard at West Colton. At Palmdale the original main line turns southeast from the primary freight route through the Soledad Canyon to Saugus and Los Angeles, where it is called the Saugus line. Because the Saugus line is the shortest rail route from the Bay Area to Los Angeles, it is often used by time-sensitive TOFC trains. Unit crude oil trains operate over the Saugus line from Bakersfield to the port area of Los Angeles. Eight trains use the Saugus line from Bakersfield to the Port area of Los Angeles.

Freight trains on the Coast and Saugus lines operate through Burbank Junction to Dayton Avenue Tower, then on the UP to the East Bank Junction of Mission Tower. TOFC trains destined for Los Angeles terminate in the yard southeast of this junction. Trains from the Coast line and as many as four of the Saugus line trains turn east onto the main line through Alhambra. Unit oil trains continue south on UP to Soto Junction, then west to Redondo Junction and SP trackage to the Port area.

2.4.5 Southern Pacific Freight Service -- Wilmington Branch

There are two Southern Pacific routes to the Ports of Long Beach and Los Angeles: 1.) the Wilmington branch, which parallels the Metro Blue line and 2.) the San Pedro branch, which parallels Alameda Street from Wilmington to Los Angeles. Originally, the SP San Pedro line used Alameda Street from south of Washington Boulevard to Bull Ring Yard, north of Union Station. Tracks are still in place on Alameda Street in front of the station building. Subsequently, SP obtained trackage rights on the UP from Clement Junction near 27th Street to Soto Junction and along the east bank of the Los Angeles River to Mission Tower and SP trackage, just south of Dayton Avenue Tower.

The SP San Pedro branch joins the Santa Ana branch just north of Firestone Boulevard. The Santa Ana branch is single-track to the southeast. There is a junction at Studebaker with the Puente branch, which is single-track, crossing the ATSF San Bernardino subdivision at DT Junction, at grade. The line continues north along the east bank of the San Gabriel River to Whittier Junction on the UP. The line operates on trackage rights over the UP to the City of Industry, where it connects to the SP main line.

Before 1987, all container traffic delivered by ship to the Ports of Long Beach and Los Angeles was drayed by trucks to the railroad yards near downtown Los Angeles for loading onto rail cars. The ATSF and UP continue to dray containers to their intermodal facilities at Hobart Yard on the ATSF San Bernardino subdivision and at East Yard on the UP main line east of Soto Junction.

In 1987, SP opened the Intermodal Containers Transfer Facility in Carson, along the Wilmington branch. This facility, which replaced their intermodal facility at Taylor Yard, now generates more than twelve trains, each way, daily. Combined with other Port traffic, as many as twenty trains, each way, use the Wilmington branch. Nearly all Port-bound traffic uses the SP main line to Mission tower, the UP to Soto Junction and Clement Junction to the Wilmington branch. In addition, seven outbound trains use the same route, in reverse. The remaining outbound traffic uses the Santa Ana and Puente branches to reach the SP main line at the City of Industry.

3. NETWORK ALTERNATIVES AND PHASING

3.1 INTRODUCTION

New commuter rail and expanded intercity passenger services are likely to be phased-in, over time, to distribute capital costs and accommodate increasing ridership demand. This section suggests three possible service scenarios representing start-up, intermediate and high service levels of operation. The start-up scenario plans for 21 trains, each way. Intermediate service calls for 57 trains, almost triple the start-up level. High service calls for 99 trains, almost double the intermediate service.

Start-up service would maximize the use of the existing tracks and signal system. Intermediate service would nearly double equipment requirements. High service requires substantially improved physical facilities.

All scenarios assume that commuter rail ridership is predominantly rush-hour, with more than 80 percent of all trips occurring during peak periods. The 1987 LACTC report, "On the Road to the Year 2000," was used to predict growth patterns for commuter rail service corridors. Riverside and Orange County service plans were provided by their respective counties. Intercity service levels were provided by LOSSAN, Caltrans, and Amtrak.

3.2 TURNBACKS

Many of the proposed lines are limited in terms of train capacity by single-track tunnels, rights-of-way limitations, civil restrictions, and other constraints. To overcome some of these constraints, trains that arrive at their final destination early in the peak period are expected to make a return trip to their origins for a second peak period run. These "turnbacks" may be scheduled to allow station stops on their return trips.

Without turnbacks, the equipment and labor required to operate the commuter rail service increases significantly. The Ventura, Santa Clarita and San Bernardino lines would require 30 percent more train sets and train crews to provide the high level of service without turnbacks. In addition to the equipment and labor required for additional trains, the storage and maintenance facility at Los Angeles would also need to be larger and require more labor to maintain this equipment. Night-layover facilities at the end of each line would need to be larger. Additional tracks might be required at Union Station to accommodate extra trains.

3.3 LINE CAPACITIES

The sections below describe the characteristics which determine the capacity of each proposed commuter line to accommodate passenger trains.

3.3.1 Ventura County Line

The SP Coast line from Ventura County to Burbank Junction is a single-track line. Passing sidings turnouts are operated manually. Where the Saugus line joins the Coast line at Burbank Junction, the route becomes double-track to Los Angeles. A significant amount of freight traffic uses this line between Burbank Junction and the City of Van Nuys.

Start-up commuter rail service on this line is planned for four morning inbound and four evening outbound trains from Moorpark, which will occur while freight operations are limited on the main line.

Intermediate service call for 10 trains in each direction using five train sets. With the completion of physical improvements recommended in the LOSSAN II Study as well as some additional improvements, second trains trips could be accommodated as far as Chatsworth, in a single peak period.

High service calls for 15 trains in each direction. The operative restriction on high service scheduling is the capacity of the single-track Santa Susana Pass tunnels between Chatsworth and Simi Valley. Operating time between the proposed Santa Susana siding and the double-track at Chatsworth is 10 minutes. Therefore, following trains separated by opposing trains cannot be operated at less than 20-minute headways.

3.3.2 Santa Clarita Line

Santa Clarita is on the SP Saugus line, between Palmdale and Los Angeles. The Saugus line is single-track, with passing sidings from north of Palmdale to Burbank Junction, where it joins the SP Coast line.

Start-up commuter rail service on this line is planned for three morning inbound and three evening outbound trains, using existing facilities.

Intermediate service call for eight trains in each direction, which will require improving and extending existing sidings and installing a new signal system.

High service calls for 14 trains in each direction. Service on the Saugus line is restricted by the single-track San Fernando Pass Tunnel between Sylmar and Newhall. The same as with the Ventura line, following trains separated by opposing trains cannot be operated at less than 20-minute headways.

3.3.3 San Bernardino Line

Assuming that rights-of-way are obtained from ATSF, the preferred route for the San Bernardino line would be the SP State Street line from Los Angeles to El Monte, the SP main line to Bassett and the SP Baldwin Park branch to La Verne and the ATSF Pasadena subdivision from La Verne to San Bernardino. This route is single-track with some passing sidings. The Baldwin Park branch is a local freight route, which will require total reconstruction before passenger service can begin. Start-up service could begin over the

ATSF Pasadena subdivision while the Baldwin Park branch is reconstructed. A separate study is being prepared to evaluate alternative transit modes between Pasadena at La Verne/Claremont/Montclair.

Start-up commuter rail service on the San Bernardino line is planned for five morning inbound and five evening outbound trains, using existing facilities between San Bernardino and Union Station.

Intermediate service call for nine trains in each direction on the preferred route to Union Station, with eight connecting shuttle trains from Claremont to Pasadena. For intermediate service, the signal system must be improved and several passing sidings installed.

High service calls for 12 trains in each direction from San Bernardino, 12 trains each way from Claremont/Montclair via Azusa and 11 trains to Pasadena from Claremont/Montclair. To provide this service, several extended passing sidings must be installed, the largest of which will be a 3.5-mile siding in the El Monte busway. The installation of this siding will require shortening the disabled vehicle lanes between the busway and the main freeway by seven feet.

3.3.4 Riverside Line

Riverside County plans to operate commuter trains from Hemet to Los Angeles, Riverside to Irvine and San Bernardino to Irvine. Start-up commuter rail service on this line is planned for two trains, each way, on each route. Intermediate service would be four trains from San Bernardino and Hemet and seven trains from Riverside. Mid-day service would be three trains from Riverside to Los Angeles. High service would be five trains on each route from Hemet. San Bernardino and Riverside mid-day service would be provided by 14 trains, each way, between Riverside and Los Angeles, with a shuttle connection between Atwood and Irvine.

3.3.5 Pasadena Light Rail Option

The ATSF Pasadena subdivision from Pasadena to Union Station is under separate analysis as a possible light rail alignment. Service scenarios for start-up, intermediate, and high service were developed assuming the light rail system on the ATSF right-of-way. Table 1 shows these scenarios.

3.3.6 LOSSAN Corridor Service

LOSSAN I refers to the Los Angeles-San Diego corridor. Start-up service for this corridor is planned for eight trains, each way, daily. Intermediate service will be 10 trains. High service will be 15 trains.

TABLE 1 SCHEDULED TRAINS ONE-WAY OPERATING SCENARIOS			
	Start-Up	Intermediate	High
Ventura County - LA	4	10	15
Santa Clarita - LA	3	8	14
San Bernardino - LA Via Covina	5	9	12
San Gabriel - LA Via Azusa	0	0	12
San Bernardino - Pasadena	0	8	11
San Bernardino - Irvine	2	4	5
Riverside - Irvine	2	7	5
Hemet	2	4	5
Riverside		3	
Riverside - LA			14
Orange County - LA	3	4	6
Total	21	57	99

LOSSAN II refers to the Los Angeles-Santa Barbara corridor. Start-up service for this corridor is planned for two corridor and one Seattle train, each way, daily. Originally, the LOSSAN II target was four trains each way. Caltrans' long-term goal is to extend about half of the San Diego trains to Santa Barbara. In that event, intermediate service would be five trains and high service would be seven trains. Consideration for a Los Angeles to Indio or El Centro area corridor passenger service to serve the Coachella and Imperial Valleys is planned. Such service would operate through Colton to the Low Desert on the route of the Southern Pacific. The routing between Los Angeles and Colton could use one of several routes.

3.3.7 Intercity Long-Haul Service

The Coastal Starlight operates daily on the Coast line. Amtrak states that a second Coast Starlight/Daylight may be operated on the this line. Such a train would reduce the needs of the LOSSAN II service by one train each way. The Southwest Chief and Desert Wind operate daily through the San Bernardino area. The Sunset operates three times a week through the San Bernardino area and may operate daily. In the future Amtrak plans to extend a San Joaquin train on an overnight schedule from Bakersfield with State of California.

4. OPERATIONS REQUIREMENTS

4.1 INTRODUCTION

Candidate projects required for expanded passenger operations are categorized according to system-wide, intercity and commuter high-service needs. Some of the projects which are needed for the expansion of the intercity corridor passenger train service are also needed for commuter service. These projects are required to provide new service, increase reliability, and reduce delays, operating conflicts and costs. Candidate improvements are designed to address the need for quick operations, passenger comforts, system maintenance facilities, and stations. All recommendations use existing facilities whenever possible. This analysis excludes projects subject to analysis by Riverside and Orange Counties, and storage and maintenance needs in Los Angeles, which are addressed in Chapter 6 of this report. Chapter 7 includes cost estimates and a phased schedule for capital construction projects.

4.2 SYSTEM-WIDE NEEDS

4.2.1 Signalized Approaches to Union Station

Because it was constructed as a terminal for long-haul trains, Union Station is stub-ended. With the initiation of San Diego - Santa Barbara service, however, the station is no longer simply a terminal stop. In 1971, Caltrans conducted a study which explored ways that the Station could be made double-ended. Although a busway has since been added, double-ending still appears to be a viable alternative.

The original track layout and signal system installed when the station was constructed in 1939 is still in use at Union Station. Over the years, trackage has been removed at the platforms and through the signal interlocking which route trains into the station.

There are five mechanical interlocking towers which control train movements along the Los Angeles River to Union Station: Hobart Tower, Redondo Junction, Mission Tower, Terminal Tower and Dayton Avenue Tower. These towers employ mechanical locking frames, which have not been manufactured in forty years. Few craftsmen still working today are qualified to adjust or repair them. Twenty-one people are required to operate this system. With a modern signal control system, the existing train dispatcher could perform this task alone.

4.2.3 Union Station to Hobart Junction

Figures 9 and 10 show potential access routes into Union Station. Operating speeds from Redondo Junction to Mission Tower are restricted below 30 miles per hour. Delays to opposing train movements are sometimes more than 20 minutes. To achieve maximum operating speeds, the track adjacent to the existing main track from Redondo Junction to Mission Tower would require upgrading to a signalized main line with super-elevations. The existing main track would also require upgrading to allow similar operating speeds. Construction of a second track would be required adjacent to the existing track in the

Figure 9

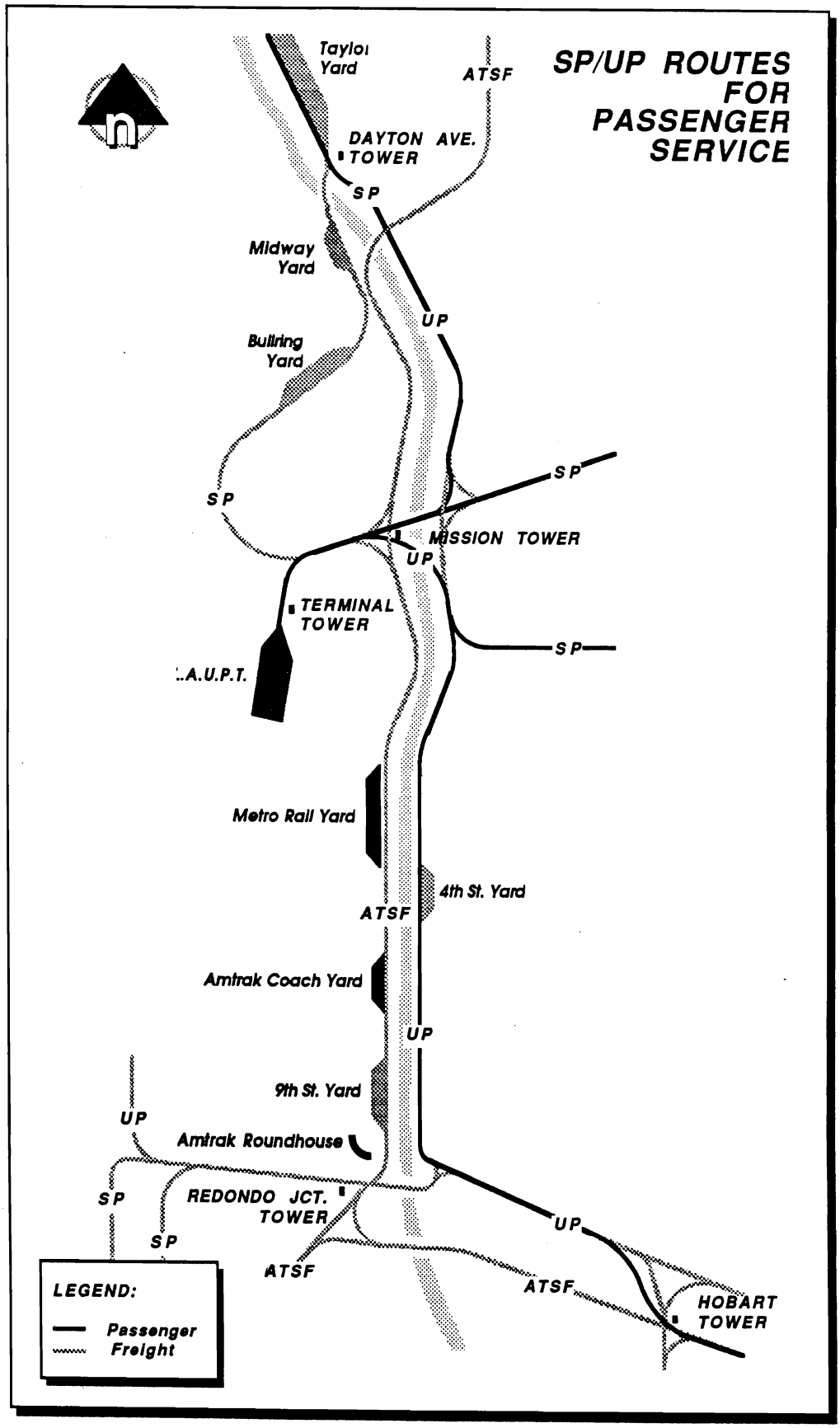
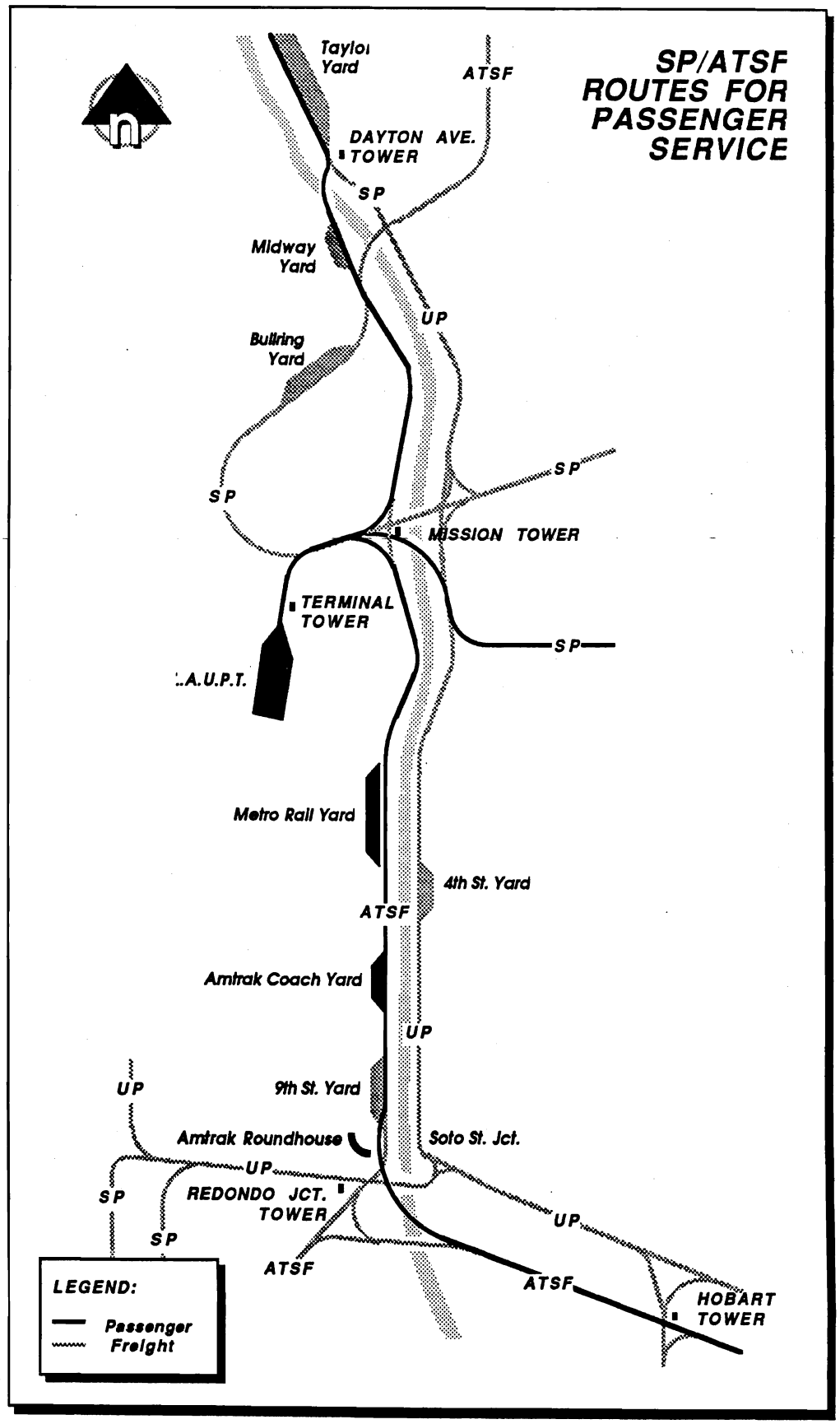

SP/UP ROUTES FOR PASSENGER SERVICE
Taylor Yard
ATSF
DAYTON AVE. TOWER
SP
Midway Yard
UP
Bullring Yard
SP
SP
MISSION TOWER
UP
TERMINAL TOWER
SP
L.A.U.P.T.
Metro Rail Yard
4th St. Yard
ATSF
Amtrak Coach Yard
UP
9th St. Yard
UP
Amtrak Roundhouse
SP
REDONDO JCT. TOWER
SP
UP
ATSF
ATSF
HOBART TOWER
LEGEND:
Passenger
Freight

Figure 10


SP/ATSF ROUTES FOR PASSENGER SERVICE
Taylor Yard
ATSF
DAYTON AVE. TOWER
SP
Midway Yard
UP
Bulring Yard
SP
SP
MISSION TOWER
TERMINAL TOWER
SP
L.A.U.P.T.
Metro Rail Yard
4th St. Yard
ATSF
Amtrak Coach Yard
UP
UP
9th St. Yard
Amtrak Roundhouse
Soto St. Jct.
UP
SP
REDONDO JCT. TOWER
UP
SP
ATSF
ATSF
HOBART TOWER
LEGEND:
Passenger
Freight

southwest quadrant at Mission Tower. Medium-speed turnouts would be required at the south connect to the main track along Los Angeles River, to achieve speeds of up to 25 miles per hour on the Terminal Tower approach. These improvements would reduce or eliminate opposing traffic delays and save over three minutes in running time.

4.2.4 Redondo Junction

The passenger main line at Redondo Junction contains a sharp, 10-degree curve, with a 2-inch super-elevation. Operating speeds here are confined to 15 miles per hour for 1.5 miles, from north of the junction to east of the Los Angeles River bridge. Operating speeds increase to 30 miles per hour for the next mile east, past Hobart Tower. By increasing the super-elevation of curves at Redondo Junction and between Redondo Junction and Hobart Tower, as well as allowing an unbalanced super-elevation of up to 3-inches, operating speeds could be increased to 30 miles per hour through Redondo Junction and 60 miles per hour from Redondo Junction to Hobart Tower. These cost-effective improvements would immediately reduce running times by more than three minutes.

The Consolidated Transportation Corridor study recommends that the existing freight track crossing the west bank passenger line at Redondo Junction be the major connector to the Ports of Los Angeles and Long Beach. Freight traffic on this line is expected to increase to 100 trains per day by the year 2000. Passenger traffic through Redondo Junction is expected to reach 70 trains per day by that year, if the high level of service is implemented. If the current at-grade crossing is not made grade-separated, major delays to both freight and passenger operations will occur at this location.

A grade separation could be constructed as follows. The existing track could ascend on a 1.0 percent grade from a point on the ATSF Railway, west of Hobart Tower. At Soto Street the tracks would begin a new alignment on a wide curve, to the north. A new bridge would be built over the Los Angeles River and Washington Boulevard. The line would continue on a viaduct or fill, until crossing a bridge over the freight line. The line would then descend on a 1.1 percent grade, through a reverse-curve to the existing alignment along the west bank of the Los Angeles River at the Olympic Boulevard overpass.

4.3 INTERCITY NEEDS

The following section describes operational requirements for intercity trains.

4.3.1 LOSSAN I Study Recommendations

The Los Angeles-San Diego (LOSSAN) State Rail Corridor Study reviewed all the railroad operations within the corridor between the namesake cities to identify situations where freight and passenger operations may conflict and cause service delays. The study stated that operating personnel of the ATSF suggested that additional crossovers be installed between the main line tracks so that double crossovers would exist at 2.5 mile intervals from Hobart Tower to Fullerton. The need for this high number of crossovers in this small area is the activity of the local road switchers that service freight customers. These road

switchers serve some side tracks directly from the main line tracks and occupy the main track while making relatively slow speed moves between sidings where switching of customers is performed.

The LOSSAN Study identified five local road switcher train assignments that work the segment of the railroad between Hobart Yard and Fullerton. One assignment never occupies or crosses the mainline tracks. Two other road switchers go on-duty at 8:00 p.m. which places their work schedule outside the normal passenger train operating period. A 7:05 a.m. road switcher works Pico Rivera Yard and switches industries from Santa Fe Springs to La Mirada. There is a switching siding on the north side of the main line tracks from Santa Fe Springs to just west of La Mirada and on the south side of the main line from La Mirada to Buena Park. One assignment, the 11:00 a.m. road switcher, picks up automobiles at Pico Rivera Yard and then works the industrial area at La Mirada. The LOSSAN Study did not present an analysis for the need for the additional crossovers except it was suggested by the ATSF personnel.

4.3.2 RCTC/ATSF Study Recommendations

The Riverside County Transportation Commission (RCTC)/ATSF Commuter Rail Study included extensive computer simulations of the Fullerton to Hobart Tower Corridor. The adjusted base case routed all the existing through freight and passenger trains which presently operate on the Pasadena Subdivision to the Fullerton to Hobart trackage. Further scenarios increased the number of freight and passenger trains projected to operate on the corridor.

The computer simulations showed the freight and passenger train reliability on various segments of the railroad. The need for a third main track between Fullerton and Basta would occur when the present Pasadena Subdivision traffic is rerouted. At the intermediate level of freight and passenger service, projected for the year 2000, a third main track would be required between Basta to La Mirada and from D.T. Junction and Commerce. The twenty miles of main line track would be triple track for all but six miles within nine years.

The adjusted base case and low level of freight and passenger service improvements are projected to be in place in 1995. The improvements required at this level of service would be to add three single crossovers at La Mirada, Buena Park and Basta and a new double crossovers at Santa Fe Springs. The computer simulations did not demonstrate the actual need for these additions to the physical plant. Again the ATSF Personnel stated the need for these crossovers for several reasons. The local road switchers occupy the main line tracks while serving local industry. Certain through freight trains occupy the main line when setting out or picking up cars.

This work by these trains effectively blocks one of the main line tracks along segments of the railroad. Also, the multiple at grade street crossings limit the locations where freight trains can wait for tracks to clear.

4.3.3 Recommendations of this Study

The work of the LOSSAN Study and the RCTC/ATSF Commuter Rail Study provide no justification by formal analysis for the need for additional crossovers between Fullerton and Hobart. The insistence of their need by ATSF would indicate that their use would be for the convenience of the freight service in this area.

The recommendation of this study would be to install the third main line track as specified in the intermediate service levels of the RCTC/ATSF Study without the additional crossovers except at the ends of the triple track. Crossovers and turnouts are high maintenance items and a life cycle analysis may show that the third mainline trackage is more economical. There is no indication that the proposed crossovers will be effective in increasing the capacity of the railroad line after the third main line tracks are installed. The capital cost versus benefit for a five year useful life will be high and will continue to be an operating (high maintenance) cost into the future.

A Universal Crossover, located every 2.5 miles along the segment of railroad between Hobart and Fullerton, would indicate that many of the subsegments are to be occupied by freight trains. The passenger service would be required to crossover from one track to another at 45 to 50 miles per hour while the plan of LOSSAN and other studies is to operate higher speed passenger service in the 65-79 miles per hour range. The effect would be to increase running times up to 50 percent over the segment from Hobart to Fullerton.

Consideration must be given to the layout of any crossovers between multi-track main lines and sidings. All plans to date have shown a route through crossovers from one side of the railroad to the other. Any crossover move by a train will block two tracks to the next crossover location. If the crossovers are placed in parallel, a crossover move will block two tracks in one direction. Such an arrangement should be evaluated before the final crossover location and layouts are designed.

The crossovers required at the entrances to the existing freight yards and the end of the proposed triple main line will place crossover as close as 2 miles apart and as great as 6 miles apart between Hobart Tower and Fullerton. This should provide adequate operational flexibility.

4.3.4 LOSSAN II Study Recommendations

Intercity service uses a double-track line from Los Angeles to Burbank Junction and single-track, with passing sidings, west to Santa Barbara. Sidings are required both for trains passing in opposite directions and for passenger trains passing slower freight trains traveling in the same direction. Sidings are low-speed, with manually-operated turnouts, which limit speeds to 10 miles per hour.

Sidings between Northridge and the western end of the line could be upgraded with high-speed, power-operated turnouts and signalized for high-speed operation. This entire line could be dispatched by a centralized traffic control system, which could be integrated with the proposed Union Station control and operation system.

The segment of the Santa Barbara route between Mission Tower and Northridge carries a significant volume of local and Coast line freight traffic, most of it time-sensitive. To facilitate freight and passenger movements, the tracks between Dayton Avenue Tower and Burbank Junction should be signalized for bi-directional operation on each track. The intermediate crossovers between the two tracks at Allen Avenue should be upgraded to high-speed crossovers. A new universal high-speed crossover should be installed south of Glendale. This crossover and the existing interlocking at Burbank should be placed under centralized traffic control.

Gemco Yard and adjacent main line tracks carry the majority of freight activities in the area, some of which is quite time-sensitive. SP provides 24-hour service to the General Motors assembly plant, some of which is "just in time" parts, which must be moved to the assembly plant immediately. Breweries located here require switching service twice daily to maintain production schedules.

Additional main line trackage will be needed to operate future intercity passenger service. A second main track will be needed from Burbank Junction to Northridge, with some additional freight sidings. The main tracks should be bi-directionally signalled and controlled by the centralized traffic control system. Several high-speed crossovers will be needed. Existing turnouts should be converted to power operation.

The current route between Union Station and Dayton Avenue Tower uses a combination of SP and UP track on the east bank of the Los Angeles River. Passenger trains swing east then west to the SP Bridge across the Los Angeles River to Union Station.

There are currently a number of train and engine moves between East Bank Junction and Dayton Avenue Tower at relatively low speeds. The existing right-of-way south of Dayton Avenue Tower limits the number of tracks to the existing two tracks.

An alternate route to Union Station, suggested by the LOSSAN II study, is the SP main line, which crosses the River at Dayton Avenue Tower and passes through Midway Yard on the west bank of the River to the Bull Ring Yard. Since SP obtained trackage rights on the UP line on the east bank of the River, the line on the west bank has been reduced to local service only. At the south end of Midway Yard there is a connection to the ATSF Pasadena subdivision near North Broadway. The ATSF Pasadena subdivision runs south to Mission Tower, where it connects with Union Station. This trackage could be upgraded with signals and new high-speed turnouts at the connection to the ATSF Pasadena subdivision. At Mission Tower a second track could be added to the northwest quadrant to allow double-track into Union Station.

The existing passing siding at Simi Valley is scheduled to be relocated to allow the construction of a grade crossing for the extension of Tapo Canyon Road to Los Angeles Avenue. The new siding location will be five miles west of the existing siding and 13 miles from the Chatsworth siding. The trackage between Chatsworth and Simi Valley is the slowest segment of the SP Coast line.

The existing Simi Valley intercity passenger station has inadequate parking. The LOSSAN II study recommends that this station be relocated. There is industrially-zoned vacant land on Los Angeles Avenue near Stearns Street, which would provide a possible station site. An additional siding could be constructed at this location, which would be half-way between the Chatsworth siding and the relocated Simi Valley siding.

The existing station at Van Nuys (Panorama City) could be relocated to Roscoe Boulevard, near the flight path to Van Nuys Airport. A station here would eliminate the present problem of train meets interfering with train operation at the Gemco Yard. The flight path area would allow for a large parking lot. Access from the San Diego freeway is good.

4.4 COMMUTER RAIL NEEDS

Because of high equipment purchase and maintenance costs, equipment utilization rates must be maximized. Rail lines serving the Los Angeles Basin are primarily single-track lines. Single-track lines restrict the operation of counter-flow trains, which allow the second use of a train and train crew in one commute period.

4.4.1 Union Station

According to this analysis, Amtrak requires four tracks to operate long-haul intercity passenger service. Intercity corridor service will require three additional tracks, bringing the a total Amtrak requirement to seven of the nine existing tracks in the station.

Start-up Commuter Rail service could be operated on two station tracks, with no provision for late trains or other operating problems. Long-term, commuter rail would require five station tracks, which would also not provide any spare operating space. To begin service, construction of two tracks would be required at the western-most platform. Further expansion would require relocation of the Amtrak mail platform to the east and the installation of the remaining two tracks allowed by the track lease area. Construction of the station platform tracks should be coordinated with the reconstruction and signaling of the interlocking towers for the intercity rail improvement program. See Chapter 5 for details.

4.4.2 Ventura County Line

Auxiliary trackage would be required from Northridge to Chatsworth, with the Chatsworth siding extended westward to the curve east of the first Santa Susana Tunnels. This improvement would reduce the single-track segment through the Santa Susana Pass tunnels by 5.5 miles.

Within five years Caltrans expects to complete a connection between Route 23 and the Simi Valley freeway. A new commuter rail station could be located where the new freeway connection crosses the SP Coast line, just east of Moorpark. A major park-and-ride facility here could be coordinated with the highway construction.

There is sufficient land for a night-layover facility at Moorpark. This facility could be equipped with ground electric power, which could be connected to trains during storage. This power would run heat or air conditioning on the passenger coaches while the diesel engine out of operation. The existing Moorpark siding could be extended eastward to include the station site, so trains could be operated from the layover facility to the station without blocking the main track.

Commuter rail service on the SP Coast line could be extended to Camarillo. A station could be located at the Ventura freeway overcrossing. A park-and-ride facility here would serve a large portion of Ventura County. Direct access to the freeway is provided by the exit and entrance ramps from Dawson Drive on the south side of the tracks. As an alternative to Moorpark, trains could layover here.

4.4.3 Santa Clarita Line

Because of ascending grades, northbound running times on this line are significantly longer than southbound times. However, this line is the shortest of the proposed commuter lines, allowing for high equipment utilization rates. With four train sets, six scheduled trains could be operated in one commute period. Such operation would require a signal-controlled passing siding with centralized train despatching control. A new siding would be required at Sun Valley. The existing sidings at Sylmar and Saugus would require upgrading with high-speed turnouts and signals.

SP operates several time-sensitive freight trains over this route, including the "just in time" assembly line parts for the General Motors Plant west of Burbank Junction. To allow for combined passenger and freight operations, a track could be installed between the existing sidings at Pacoima and San Fernando and the siding upgraded with signals and high-speed turnouts, to provide a single, long siding. Similarly, the side tracks adjacent to the single-track, main line at Newhall should be upgraded, signalized and connected to the siding at Saugus. There is sufficient land available to accommodate a commuter train layover facility at Saugus.

4.4.4 San Bernardino Line

This portion of the San Bernardino line would carry the greatest density of train traffic, since all passenger trains to Los Angeles and all SP freight trains through or originating at Mission Tower would use this track. The initial project would extend the passing sidings toward each other to reduce the single-track section of this line. For intermediate service, this segment would need to be double-tracked.

The Baldwin Park branch is a low-speed, industrial service track, mostly consisting of light, 75-pound rail. This track would need to be replaced for the entire distance from Bassett to La Verne, 13 miles. A 900-foot connection, which includes a grade crossing of Arrow highway would be required from La Verne to the ATSF Pasadena subdivision.

This line is currently unsignalized; a complete system of signals with centralized traffic control would be required. Sidings allowing counterflow trains to pass at Baldwin Park and

Covina would also be required. A new Baldwin Park siding would replace the sidings at Pacific Avenue and Ramona Boulevard and connect to form a single siding. The existing 0.5-mile siding at Covina would require lengthening to 1 mile.

The Pasadena subdivision is in good condition. It consists of 115-pound, bolted rail for the first 16 miles and 119-pound, continuously welded rail for the final 10 miles into San Bernardino. The bolted rail should be replaced with continuous welded rail. The old bolted rail could be recycled for use in the storage yards and layover facilities. This line is signalized by the absolute block system. To allow a higher level of train service, installation of an extension of the Baldwin Park branch centralized traffic control system would be required on the balance of the subdivision.

The Covina siding would be required to allow passing of counterflow trains, while the Claremont siding would be a turnback location for several trains. Since these sidings are relatively close together, they should be connected into one long siding, with a universal crossover in the center. Power switches and associated controls may be needed.

For San Bernardino line trains, a night-layover facility would be required at San Bernardino. This facility could accommodate San Bernardino - Riverside - Orange County trains.

5. UNION STATION DESIGN RECOMMENDATIONS

Because Union Station was designed as the terminal station for long-haul passenger service, the station provides large waiting areas, restaurants, newsstands and other amenities. It does not provide easy access to station platforms from the street level. The walk from the front of the station headhouse to the track area is excessively long. The pedestrian tunnel under the tracks is of limited capacity. This tunnel will also be used to provide access to the Metro Red Line as well as bus connections.

In the years since its construction, Union Station trackage was reduced as the number of passenger trains using the terminal declined. At present, the trackage is further reduced to allow for the construction of the Metro Red Line subway station below the terminal tracks. When the Metro station is completed, the terminal tracks will be restored as follows:

- Four passenger platforms (#3, #4, #5 and #6), with tracks on each side for a total of eight passenger train tracks
- Three engine escape tracks between paired platform tracks
- One "mail platform" track

The pedestrian access ramps linking the subway and the terminal platforms do not meet current requirements for accessibility to the handicapped. During the Metro station restoration project, platforms #2, #3, #4 and #5 will be reconstructed in compliance with those requirements. The restoration will not include access ramps to platform #6 or tracks for platform #2. Construction of tracks serving platform #2 will be needed immediately. For future intermediate service, construction of a handicapped-accessible ramp for platform 6 will also be needed.

5.1 CURRENT AMTRAK TRACK NEEDS

Amtrak provided an track initial occupancy diagram which indicated the need for six tracks (three platforms) at current service levels. Under this plan, one track is occupied from 7:25 a.m. to 5:45 p.m. by the Orange County Commuter Train (#569-#582). If track assignments are reorganized, trains could be consolidated to accommodate all, except #571 and #783, on three station tracks. Amtrak also specified the need for engine escape tracks for short-term equipment storage, although the track occupancy diagram did not indicate this use.

5.2 START-UP COMMUTER SERVICE

The proposed commuter rail start-up schedule requires four station tracks at Union Station during the morning rush period and a fifth station track for one train in the afternoon rush period. Current and near-term intercity passenger service and commuter rail start-up service can be handled on eight platform tracks at Union Station, which serve handicapped passengers. This schedule uses the two tracks on platform #6, which is not handicapped-

accessible, for problems such as overflow, late trains, etc. The occupancy plan does not use the "mail" track or the engine escape tracks. Figure 11 shows Union Station track occupancy for existing intercity and start-up commuter rail service.

The commuter start-up service scenario is based on inputs from the Riverside County and Orange County commuter rail studies and Los Angeles County projections. Because arrival and departure times were planned ideally and without regard for current usage, in several cases high track-occupancy demand occurs during rush periods. Some rescheduling would improve track utilization as well as service in these cases.

For example, an Orange County train is scheduled to leave Fullerton at 6:42 a.m and arrive in Los Angeles at 7:28 a.m., followed by a Riverside County train at 6:49 a.m. at Fullerton and 7:35 a.m. at Los Angeles. This schedule requires two station tracks at Los Angeles and runs two train close together, followed by a large block of time with no service from Fullerton to Los Angeles.

5.3 INTERMEDIATE SERVICE

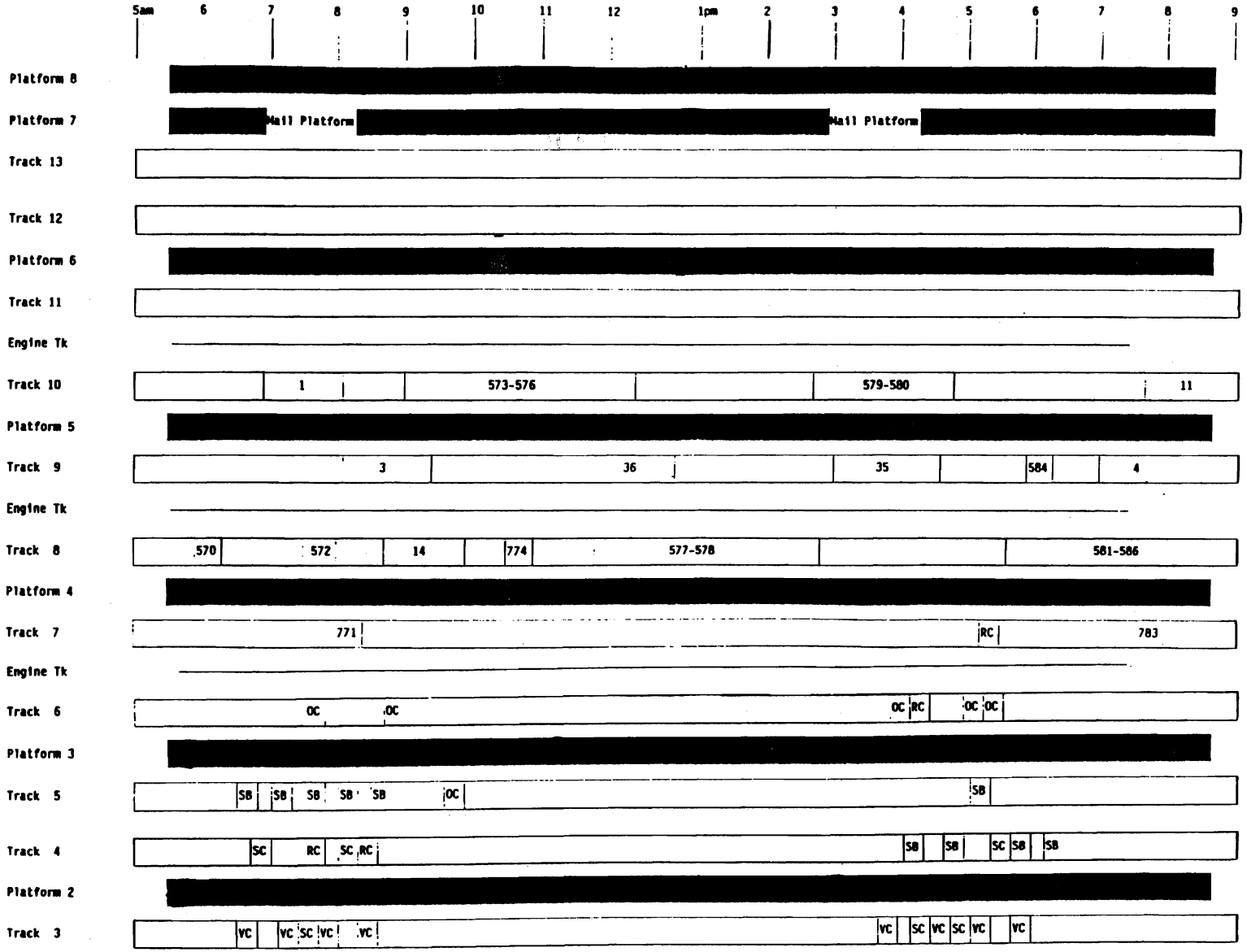
For the intermediate service level, intercity corridor service would increase to ten or twelve trains each way between San Diego and Los Angeles. Through-trains from Los Angeles to Santa Barbara would increase to five or six. Long-distance service would include an extended San Joaquin train on an overnight schedule from Bakersfield. Intermediate intercity service could be handled by four platform tracks, except for one midday through-train, which would use a fifth track The fifth track would not be required if one of the two Los Angeles-San Diego trains were not stored in the station for six hours, which is the present Amtrak practice. Figure 12 shows track occupancy for intermediate service.

Intermediate commuter rail service would require five platform tracks, one for each line operated into the station during the rush period. This service would include some off-peak trains, which would require three platform tracks during midday and evening. To handle this service, Union Station will the construction of a handicapped-accessible ramp to platform #6, for a total of five platforms and ten platform tracks, in addition to the "mail" platform track. This track occupancy plan does not use the "mail" track or the engine escape tracks for train storage.

5.4 HIGH SERVICE

At high service, these will be 15 trains between San Diego and Los Angeles, with seven trains running through to Santa Barbara. One San Joaquin train would be extended from Bakersfield to Los Angeles on an overnight schedule. The San Diego to Santa Barbara corridor service could be scheduled to use two platform tracks and two engine escape tracks for long layover trains. Figure 13 shows track usage at the high level of service.

Long haul passenger train service could be operated on three station tracks between 7:00 a.m. and 10:00 a.m. and on one track the remainder of the active day, except for a conflict with San Joaquin and Sunset trains clearing station tracks within 80 minutes of arrival to make room for the Coast Starlight, 90 minutes before its departure. Consolidating track

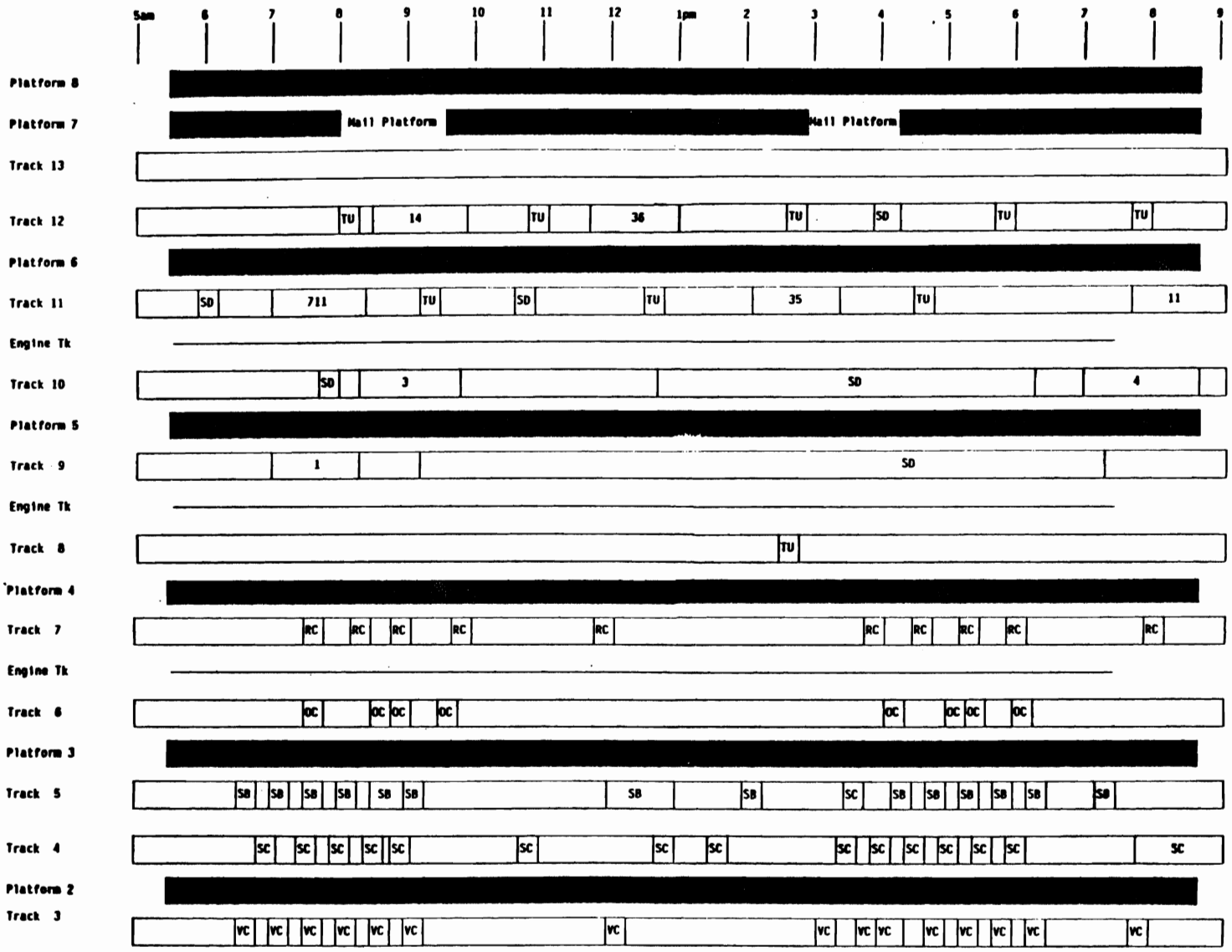


LEGEND

OC - Orange County Commuter Train
RC - Riverside County Commuter Train
SB - San Bernardino - LA Commuter Train
AZ - Pomona - LA via Azusa Commuter Train
SC - Santa Clarita - LA Commuter Train
VC - Ventura County - LA Commuter Train
SD - San Diego - LA Corridor Passenger Train
/U - San Diego thru to Santa Barbara Passenger Train
- Long Distance Intercity Trains

EXISTING INTERCITY TRAIN SERVICE
INITIAL COMMUTER RAIL SERVICE

FIGURE 11

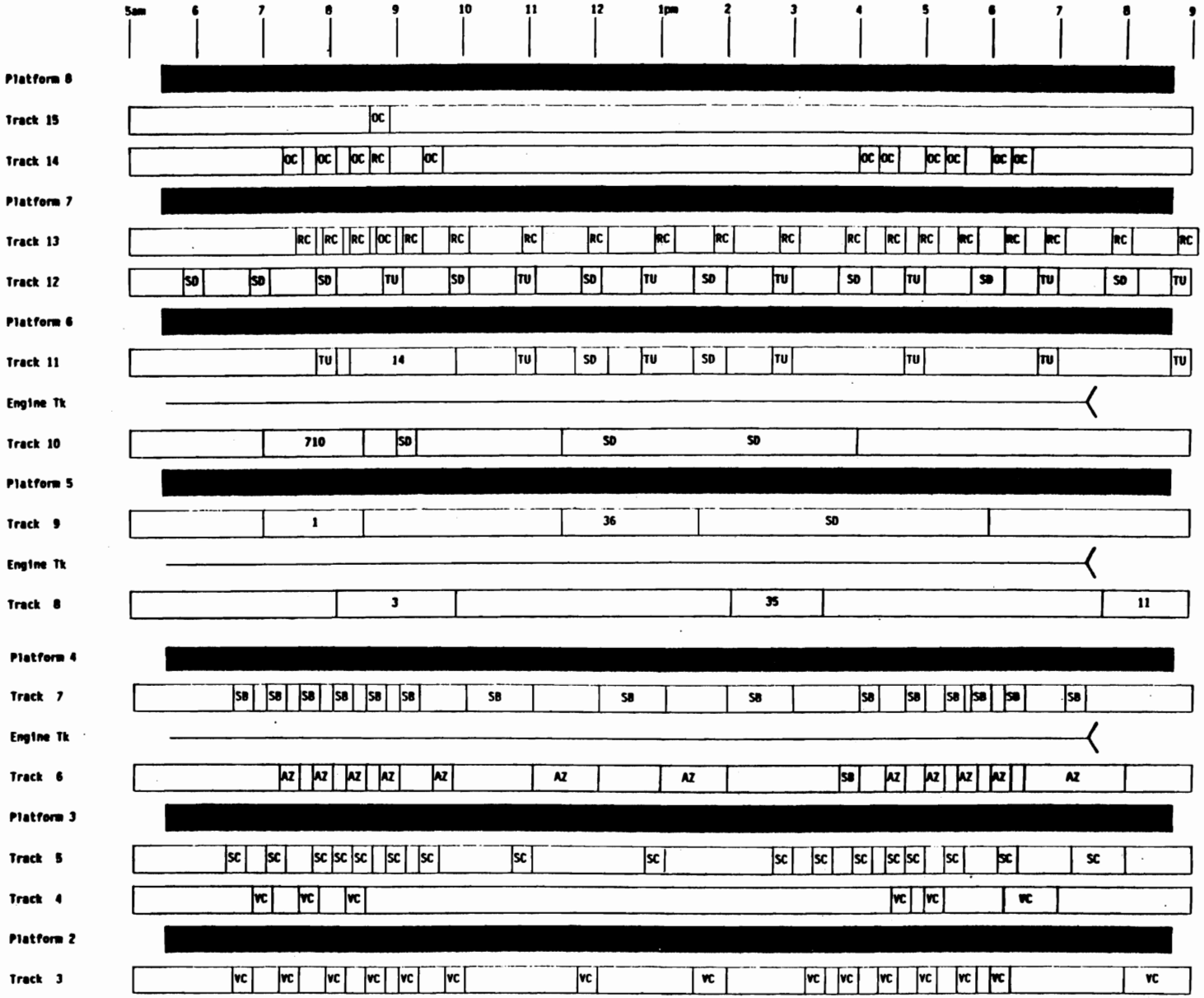


LEGEND

INTERMEDIATE TRAIN SERVICE

OC - Orange County Commuter Train
RC - Riverside County Commuter Train
SB - San Bernardino - LA Commuter Train
AZ - Pomona - LA via Azusa Commuter Train
SC - Santa Clarita - LA Commuter Train
VC - Ventura County - LA Commuter Train
SD - San Diego - LA Corridor Passenger Train
TU - San Diego thru to Santa Barbara Passenger Train
- Long Distance Intercity Trains

FIGURE 12



LEGEND

OC - Orange County Commuter Train
RC - Riverside County Commuter Train
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VC - Ventura County - LA Commuter Train
SD - San Diego - LA Corridor Passenger Train
TU - San Diego thru to Santa Barbara Passenger Train
- Long Distance Intercity Trains

UNION STATION TRACK OCCUPANCY
HIGH LEVEL OF SERVICE

FIGURE 13

6. POTENTIAL STATION SITES

Commuter Rail service will provide high-speed rail access from a wide residential area to Downtown Los Angeles and other business centers. A key element in the success of the overall system is the selection of station sites, which provide interchange points between transportation modes. Business center stations must be within walking distance of employment centers or provide direct connections to public transportation which serves employment centers. Suburban stations must provide convenient parking and kiss-and-ride facilities. Generally accepted transportation industry criteria was used to evaluate and recommend station locations as indicated in Figure 14.

6.1 BUSINESS DISTRICT STATIONS

Other Commuter Rail business center stations should be located in Santa Ana/Irvine, Pasadena, Glendale, and Burbank. The Santa Ana/Irvine service from southern Orange County and from Riverside and San Bernardino Counties are the subjects of other studies.

The Pasadena, Glendale and Burbank Media District form a linear business district north of Downtown Los Angeles. A feeder bus system could be operated in conjunction with the Commuter Rail service on the Pasadena-San Gabriel Valley Line, the Santa Clarita-Los Angeles Line and the Ventura County-Los Angeles Line. These buses would connect Downtown Pasadena and the San Gabriel Valley Commuter Rail trains, Downtown Glendale and the Ventura/Santa Clarita Commuter Rail trains and the Burbank Media District.

Union Station and alternate downtown Los Angeles sites were discussed in Chapter 5 of this report.

6.2 REGIONAL STATIONS

Commuter Rail trains have the capability to provide high-speed service, if the system is not constrained by too frequent stops. At speeds of sixty miles per hour, a station stop requires more than two minutes of additional schedule time. If stations are too close together, they will prevent commuter trains from reaching maximum speed. One way to reduce the number of station stops on a Commuter Rail line is to construct a regional "mega-station."

The mega-station should be located near an exit on a major multi-lane highway. If a suitable freeway exit is not available, the site and station design should allow for future construction of exit ramps. A mega-station could provide a very large parking area designed to be easily accessible to the station platform. Unlike a local station, a mega-station may not be the development responsibility of an individual City, but could be a system-wide project.

Several sites have been identified as potential locations for regional mega-stations. The sites described below should be subject to further study to evaluate expected system benefits, construction feasibility, land availability, environmental impacts.

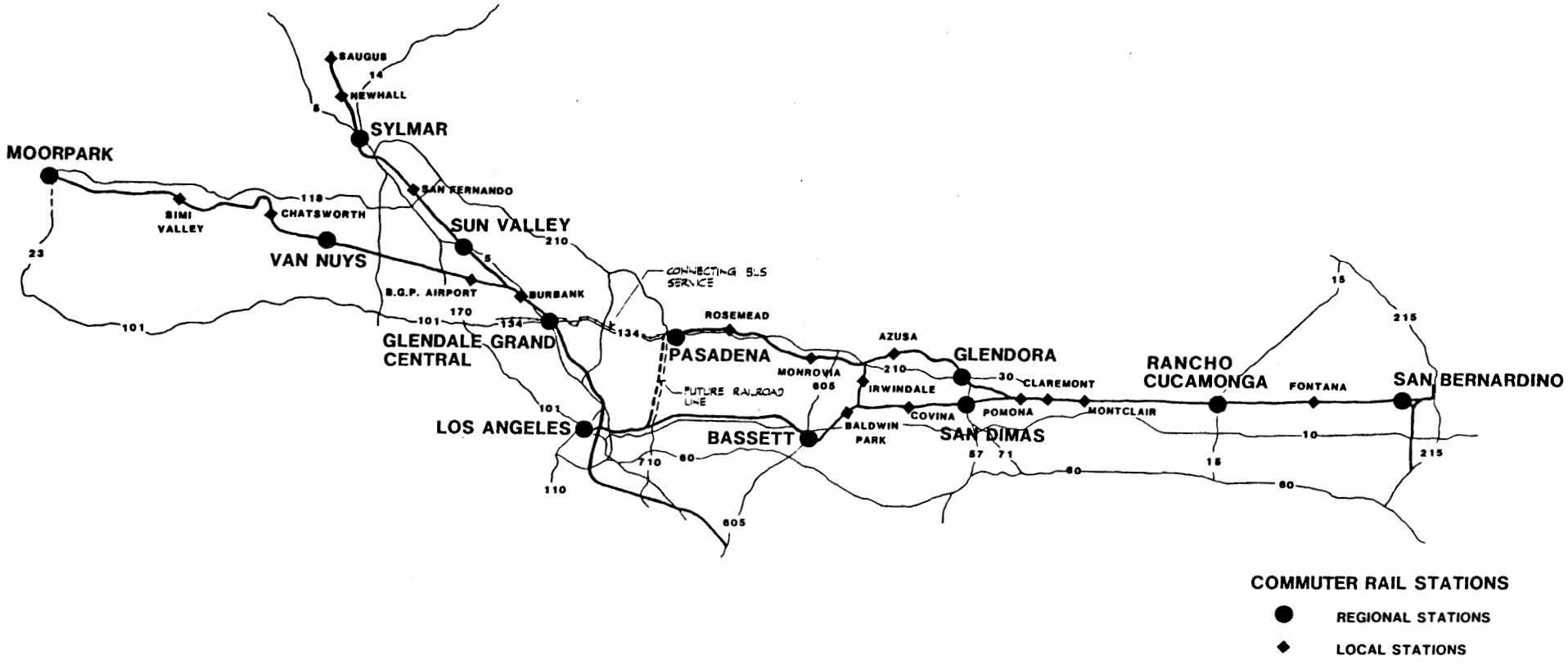

SAUGUS
NEWHALL
SYLMAR
MOORPARK
SAN FERNANDO
SIMI VALLEY
CHATSWORTH
SUN VALLEY
VAN NUYS
B.G.P. AIRPORT
BURBANK
CONNECTING BLS SERVICE
ROSEMEAD
PASADENA
GLENDALE GRAND CENTRAL
AZUSA
GLENDORA
MONROVIA
IRWINDALE
CLAREMONT
RANCHO CUCAMONGA
FONTANA
SAN BERNARDINO
FUTURE RAILROAD LINE
LOS ANGELES
BASSETT
BALDWIN PARK
COVINA
POMONA
MONTCLAIR
SAN DIMAS
118
5
210
23
101
170
134
605
710
60
110
57
71
30
15
215
10
COMMUTER RAIL STATIONS
REGIONAL STATIONS
LOCAL STATIONS

FIGURE 14

6.2.1 Ventura County Line

Eastern Ventura County

The Moorpark Freeway (Route 23) and the Simi Valley Freeway (Route 118) approach Moorpark from the south and east, respectively, but terminate before reaching Moorpark. Caltrans is in the process of designing a freeway connection which will cross the SP Coast line one mile east of Moorpark. A station at this location would allow for easy access to the Commuter Rail System from Thousand Oaks, Simi Valley, and Moorpark. A night layover facility might be better located at this site rather than in Downtown Moorpark.

Central San Fernando Valley

Intercity passenger stations are currently located at Chatsworth and Van Nuys/Panorama City. The Chatsworth Station is located on De Soto Avenue, on a site with limited access. The Van Nuys/Panorama City Station is located at 7724 Van Nuys Boulevard, with its only entrance from the northbound traffic lane. This station is situated across from the switching yard that serves the General Motors Assembly Plant.

The LOSSAN II Study identified several potential station sites, including the existing stations. The study assumed that a station at Roscoe Boulevard and Havenhurst Avenue at the north end of Van Nuys Airport would replace the Panorama City Station. Roscoe Boulevard provides access to the central section of the San Fernando Valley. The site is one mile from the San Diego Freeway exit. A station here would provide better access from major highways as well as adequate parking. Sufficient land is available in the airport "clear zone" to develop parking for 1,000 automobiles.

6.2.2 Santa Clarita Line

Sylmar North - San Fernando Pass

The Antelope Valley and Golden State freeways merge just south of the SP Saugus line San Fernando Pass tunnel. Southbound exits from both freeways combine to connect with San Fernando Road, within the Pass. Northbound entrances to both freeways originate from Sierra highway, within the Pass. The railroad line could be double-tracked or passing siding could be installed from the Sierra highway overhead bridge, south. The area between San Fernando Road and the railroad is currently in industrial use, which would be environmentally compatible with a railroad station.

Sun Valley

The Golden State freeway crosses over the SP Saugus line and San Fernando Road in the Sun Valley section of Los Angeles. There are freeway exits to Tuxford Street north of the railroad overcross and to Penrose Street south of the overcross. San Fernando Road connects with these two parallel street on each side of the railroad. San Fernando Road-East is a minor street which terminates at Tuxford Street. To the east, a concrete products manufacturing facility and vacant land border San Fernando Road-East. The section of San

Fernando Road-East between Penrose Street and Tuxford Street could be closed and combined with the vacant land for a station site. Tuxford Street is grade-separated from the railroad line.

6.2.3 Ventura/Santa Clarita Line

Grand Central

The Grand Central area of Glendale is named for the former airport, which served the Los Angeles area before LAX and Burbank Airport were constructed. At the south end of this area is the Glendale Municipal Electric Power plant and the Ventura freeway (Route 134) overcrossing of the Los Angeles River, San Fernando Road and the combined SP Coast and Saugus lines. Freeway exits to Fairmont Avenue and Doran Street connect to San Fernando Road. Caltrans owns the area under the freeway between the railroad and the river. This area could be used to construct Commuter Rail station with a large parking lot. Connecting buses would serve the Burbank Media District, this station, Downtown Glendale, and Pasadena.

Pedestrians would have to use the Doran Street grade-crossing to reach the parking lot, which would present some problems. The traffic control system at the freeway exits would need to be upgraded.

6.2.4 San Bernardino Line

Rancho Cucamonga/Rochester

The Devore freeway (Route I-15) crosses the San Bernardino line near Rochester Avenue in Rancho Cucamonga adjacent to Arrow highway. There are freeway exits at Foothill Boulevard north of Arrow highway and at Fourth Street south of Arrow highway. East of the freeway a power line right-of-way crosses the railroad line, creating a large piece of unused land. Existing freeway access requires exiting at Foothill Boulevard and driving south 0.5 miles on Etiwanda Avenue and west 0.5 miles on Arrow highway. This site could be improved by construction of additional freeway exit ramps or access roads.

The Rancho Cucamonga/Rochester Station is two miles north of the San Bernardino freeway (Route I-10) interchange and six miles north of the Pomona freeway (Route 60) interchange. It is ideally located to serve large areas of San Bernardino and Riverside Counties.

San Dimas

The Foothill freeway extension (Route I-210) crosses the SP Baldwin Park branch, which is the preferred route for the San Bernardino Line, at San Dimas. There are complete freeway exits at Covina Boulevard. East of the freeway, most of the land adjacent to the railroad has been developed as industrial parks. Covina Boulevard to the east turns north as Cataract Avenue and crosses the railroad. There is some land south of the railroad and

east of Cataract Avenue which is not developed at this time. This area could accommodate a station site, although it is limited in size.

Charter Oaks Mobil Estates and a horticultural nursery are west of the freeway north of Covina Boulevard. San Dimas High School and the San Dimas Swim Park and Racquet Club are across Covina Boulevard. The mobil home park would be an ideal location for a major park-and-ride station. The horticultural nursery location would be acceptable as a second choice. A relocation program for the mobile home residents might facilitate the acquisition of this parcel for transportation use. If the site is targeted for commercial development, there is the possibility that it could be lost as a transportation alternative.

Glendora

For intermediate level Commuter Rail service the ATSF Pasadena subdivision west of La Verne would be used. This line would be used for direct service to Pasadena and as a loop of the San Bernardino service on the Azusa Branch from Irwindale to Baldwin Park. The Pasadena subdivision main track is southwest of the intersection of the Foothill freeway (Route I-210) and Route 30. This location is approximately 1.25 miles north of the San Dimas site described above. There are exits from the Route 30 freeway at Lone Hill Avenue and from the Route I-210 freeway at Auto Center Road.

These local streets and the Pasadena subdivision intersect at an area which is the subject of proposed development such as a shopping mall or a sports park. Vacant land in this area which could be used for a parking lot and commuter rail station. There is an area between the San Dimas Wash and the south side of the Foothill freeway that abuts the railroad and which is not in use and may be public land. Land for this station and parking lot should be reserved now for future use.

Bassett

The SP Baldwin Park branch, which is part of the preferred route to San Bernardino, crosses under the San Bernardino freeway (I-10) between Baldwin Park and Bassett. The area is already developed. Freeway exits do not currently provide good access.

The San Gabriel River freeway (I-605) crosses the portion of the SP Main line which would be used by the commuter rail system at Bassett, adjacent to the San Gabriel River. There are freeway exits onto Valley Boulevard, which is parallel and south of the railroad. There are several potential parking lot and station sites in this area. There is a County of Los Angeles Department of Parks and Recreation supply yard north of the railroad and adjacent to a power line easement. A major drawback to these sites is the need to cross the railroad at grade to reach the station sites.

6.3 LOCAL STATIONS

Local stations will be required to provide access to the commuter rail network. Some of these local stations may be restricted in the number of trains which provide service during the rush periods.

6.3.3 San Bernardino Line

San Bernardino

The San Bernardino station will be the station of origin for commuter trains to Los Angeles and Orange Counties. In future, a night layover and maintenance of equipment facility will be located here. This entire area is under study for a railroad relocation project, for which land is available. Improved access to the I-215 freeway may be provided.

Rialto

Rialto is located 3.5 miles west of the existing San Bernardino station. A new station is proposed at Riverside Avenue, two miles north of the San Bernardino freeway. This site is an alternate to the San Bernardino station site for the railroad relocation project. Rialto is 3.9 miles from the site of a station proposed for Fontana. Because of the proximity of the Fontana station, a stop at Rialto may not be required.

Fontana

A Fontana station could be located at Sierra Avenue. This site is 7.5 miles from the existing San Bernardino station and two miles north of the San Bernardino freeway (I-10). The Fontana station would be six miles from the Rancho Cucamonga/Rochester station at the Devore freeway (I-15). This station would serve a large area of San Bernardino County and should receive full service.

Rancho Cucamonga

A Rancho Cucamonga station could be located at Haven Avenue, although a station site on the Las Vegas to Anaheim Superspeed Train line is also under consideration. The station site at the Devore freeway (I-15) may be close to the Superspeed route. Since the Haven Avenue location is less than two miles from the Devore freeway and about four miles from Upland, this station site may not be required.

Upland-Montclair-Claremont-Pomona

The Cities of Upland, Montclair, Claremont and Pomona are each candidates for commuter rail station. However, the entire distance of this segment is only 5.8 miles, resulting int stations less than two miles apart, which is too close for acceptable train operations.

The Upland site at Euclid Avenue would be 6.1 miles from Rancho Cucamonga/Rochester Station. The San Bernardino freeway (I-10) is at its most northerly alignment through Upland and Montclair, approximately 0.5 miles from the ATSF Pasadena subdivision. In Upland, the area along the rail line is highly developed, leaving little opportunity for construction of parking facilities.

A park-and-ride lot and express bus station are adjacent to the south side of the railroad tracks in Montclair. The land opposite the park-and-ride lot, north of the rail line is available for an expanded parking lot. This site would make a good combined Upland/Montclair area commuter rail station with full train service.

Claremont has proceeded with the selection of a consultant to design a transportation center around the original railroad station located between Indian Hill Boulevard and College Avenue. This site has limited land available for parking. The Baldwin Park branch operates on the ATSF Pasadena subdivision through Claremont. The connection to the Baldwin Park branch east of Claremont is proposed for use as a holding track for turnback train service to Los Angeles via the Azusa Loop and the Pasadena service. Claremont will receive sufficient service from the combination of through trains to Los Angeles on a limited basis and the Azusa Loop trains, which will originate at this location.

In Pomona, the existing intercity station is at Garey Avenue. This station site could be expanded with additional parking. This station will receive service similar to Claremont, except that through trains that do not stop at Claremont would stop at Pomona.

Covina

In Covina, a station could be located at Barranca or Citrus Avenue, on the rail line. Either location would have land available for parking an the station facility. The site would be four plus miles from the stations on either side and would receive a high level of service.

Baldwin Park

The City of Baldwin Park has suggested a site for the commuter rail station on Pacific Avenue behind City Hall. The parking would consist of several parcels around the station site and City Hall. This station site would require traffic engineering and pedestrian flow analysis to ensure access for both City Hall and Commuter Rail.

The Baldwin Park station would receive train service from the through San Bernardino - Los Angeles trains and, in the future, operations on the Azusa Loop. During rush period, not all trains will stop at the station.

El Monte

A commuter rail station could be constructed in El Monte adjacent to the busway station parking lot. The rail station would be an aerial structure, adjacent to the viaduct of the State Street Line.

The SP State Street line is single-track from Soto Street to North El Monte, a distance of 11 miles. The single-track segment is the main limitation on train headways. A stop on this single-track line would increase the time between trains, therefore this location is not recommended.

6.3.4 Pasadena Line

Azusa

Azusa will receive San Gabriel Valley-Pasadena service at the intermediate level and, in the future, the Azusa Loop service of the San Bernardino - Los Angeles service. In Azusa, the main north-south access is a one-way couplet of Azusa Avenue northbound and San Gabriel Avenue southbound. These streets cross the Pasadena subdivision just north of Foothill Boulevard, where a major commercial development is proposed. There may be potential for a joint development at this site, or a separate commuter rail station could be located on land available on either site of this location. Although the Pasadena service may be three to five years away, the land commitment should be made to secure the site.

Glendora

A station could be located at Glendora Avenue in Glendora. This site is not recommended because it would be less than one mile from the Glendora regional station.

Duarte-Monrovia-Arcadia

The Pasadena line is located about 1,000 feet south of the Foothill freeway (I-210) through Duarte and Monrovia. The original station site at Monrovia was located on Myrtle Avenue, which has a freeway exit. The grade crossing at Myrtle Avenue is on a curve in the rail line. Because of the super-elevation of tracks required, a station stop could not be made until west of the curve. A siding serving an industrial user is located west of the station, which may limit the size of the station platform.

East Pasadena

A station could be located in the freeway median at Sierra Madre Villa Avenue. This location would use a siding for the abandoned connection to the ATSF East Pasadena industrial spur to provide sufficient width for a platform and second track. Several commercial businesses have parking lots bordering the freeway in this area. Some opportunities may exist for joint development of station facilities off the freeway.

Pasadena

Pasadena will require a joint commuter rail, light rail, and connecting bus station. The existing station used by Amtrak is at Del Mar Boulevard. The right-of-way both north and south of this station is so narrow that commuter and light rail alignments could not be constructed parallel for turnback tracks or other use. It might be possible for the light rail to swing west, close t the station building and the commuter rail to continue straight on the east side of the light rail to form a joint station. This configuration would terminate the light rail here, south of the Pasadena Civic Center. There is freeway access to I-710 at Del Mar Boulevard. Parking at this site is limited.

An alternative would continue the light rail north to Memorial Park at the proposed Pasadena Civic Center West. The Park is separated from the existing railroad by a high retaining wall. Commuter rail could enter the station on a single-track on the west side of the site, adjacent to the retaining wall. The light rail would swing to the east side of the station site. Connections to buses could be made on the Walnut Street overhead bridge north of the station site. Freeway access is available at Fair Oaks Avenue and Marengo Avenue, which connect with Walnut Street west and east of the station site, respectively. Parking in this area is limited to garages.

If the commuter rail is extended west on the Foothill freeway and south on the I-710 freeway to the San Bernardino Line at Monterey Park, the Civic Center West station site would remain the light rail station. In this event, a new Pasadena commuter rail station could be located in the freeway median at Marengo Avenue or on the I-710 median at Colorado Boulevard. Under this plan, the exchange of passengers between systems would be reduced and could be handled where the light and commuter rail lines cross in South Pasadena.

7. EQUIPMENT STORAGE, SERVICING, AND MAINTENANCE FACILITIES

7.1 INTRODUCTION

This chapter evaluates potential locations and configurations of the facilities required for passenger rail equipment storage, servicing, and maintenance as well as organizational questions relating to the operations of these facilities. Tables 2, 3 and 4 **detail train service, equipment requirements and service locations associated with each start-up, intermediate, and high service scenarios.** For the purpose of this study, maintenance activities are classified into three categories, as follows:

Storage:

- Midday and night equipment storage
- Light cleaning including trash removal, sweeping and mopping
- Visual equipment inspections
- Emergency light repairs

Servicing:

- Locomotive fueling and sanding
- Control cars sanding
- Legally-mandated daily inspections
- Daily interior equipment cleaning
- Exterior washing
- Toilet servicing

Inspection/Repair:

- Mandatory inspections
- Preventive maintenance
- Periodic heavy interior cleaning
- Running repairs
- Heavy repairs
- Overhaul
- Component repair

7.2 LOCATION SELECTION CRITERIA

For commuter operations, total fleet size is generally a function of equipment needs during morning and evening peak periods plus additional equipment needed to substitute for units undergoing inspection or repair. Storage and service can usually occur between peak periods and do not effect peak equipment requirements. Optimal scheduling of inspection,

TABLE 2
START-UP OPERATING SCENARIO

	Equipment	*Requirements*		
	Trains	*Loco*	*Coaches*	*Service Location*
Ventura County - LA	4	4	16	Los Angeles
Santa Clarita - LA	3	3	12	Los Angeles
San Bernardino - LA	5	5	20	Los Angeles
San Gabriel - LA				
San Bernardino - Pasadena				
San Bernardino - Irvine	2	2	9	Los Angeles
Riverside - Irvine	2	2	9	Los Angeles
Hemet	2	2	8	Los Angeles
Orange County - LA	3	3	13	Oceanside
Sub-Total	21	21	87	(68 Trailers, 19 Cabs)
Spare Fleet		5	12	(8 Trailers, 4 Cabs)
Total	21	26	99	
Serviced at Los Angeles	18	21	84	
Serviced at Oceanside	3	4	15	
Day Storage at Los Angeles	17	20	78	
Day Storage at Irvine	4	5	21	
Night Storage at Moorpark	4	5	19	
Night Storage at Saugus	3	3	12	
Night Storage at San Bernardino	7	9	34	
Night Storage at Riverside	2	2	10	
Night Storage at Hemet	2	2	9	
Night Storage at Oceanside	3	4	15	

TABLE 3
INTERMEDIATE MAINTENANCE SCENARIO

	Equipment	*Requirements*		
	Trains	*Loco*	*Coaches*	*Service Location*
Ventura County - LA	5	5	23	Los Angeles
Santa Clarita - LA	5	5	18	Los Angeles
San Bernardino - LA	6	6	28	San Bernardino
Via Covina				
San Gabriel - LA				
Via Azuza				
San Bernardino - Pasadena	2	2	6	San Bernardino
San Bernardino - Irvine	4	4	20	San Bernardino
Riverside - Irvine	4	4	20	San Bernardino
Hemet	4	4	18	Los Angeles
Riverside	0	Use Hemet Equip.		
Orange County - LA	4	4	20	Oceanside
Sub - Total	34	34	153	(121 Trailers, 35 Cabs)
Spare Fleet		6	22	(16 Trailers, 6 Cabs)
Total	34	40	175	
Serviced at Los Angeles	14	16	67	
Serviced at San Bernardino	17	19	85	
Serviced at Oceanside	4	5	23	
Day Storage at Los Angeles	19	23	98	
Day Storage at Irvine	7	8	45	
Day Storage at Pasadena	1	1	3	
Night Storage at Moorpark	5	6	26	
Night Storage at Saugus	5	6	21	
Night Storage at San Bernardino	12	14	61	
Night Storage at Riverside	4	5	24	
Night Storage at Hemet	4	4	20	
Night Storage at Oceanside	4	5	23	

TABLE 4
HIGH MAINTENANCE SCENARIO

	Equipment	*Requirements*		
	Trains	*Loco*	*Coaches*	*Service Location*
Ventura County - LA	8	8	48	Los Angeles
Santa Clarita - LA	7	7	35	Los Angeles
San Bernardino - LA	6	6	33	Los Angeles
San Gabriel - LA	4	4	19	
San Bernardino - Pasadena	3	3	9	
San Bernardino - Irvine	5	5	31	Los Angeles
Riverside - Irvine	5	5	31	Los Angeles
Hemet	5	5	31	Los Angeles
	0	Use Hemet Equip.		
Riverside - LA	1	1	4	
Orange County - LA	6	6	32	Oceanside
Sub - Total	50	50	273	(68 Trailers, 19 Cabs)
Spare Fleet		8	30	(8 Trailers, 4 Cabs)
Total	50	58	303	
Serviced at Los Angeles	25	29	152	
Serviced at San Bernardino	19	22	115	
Serviced at Oceanside	6	7	35	
Day Storage at Los Angeles	27	33	180	
Day Storage at Irvine	9	11	65	
Day Storage at Pasadena	2	2	6	
Night Storage at Moorpark	8	9	55	
Night Storage at Saugus	7	8	40	
Night Storage at San Bernardino	14	17	80	
Night Storage at Hemet	5	6	30	
Night Storage at Riverside	5	6	30	
Night Storage at Oceanside	6	7	30	
Night Storage at Claremont	4	5	12	

maintenance, storage, and serving is an essential tool in controlling fleet size and cost. Non-essential equipment is a significant liability to a system because it must also be maintained, increasing not only capital but also operating costs.

Location of maintenance and storage facilities plays a key role in equipment utilization rates, because moving time from revenue to maintenance locations is a loss of both equipment and crew time. Maintenance facilities should be located as close as possible to terminal to reduce non-revenue train moves.

Storage facilities are required near line terminal points when equipment is not needed during mid-day and night periods. At outlying locations, where land is generally more available at a lower cost, storage facilities may be located near or incorporated into terminal design. For the proposed system, seven such storage facilities are recommended.

To minimize non-revenue moves, it is most efficient to locate servicing facilities near storage facilities. However, for outlying storage sites, that practice would require multiple facilities, in contrast to an in-bound site where several lines could be serviced in one location. Also, experience has shown that inspections are more accurate when performed in daylight than at night, even with state-of-the-art lighting. For the proposed system, Oceanside and Los Angeles offer the opportunity to both handle multiple lines and perform daylight inspections.

Inspection/repair facilities should also allow ease of equipment exchange between revenue and maintenance activities. Daytime repair is not critical because most work is performed indoors under lighting adequate for this function. For the proposed system, in addition to Oceanside and Los Angeles, San Bernardino offers proximity to major equipment storage sites and to ATSF locomotive overhaul facilities, which increases the pool of experienced workers.

At present, San Diego County plans to construct a storage, serving, and maintenance facility at Oceanside for Orange County and San Diego North County equipment. This study has focused on Los Angeles area needs, including the possibility of staged-construction with future expansion at Los Angeles or San Bernardino.

7.3 FACILITIES DESCRIPTION

To estimate land requirements to store, service, inspect and repair the Los Angeles fleet, the dimensions of the facilities footprint was determined. This footprint reflects a maintenance philosophy developed from the experience of existing and planned facilities for similar commuter systems, described below.

Trains for servicing will be operated into the yard locomotive forward from the terminal. They will be placed on either the servicing tracks or directly into the storage yard, if no servicing track is available. Trains on servicing tracks will receive the following services:

- Locomotive fueling
- Locomotive and control car sanding
- Daily cleaning
- Legally-mandated daily equipment inspection
- Toilet servicing
- Minor repairs

When servicing is complete, trains will be operated into the yard for storage or dispatched back to service. An automatic train washer located on the leads into the storage yard will wash the trains.

7.3.1 Progressive Intact Train Work

Locomotive and coach inspections will done by the progressive intact train approach, similar to GO Transit. Train sets will enter the shop approximately once every two to three weeks, at approximately 2000-mile intervals. During these visits work will be performed as follows.

Locomotives: All preventive maintenance and inspections required at intervals of 92-days or less as well as running repairs which can be performed within the shift time.

Coaches: All cleaning, preventive maintenance and inspections required at intervals of three years or less as well as running repairs which can be performed within the shift time.

Control Cars: All cleaning, preventive maintenance and inspections required at intervals of one year or less as well as running repairs which can be performed within the shift time.

7.3.2 Individual Unit Work

The following work will be performed on an individual unit basis:

- Locomotive 92-day, six-month, annual, and three-year air brake inspection work as well as running repairs and emergency component change-out.
- Coach three-year air brake work, control car annual air-brake work, running repairs which can not be done during one of the progressive visits, and minor modification work.
- Wheel profiling, which will be done with in-ground equipment.
- Truck and axle change-out for all equipment will be done with a drop table. Single-axle drop equipment on progressive tracks will also be used to change out coach and control car wheel sets.

7.3.3 Overhaul

Overhaul, major painting, major modifications and component overhauls, except air-brake and truck work, will be done off-site. The overhaul facility should be designed for high-service system requirements, as follows:

Servicing: 27 train sets per day between 9:00 a.m. and 3:00 p.m.

Storage: 20 trains and 140 cars (maximum at midday)
Minimum train length: 1 locomotive and 5 cars.
Maximum train length: 1 locomotive and 10 cars.

Inspection/Repair:

36 locomotives
230 coaches (36 control cars, 194 coaches)

# Trains	Length	Avg. Miles/Day
18	5 or less cars	200
6	6 or 7 cars	120
9	8 or more cars	120
33		

7.3.4 Staging Plan

For the purposes of developing a staging plan the following criteria has been assumed for the intermediate growth scenario.

Servicing: 18 train sets per day between the hours of 9:00 a.m. and 3:30 p.m.
Minimum train length: 1 locomotive and 3 cars
Maximum train length: 1 locomotive and 5 cars

Inspection/Repair:

21 locomotives
68 coaches (21 control cars, 47 coaches)
18 trains of 5 or less cars at an average of 120 miles per day

7.4 MAINTENANCE OF INTERCITY EQUIPMENT

Maintenance and storage of intercity equipment in the Los Angeles area is another factor for consideration in developing facilities footprint requirements. With proposed California service improvements, additional intercity equipment requiring maintenance will be acquired, requiring expansion of existing maintenance.

Since the commuter equipment will be located in Los Angeles only during the daytime hours, there is the potential for intercity equipment to use the proposed facility at night. Regional corridor trains could be maintained in a manner similar to the commuter equipment and could therefore use the same facilities. Joint use could reduce the need to expand existing intercity facilities as well as provide an alternative to the current maintenance contractor.

7.5 SITE SELECTION

The Amtrak Facility, ATSF First Street Yard, UP Forth Street Yard, SP Midway Yard, and SP Taylor Yard were evaluated as to their ability to handle operations described above. Sites were evaluated for efficiency and economy, with preference for existing and shared facilities. The results of the evaluation are summarized as follows:

7.5.1 Amtrak Facility

If the Amtrak facility were to be chosen, maintenance facilities required for commuter operations would have to be merged with the existing intercity equipment maintenance program. This program is tailored to labor agreements with the current operator.

Upon arrival at the storage and service facility, Amtrak trains are separated into individual units. Locomotive are sent to a fueling and sanding facility for inspection and minor repairs. Coaches and special purpose cars are inspected and repaired on a track equipped with a pit for intercross inspection. Following the inspection and repair process, equipment is washed prior to being placed in the storage yard. The actual sequence varies depending on the work load of the pit track and of the train washer. Once in the storage yard, internal servicing, including stocking food service cars is performed. Equipment is moved by switch engines to Union Station. Motive power is added later. Coaches and specialty cars receive monthly, 92-day, and annual inspections at a recently constructed facility, which contains a wheel-truing machine and other service equipment. The old roundhouse has a wheel drop table. This facility services 56 coaches and specialty cars each month.

This facility is located on a narrow site, extending more than a mile along west bank of the Los Angeles River. The wider portion or the site is at the south end, near Redondo Junction. Amtrak has constructed a new car maintenance facility next to the existing roundhouse in this wide area. The shops are about 2000 feet from the storage yard, which consists of six tracks with a pit track. This yard lies between the Santa Monica freeway bridge and the Olympic Boulevard bridge. Another yard, north of the Santa Monica Freeway bridge is currently used only for the train washer on the river side of the yard.

Commuter rail equipment would be maintained by the progressive intact train approach, as discussed in Section 7.3.1. Such a system has not been adapted for long-haul intercity passenger equipment, which has a wide variety of special purpose cars. For commuter rail equipment and certain intercity corridor trains, intact service provides much lower operating costs.

Because of the narrowness of the site, to service commuter trains here would require segmenting the facility into several separate buildings and functions. The only area wide enough handle a double-ended progressive maintenance facility is between the Santa Monica freeway bridge and the Seventh Street bridge. The area south of the freeway bridge could be used as a turnback to access the shop and as a location for the long-distance trains' washer. Commuter daytime service and storage could be handled in the area north of Seventh Street, which is the ATSF First Street Yard. Fueling, cleaning, and other services could be provided near Seventh Street bridge. In summary, although the Amtrak facility could physically accommodate the required facilities, its linear design with separation of facilities would lead to poor personnel utilization and awkward operations and the considerable cost advantages of intact train service and inspection would be lost.

7.5.2 ATSF First Street Yard

Individually, this yard does not contain sufficient land to support the required facilities. However, this yard could be combined with the Amtrak yard to make one yard with sufficient space.

7.5.3 Union Pacific Fourth Street Yard

Union Pacific maintains a freight yard on the east side of the Los Angeles River between Fourth and Seventh Streets. This yard was originally constructed to support local freight service along the east side of the river and the Glendale and Pasadena branches, which have diminished such that a single local switcher now provides all the service and operates from East Yard. Sufficient land is not available here, additional land would have to be acquired.

7.5.4 Southern Pacific Midway Yard

Midway Yard is located on the west side of the Los Angeles River between North Broadway and the Pasadena Freeway bridge. The steep hills of Elysian Park border the west side of the site. The overall width and length of the yard cannot accommodate needed commuter train service, storage and maintenance facilities. This site could be used to supplement the Taylor Yard site, as a staging facility, as long-term out of service storage, or as a location for Maintenance of Way facilities.

7.5.5 Taylor Yard

Southern Pacific is eliminating Taylor Yard as a freight facility and plans to sell much of the land. The southern end of the yard near Dayton Tower could be a potential location for the proposed facility. This site could be connected to the passenger terminal by the tracks used by Coast and Saugus line trains. There is sufficient land at the site to accommodate the required facilities. Site configuration would allow a central shop to be constructed with good track access and storage.

7.5.6 Summary

Of the five sites evaluated above, only the Amtrak/ATSF site and the Taylor Yard site have sufficient land to meet maintenance facility requirements.

7.6 INSTITUTIONAL ISSUES

Both the institutional framework for operating of the commuter rail system and the specific operator are yet to be determined. Operator options include an existing freight railroad, Amtrak or a private operations management company. A key goal in choice of operator will be the achievement of minimum operating costs. Use of an Amtrak owned and operated facility could mandate compliance with existing labor agreements and impose additional labor costs. Such compliance might reduce potential cost savings available under private contracting options.

7.7 CAPITAL COSTS

Land at the Amtrak facility would be available as Amtrak's contribution to the facility. However, the ATSF land required to complete the facility is very expensive, 250 percent higher than land at Taylor Yard. In addition, ATSF requires that the purchaser buy additional land and build a replacement yard.

Construction at the Amtrak site would also be more expensive and require a longer time than at Taylor Yard, due to the need to phase construction so as to avoid interference with existing operations. By contrast, at the Taylor Yard site the land is vacant.

7.8 RECOMMENDATIONS

Based on the above evaluation, we recommend that the Los Angeles maintenance facility be located on the Taylor Yard site. To verify that this site is workable, this option was developed to a level of design needed to assure that all required facilities can be accommodated and a good operational flow established. A separate report is being prepared on the Taylor Yard site.

8. FIXED FACILITIES REQUIREMENTS

8.1 INTRODUCTION

This chapter describes the fixed facilities which will be required to accommodate intercity and commuter rail service to the year 2000. Estimates assume a regional system, with service throughout the day during intermediate and high service operations. To accommodate moving train meets, sidings must be three miles apart. Storage and maintenance needs in Los Angeles are addressed in Chapter 6 of this report.

For improvements identified in the LOSSAN studies, projected capital costs were inflated to 1990 dollars. Intercity improvements not detailed in LOSSAN and commuter rail improvements on lines not subject to other study are included in this report.

8.2 CURRENT INTERCITY SERVICE

The following capital projects were identified by this study and LOSSAN I as needed to improve on-time performance. The current schedule calls for eight trains, each way, from Los Angeles to San Diego and two trains, each way, from Los Angeles to Santa Barbara. Although these recommendations are made for intercity service, they are also needed to begin commuter rail service.

Los Angeles Union Passenger Terminal **$9,217,000**

- o New interlocking layout for Terminal Tower.
- o Three-track lead from Terminal Tower to Mission Tower.
- o Two-track lead from Union Station to the west bank of the Los Angeles River, southbound, including the possibility of adding a future third track.
- o New consolidated signal control system, with future expansion capabilities.
- o Passenger amenities improvements planned in conjunction with the commuter rail system would also provide benefits for the intercity service. (See Task 5.4)

Mission Tower to Redondo Junction **$1,467,000**

- o Upgrade the existing single-track main line.
- o Upgrade the existing track adjacent to the main line to meet main line standards.
- o Reverse signal the second track, creating a double-track main line.

Hobart Tower to Fullerton **$28,965,000**

Install a Third Main Line track from Commerce to D.T. Junction and from La Mirada to Fullerton.

8.3 FUTURE INTERCITY SERVICE

This set of capital improvements would be required to provide a service level of ten trains, each way, between Los Angeles and San Diego and four trains, each way, between Los Angeles and Santa Barbara. Although these recommendations are made for intercity service, they are also needed to begin commuter rail service.

Burbank Junction to Oxnard **$5,236,000**

Install a centralized traffic control system to facilitate remote operation of all signals and sidings.

Burbank Junction to Gemco Yard **$9,814,000**

Install auxiliary sidings or double-track through freight switching area, with signals and turnouts which use the centralized traffic control system.

Gemco Yard to Northridge **$9,649,000**

Install auxiliary sidings or double-track through the freight switching area, with signals and turnouts which use the centralized traffic control system.

Reverse-Signalization **$1,338,000**

Reverse-signal each track of the double-track main line between Burbank Junction and Dayton Avenue Tower, upgrade the Allen Avenue crossovers, and install new crossovers south of Glendale Station. Signals and crossovers would use the centralized traffic control system.

Chatsworth Siding **$1,359,000**

Upgrade track and signals. Install high-speed turnouts at sidings. Signals and turnouts would use the centralized traffic control system.

Moorpark Siding **$1,410,000**

Upgrade track and signals. Install high-speed turnouts at sidings. Signals and turnouts would use the centralized traffic control system.

Simi Valley Siding **$1,529,000**

Relocate to the west. Upgrade with signals and high-speed turnouts. Install the centralized traffic control system (an on-going project of the City of Simi Valley, Caltrans and SP).

8.4 COMMUTER RAIL START-UP SERVICE

Union Station - General **$9,498,000**

Although not all of these improvements would be required immediately, they would be needed relatively soon, to assure long-term service reliability. To achieve maximum operating speeds, these improvements include, whenever possible, medium-speed turnouts and super-elevation of curves. All costs noted below include design, engineering and contingency.

- Install two additional station platform tracks.
- Construct two-track leads to the west bank line along the Los Angeles River, both northbound and southbound.
- Reconfigure Mission Tower, East Bank Junction and Pasadena Junction to allow the highest possible train operating speeds with the lowest possible maintenance costs.
- Provide access to the storage and maintenance facility at Taylor Yard by upgrading and constructing new trackage from Dayton Avenue Tower across the Los Angeles River Bridge, through Midway Yard to the Downey Connection to the ATSF Pasadena subdivision.

Union Station Access and Amenities **To Be Determined**

Improve the passenger tunnel, passenger flow to the Metro entrance, handicapped accessibility, and passenger amenities such as signage, lighting, platforms, and ticketing improvements.

Los Angeles Storage and Maintenance Facility **$36,529,000**

This facility will accommodate commuter rail trains that layover in Los Angeles between the morning and evening commute periods. The facility will include servicing tracks for refueling, cleaning, and other daily services, as well as a train washer. The facility will be designed to allow expansion as the system grows.

San Bernardino to Los Angeles Service **$23,548,000**

The following recommendations assume that the full system will incorporate both SP and ATSF trackage. If the full system were to use only the ATSF Pasadena subdivision, fewer improvements would be needed. If the SP Baldwin Park branch is used for service through to San Bernardino, substantially more costly improvements would be required between La Verne and Rialto. Long-term, the inner portion of the ATSF Pasadena subdivision is expected to be converted into a light rail line. Alternatives for future service on the ATSF Pasadena subdivision from Azusa to Pasadena are currently under separate analysis.

- Replace the track and turnouts on the Baldwin Park branch from Bassett to La Verne with continuous welded rail, new ties and stone ballast, undercut in sections. Replace all switch timber and switch steel. Rebuild all highway grade crossings and upgrade, as needed, with complete gates, lights, cantilevers, and motion detectors.

- Construct a new connection from the Baldwin Park branch to the ATSF Pasadena subdivision at La Verne. A high-speed turnout would connect to the ATSF Pasadena subdivision, west of this location. A new grade crossing would be required at Arrow highway.

- Extend the El Monte siding east to the San Gabriel River Bridge. Install a high-speed turnout at the bridge end of the siding.

- Install a high-speed turnout at the west end of the Bassett siding on the main line. Upgrade the north siding and connection to the Baldwin Park branch with a medium-speed turnout.

- Install a signal system on the Baldwin Park branch from Bassett to La Verne. Replace the grade crossing protection.

- Install a new centralized traffic control system on the Baldwin Park branch from Bassett to La Verne and on the ATSF Pasadena subdivision from La Verne to San Bernardino. Upgrade the existing centralized control system on the SP State Street line. Convert to a single system for all lines.

- Construct a night-layover facility for Commuter Rail trains at San Bernardino, in conjunction with the San Bernardino -Riverside - Irvine service. Design the facility with future expansion capabilities.

Santa Clarita to Los Angeles Service **$12,876,000**

- o Install a new centralized dispatching and signal control system from Burbank Junction to Saugus.
- o Upgrade the Sylmar siding with high-speed turnouts and signals. Extend the siding north to the tunnel side track to accommodate a station.
- o Upgrade the Saugus siding with high-speed turnouts and signals.
- o Construct a night-layover facility for the Commuter Rail trains at Saugus.

Ventura County to Los Angeles Service **$2,667,000**

Construct a night-layover facility for Commuter Rail trains at Camarillo or Moorpark.

8.5 COMMUTER RAIL INTERMEDIATE SERVICE

System-wide Needs **$20,545,000**

- o Expand yard facilities at Los Angeles to accommodate additional Commuter Rail trains.
- o Expand or construct an additional maintenance facility for the additional Commuter Rail and/or Amtrak trains.
- o Construct a second track from the Los Angeles storage and maintenance facility to Union Station. This project would include a second Los Angeles River Bridge at Dayton Avenue.

San Bernardino to Los Angeles Service **$15,846,000**

- o Extend the State Street siding east, as far as possible. From Soto Street, extend it approximately 0.5 miles along the north side of the El Monte busway. Install a high-speed turnout.
- o Extend the Bassett siding to connect along the main line to the Baldwin Park branch siding and upgrade for higher-speed operations.
- o Rebuild and upgrade the siding at Baldwin Park and Azusa Junction. Connect the two sidings. Install high-speed turnouts and signals.
- o Construct a new siding using part of the former Covina siding from Hollenbeck Street to Barranca Street. Use high-speed turnouts and signals.

- o Construct a new siding at Pomona, on the south side of the main line, from Thompson Creek channel to the Claremont siding.
- o Upgrade the Claremont siding.
- o Construct a universal crossover near the center of the new siding. Use high-speed turnouts and signals throughout.
- o Upgrade the siding at Cucamonga, including high-speed turnouts and signals.
- o Upgrade the Kaiser siding and extend it west. Install high-speed turnouts and signals. Construction alternatives include using the first yard track or creating a new second siding, south of the main line.
- o Expand the night Commuter Rail night-layover facility in San Bernardino.

Santa Clarita to Los Angeles Service **$13,951,000**

- o Construct a new siding at Sun Valley, with high-speed turnouts and signals.
- o Extend the Pacoima siding north to connect with the San Fernando siding. Upgrade with high-speed turnouts and signals.
- o Upgrade and extend the existing side track into one long siding from Newhall through Saugus, with a universal crossover in its center.
- o Expand the Commuter Rail night-layover facility at Saugus.

Ventura County to Los Angeles Service **$9,955,000**

- o Construct a second, main track or auxiliary siding from Northridge to Chatsworth and extend the Chatsworth siding to the west. Upgrade with high-speed turnouts and signals.

8.6 COMMUTER RAIL HIGH SERVICE

System-wide Improvements **$53,048,000**

- o Relocate the mail platform at Union Station.
- o Construct additional platform tracks at Union Station.
- o Expand the Los Angeles layover facility.

- o Expand the equipment-maintenance facility.
- o Construct an additional facility at San Bernardino or Oceanside.

San Bernardino to Los Angeles Service **$14,822,000**

- o Construct a new siding with high-speed turnouts and signals on the State Street line, between Monterey Park and South San Gabriel. Reduce the disabled vehicle lanes on the El Monte busway by seven feet on each side and reconstruct the five bridges for double-track.
- o Construct a second main track from El Monte to Bassett, with a new San Gabriel River Bridge. A third track may be required in this area.
- o Construct a second main track from the Covina siding to the Pomona siding, with a universal crossover at La Verne and San Dimas.
- o Reconstruct the Azusa branch from Irwindale to Baldwin Park, including new rails, ties, stone ballast and signals.

8.7 ALTERNATIVE SERVICE ON THE PASADENA SUBDIVISION

Azusa Branch Service **$5,335,000**

- o Provide a new connection to the ATSF Pasadena subdivision at Irwindale.
- o Connect two sidings at Irwindale and upgrade with high-speed turnouts and signals.

La Verne to Pasadena Service **$3,430,000**

- o Construct a new siding in the center of the Foothill freeway at Sierra Madre. Use high-speed turnouts and signals.
- o In conjunction with the Pasadena Light Rail Project, construct a joint-use station for Commuter Rail turnback trains.

Santa Clarita to Los Angeles Service **$8,130,000**

- o Construct a second main track by connecting the Sun Valley siding to the Pacoima siding.

- Construct a second main track by connecting the Pacoima siding to the Sylmar siding.

Ventura County to Los Angeles Service **$11,171,000**

- Construct auxiliary sidings to allow local freight switching from Burbank Airport to the Hewitt siding.
- Construct auxiliary sidings to allow rapid passenger train by-pass of heavy freight locations from the Hewitt siding to Gemco Yard.
- Construct auxiliary sidings to allow rapid passenger train by-pass of heavy freight locations from Gemco Yard to Raymer.
- Construct an auxiliary siding from north of Burbank Junction on the Saugus line to Burbank Yard.
- Construct an auxiliary siding from Burbank Yard to Glendale and Taylor Yard lead. This project will allow rapid, passenger moves to downtown, unencumbered by freight service scheduling.

8.8 CANDIDATE IMPROVEMENT REQUIRING FURTHER ANALYSIS: REDONDO JUNCTION GRADE SEPARATION

Improvements are being considered at Redondo Junction in conjunction with a study in progress by the Consolidated Transportation Corridor Joint Powers Authority. A possible option is to raise the double-track main line of the ATSF San Bernardino subdivision on a 1.0 percent grade from Hobart Tower, crossing the Los Angeles River with a new alignment on a new bridge. The new alignment would pass over Washington Boulevard and the Consolidated Transportation Corridor. The line would then descend on a 1.1 percent grade to the west bank of the Los Angeles River, near the Olympic Boulevard overhead bridge. The ATSF freight service to the Ports of Los Angeles and Long Beach would follow the UP San Pedro branch north from Hobart Yard and west to Redondo Junction.

APPENDIX A

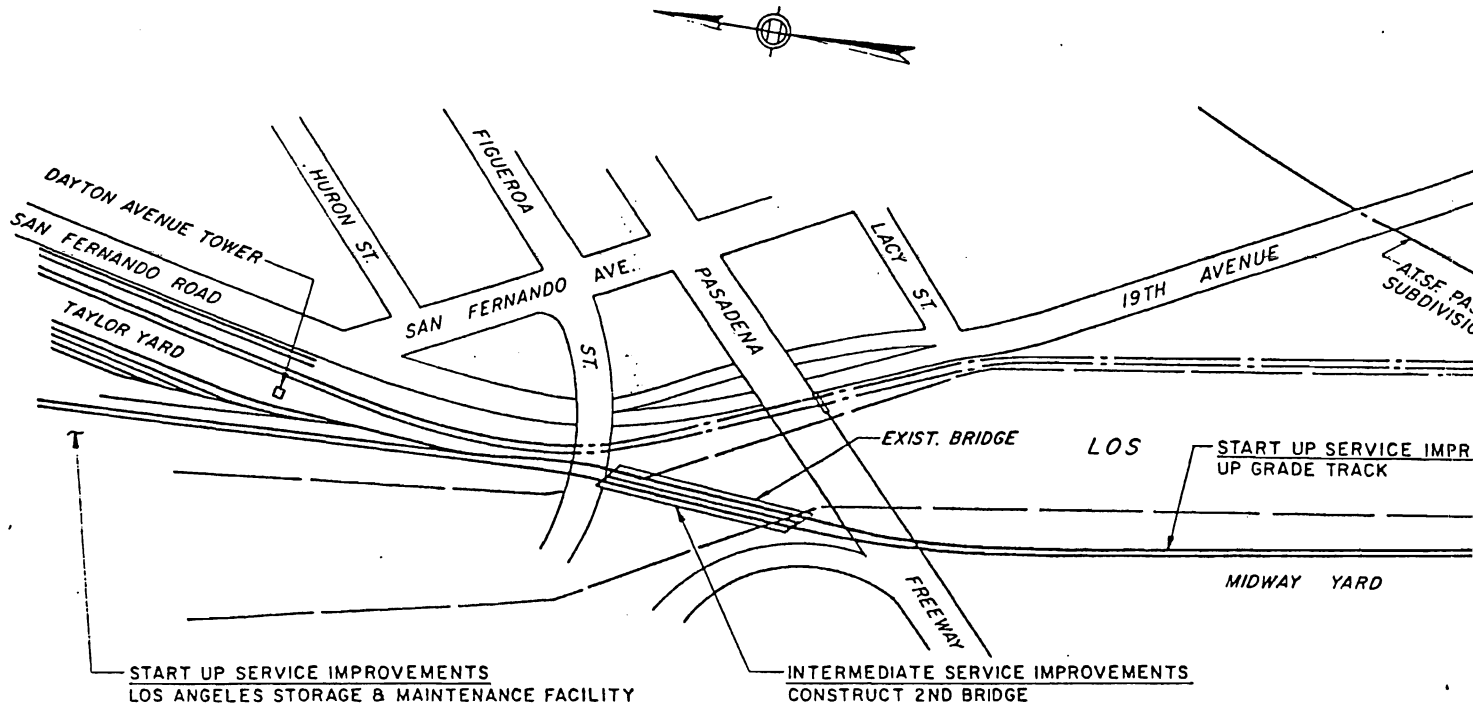
UNION STATION TRACK ALIGNMENT PLAN

APPENDIX B

DAYTON AVENUE TOWER TO NORTH BROADWAY TRACK ALIGNMENT PLAN

APPENDIX C

FACILITY IMPROVEMENTS CHARTS


DAYTON AVENUE TOWER
SAN FERNANDO ROAD
TAYLOR YARD
HURON ST.
FIGUEROA
SAN FERNANDO AVE.
ST.
PASADENA
LACY ST.
19TH AVENUE
EXIST. BRIDGE
LOS
START UP SERVICE IMPR
UP GRADE TRACK
MIDWAY YARD
FREEWAY
START UP SERVICE IMPROVEMENTS
LOS ANGELES STORAGE & MAINTENANCE FACILITY
INTERMEDIATE SERVICE IMPROVEMENTS
CONSTRUCT 2ND BRIDGE

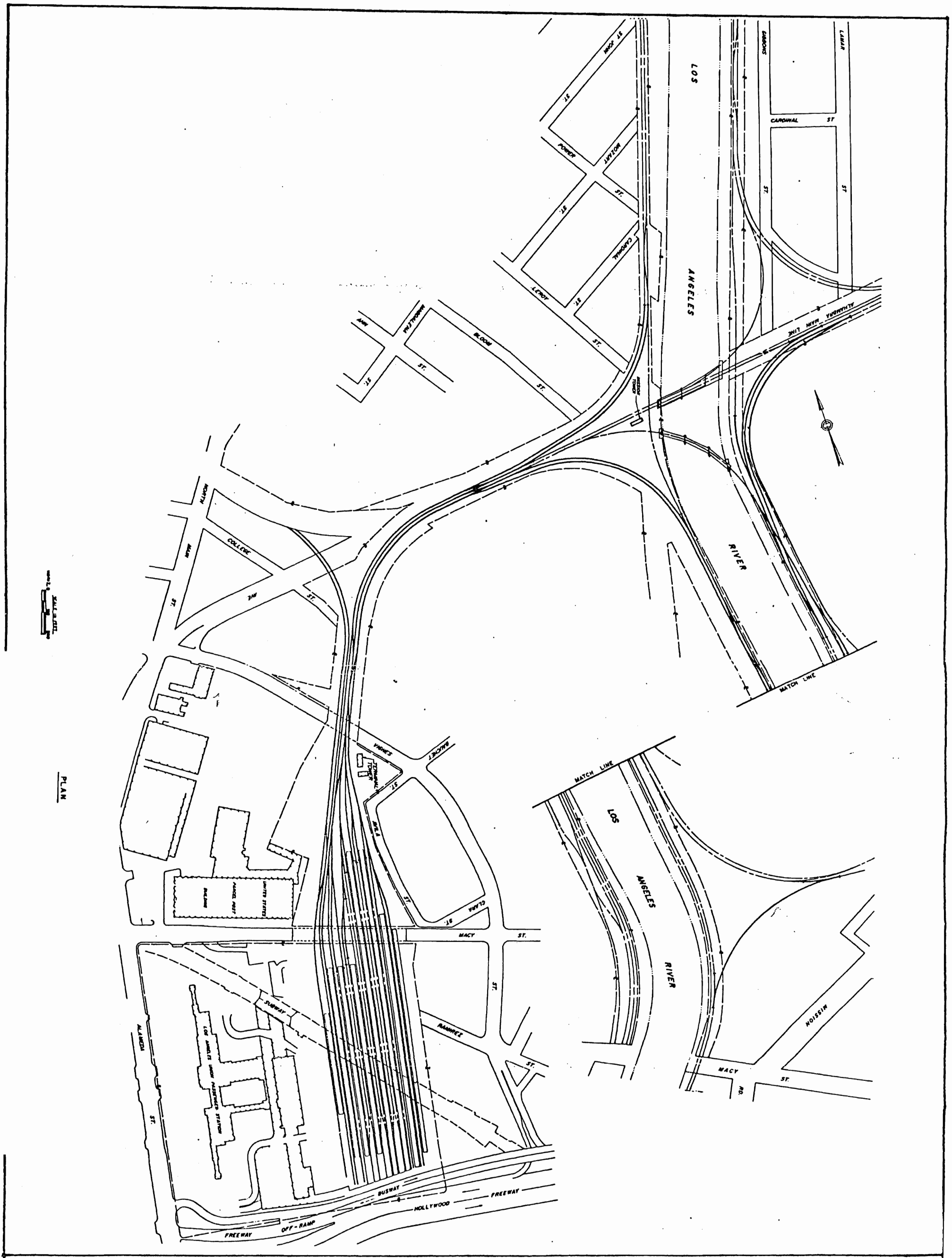


FIGURE UNION PASSENGER TERMINAL TRACK ALIGNMENT IMPROVEMENTS

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LEGEND

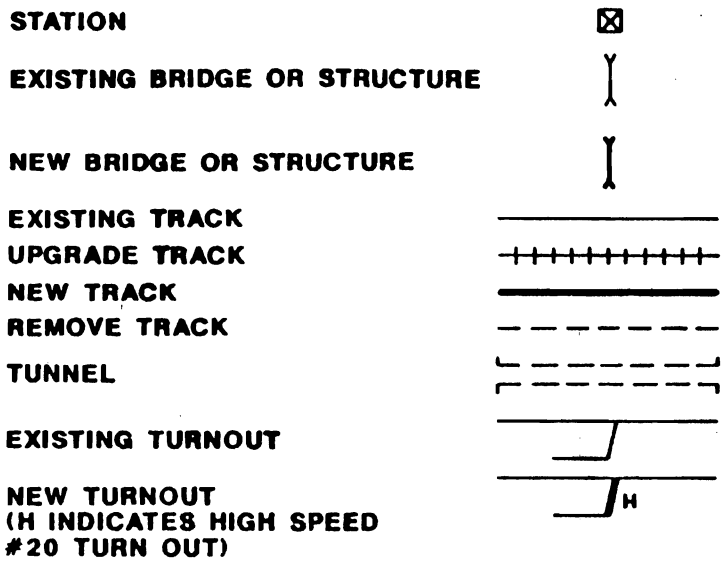

FIGURE **M.P.** **TO M.P.**

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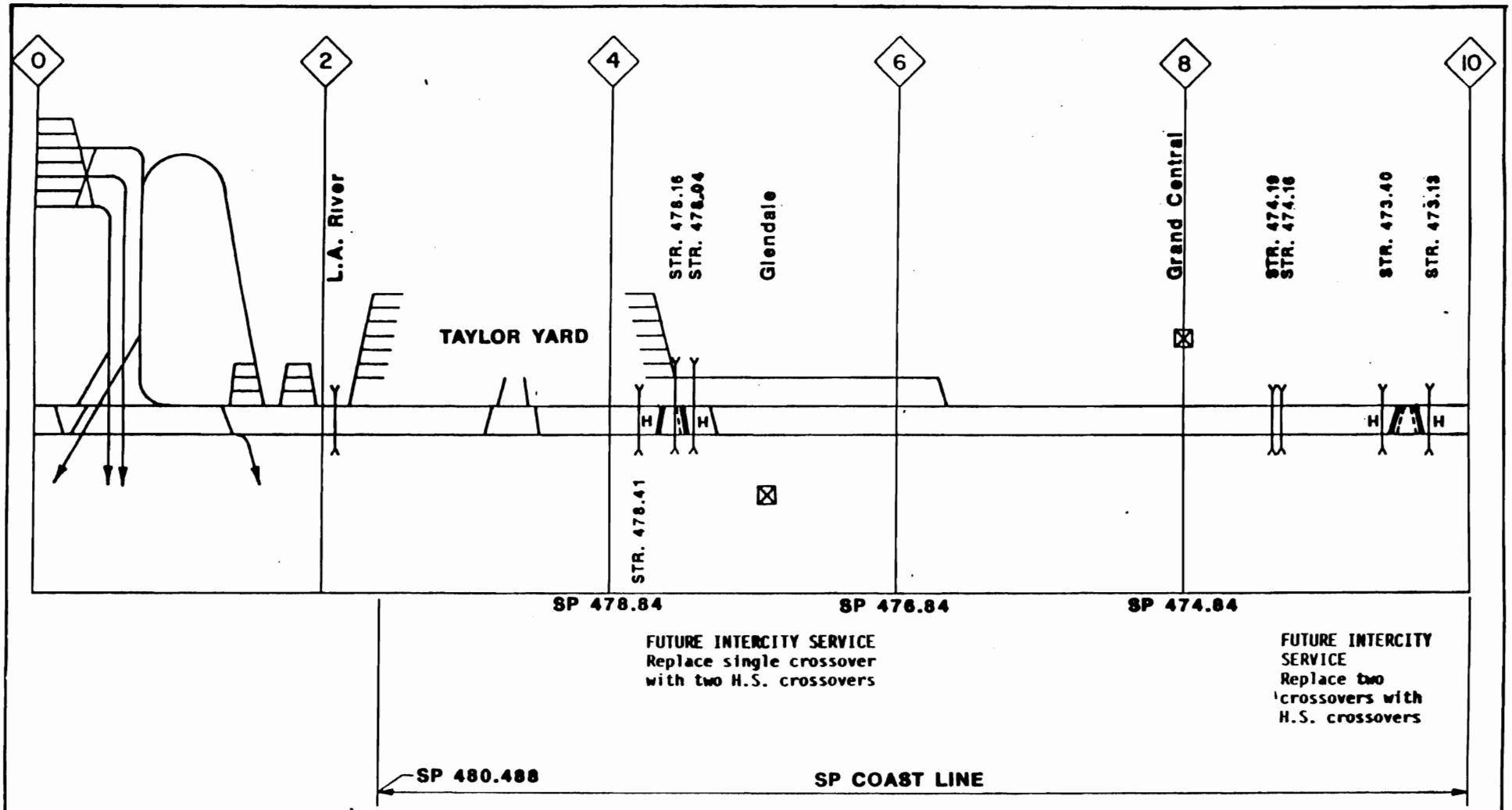

FIGURE **VENTURA COUNTY TO LOS ANGELES SERVICE** **M.P. 0 TO M.P. 10**

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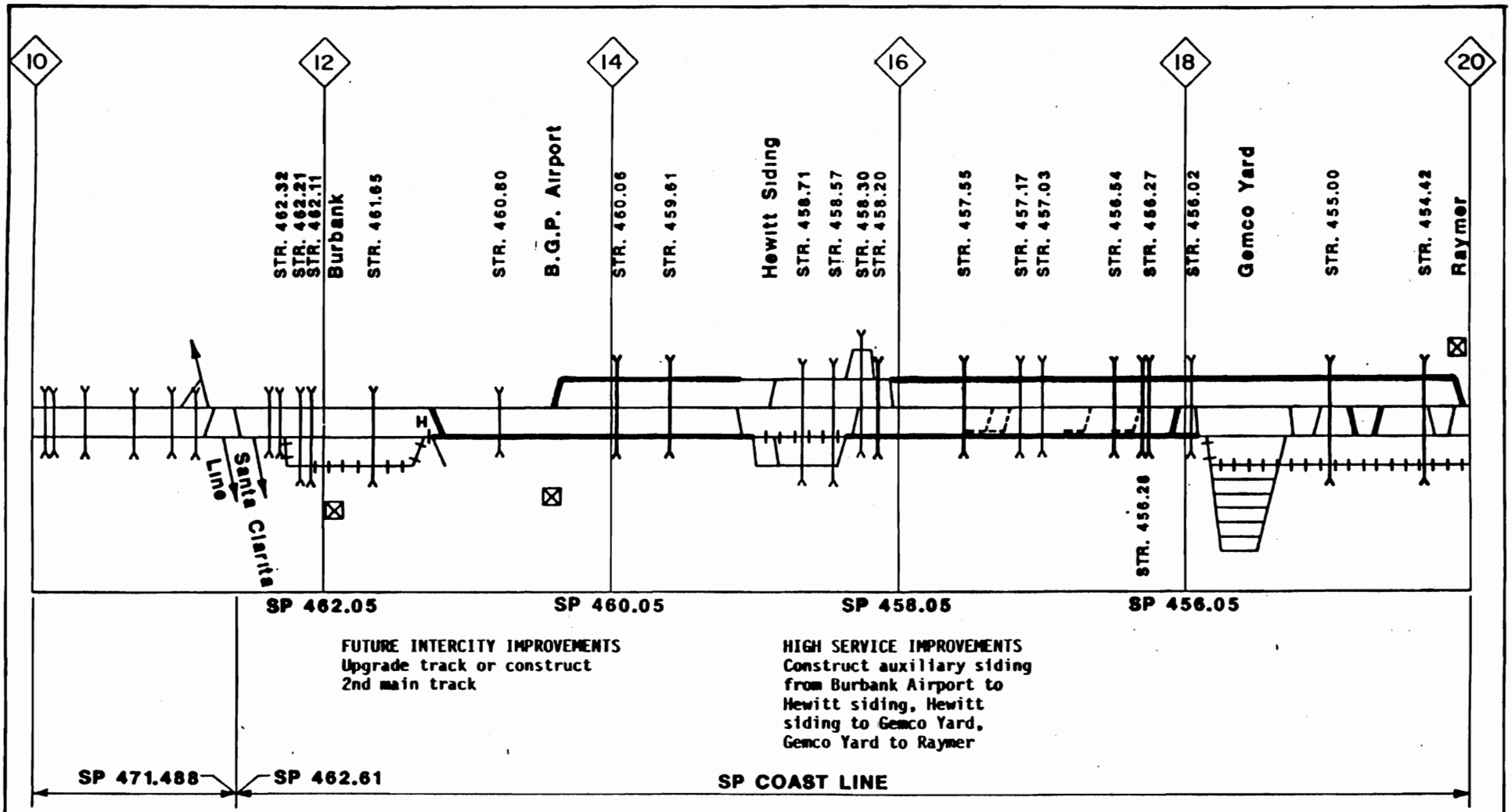

FIGURE **VENTURA COUNTY TO LOS ANGELES SERVICE** **M.P. 10 TO M.P. 20**

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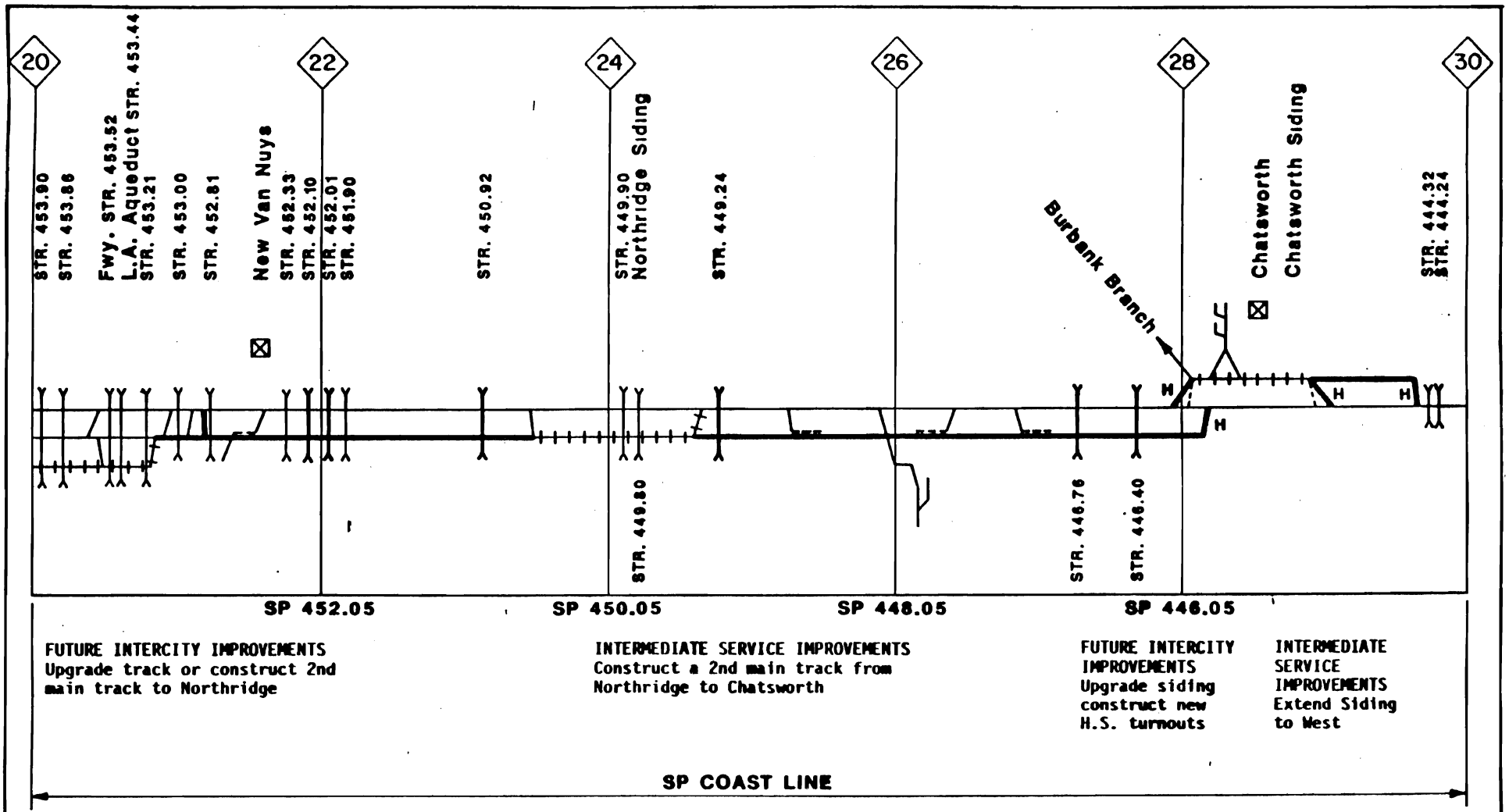

FIGURE **VENTURA COUNTY TO LOS ANGELES SERVICE** **M.P. 20 TO M.P. 30**

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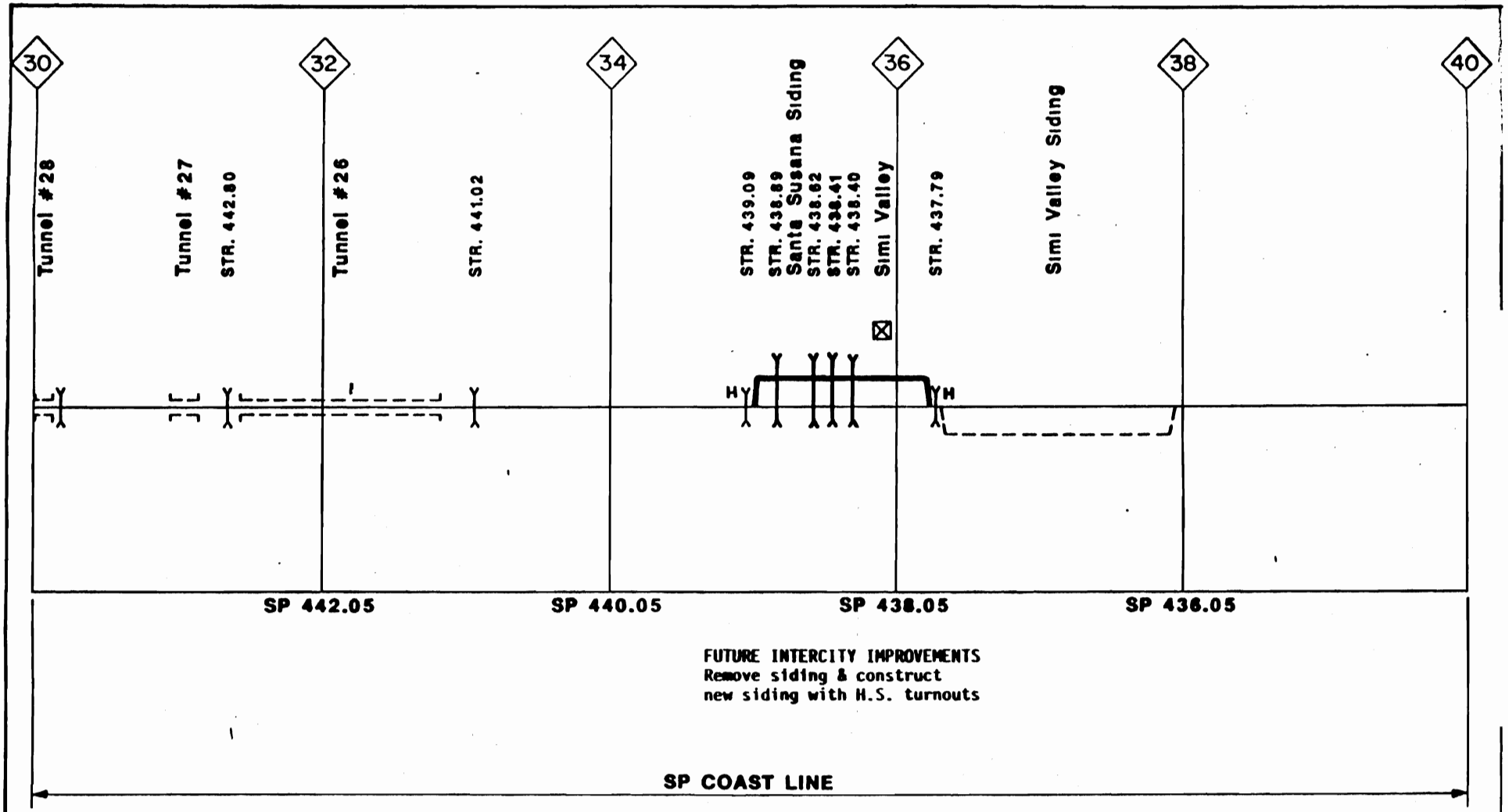

FIGURE **VENTURA COUNTY TO LOS ANGELES SERVICE** **M.P. 30 TO M.P. 40**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

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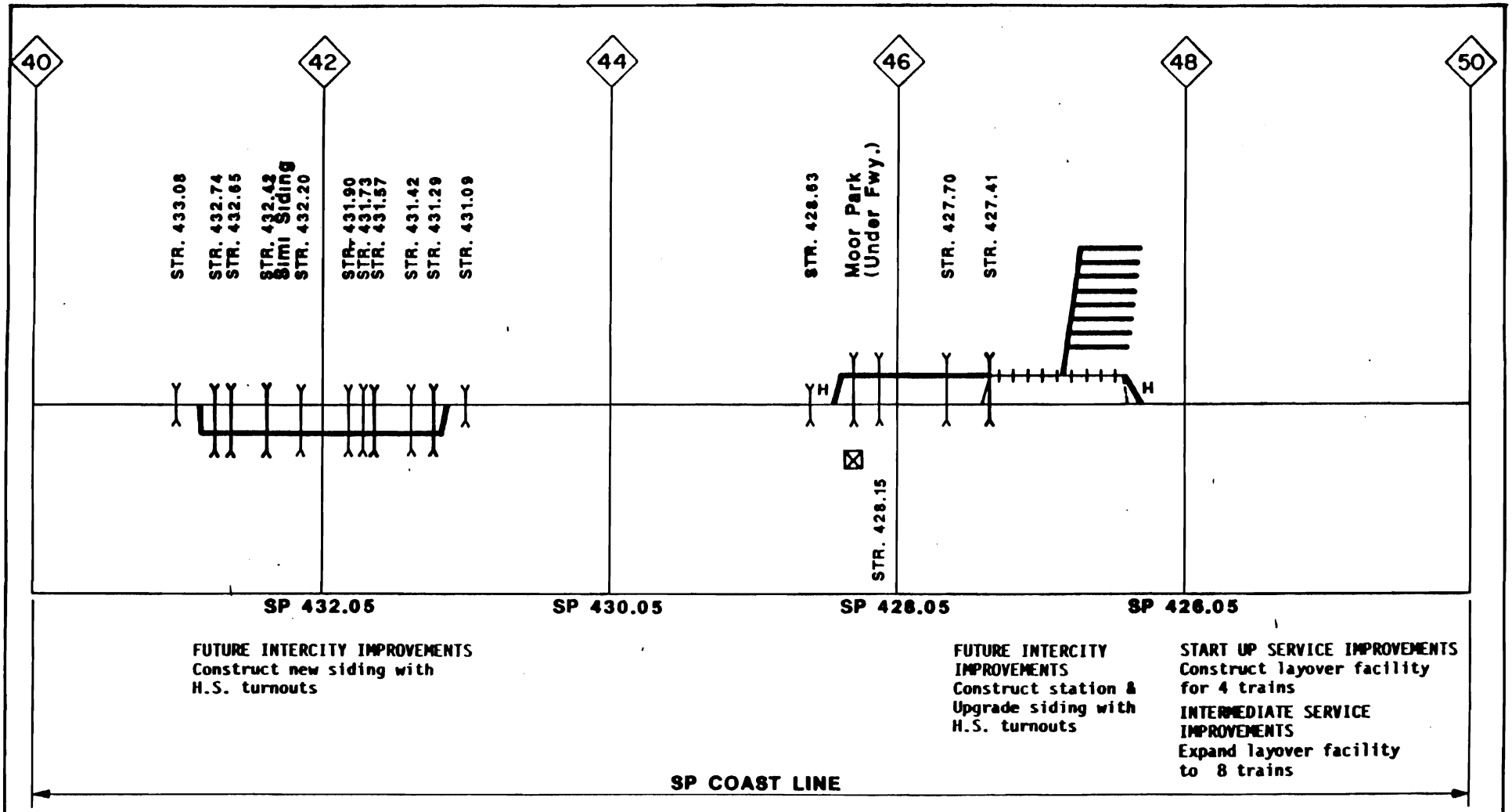

FIGURE **VENTURA COUNTY TO LOS ANGELES SERVICE** **M.P. 40 TO M.P. 50**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission

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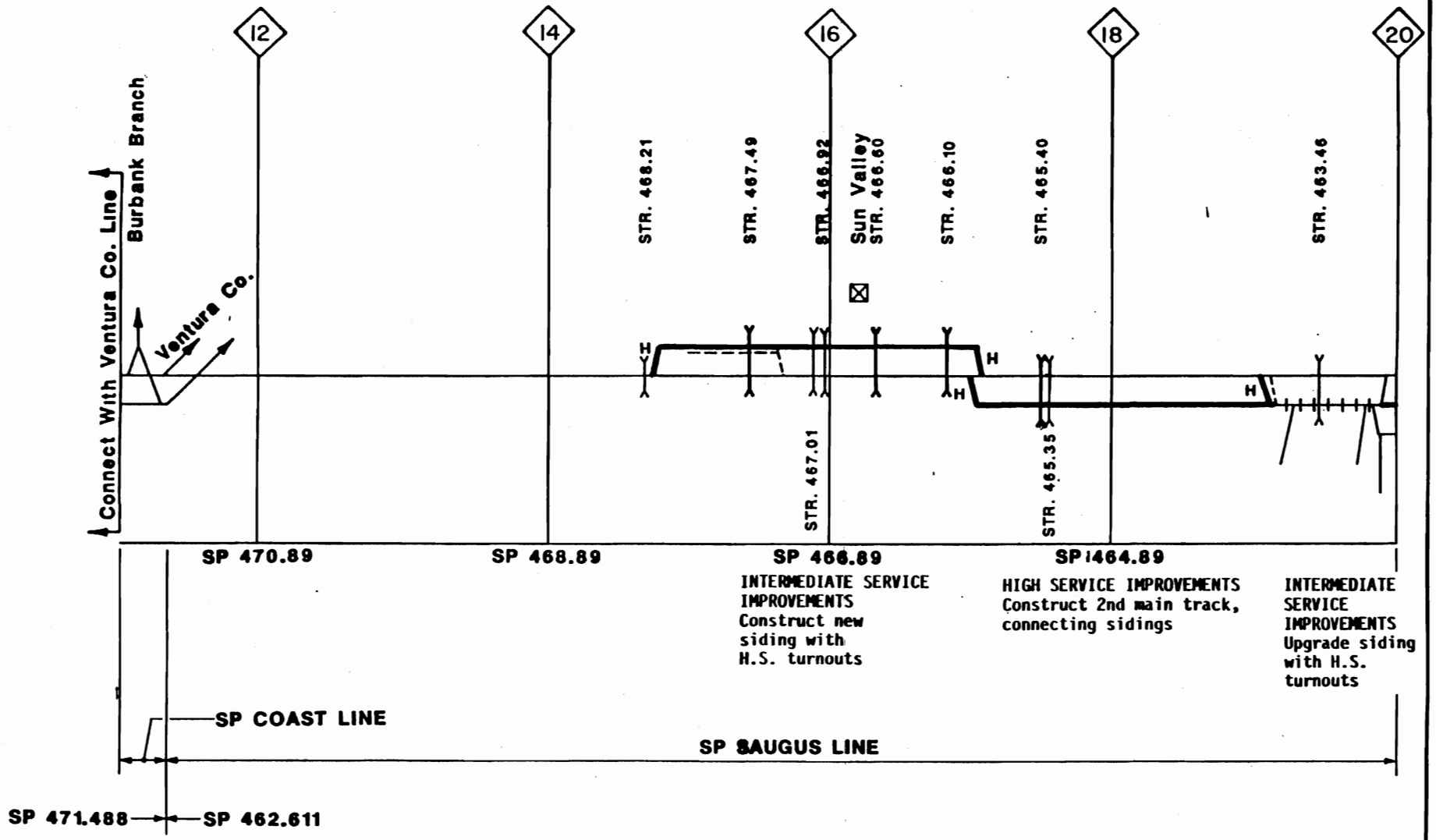

FIGURE **SANTA CLARITA TO LOS ANGELES SERVICE** **M.P. 12 TO M.P. 20**

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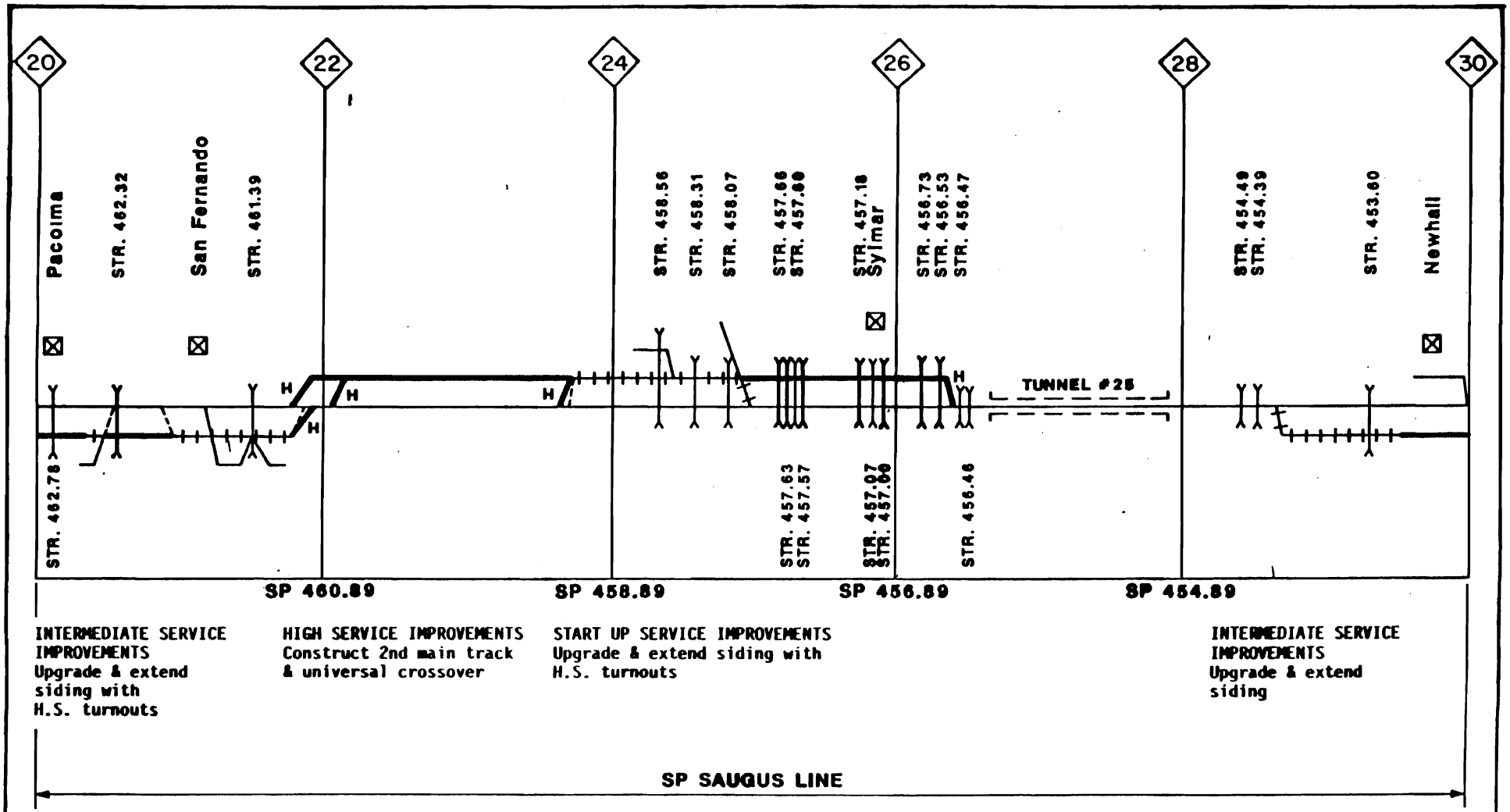

FIGURE **SANTA CLARITA TO LOS ANGELES SERVICE** **M.P. 20 TO M.P. 30**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission

California State Department of Transportation Division of Rail

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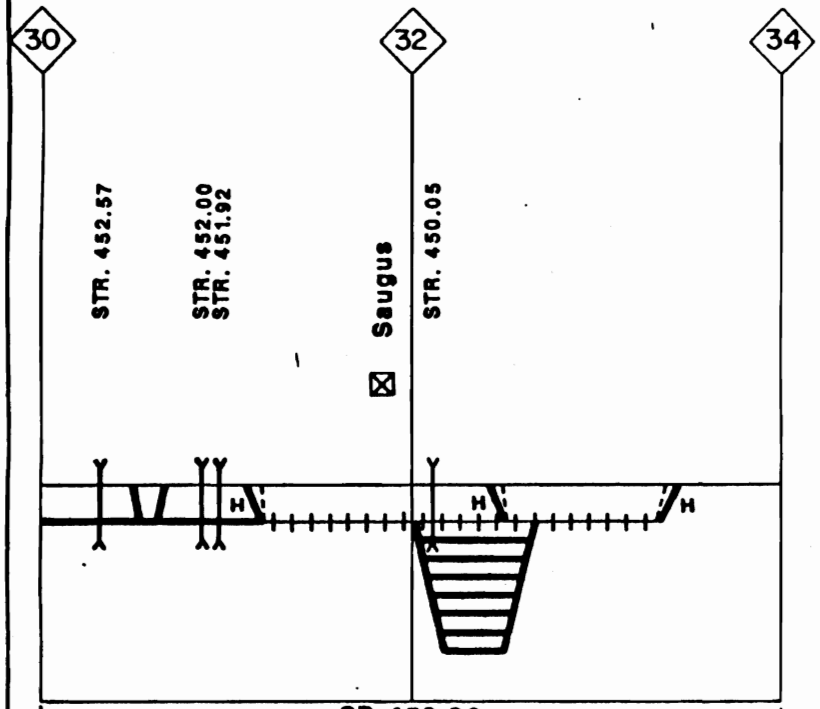

FIGURE **SANTA CLARITA TO LOS ANGELES SERVICE** **M.P. 30 TO M.P. 34**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission
LACTC

California State Department of Transportation
Division of Rail

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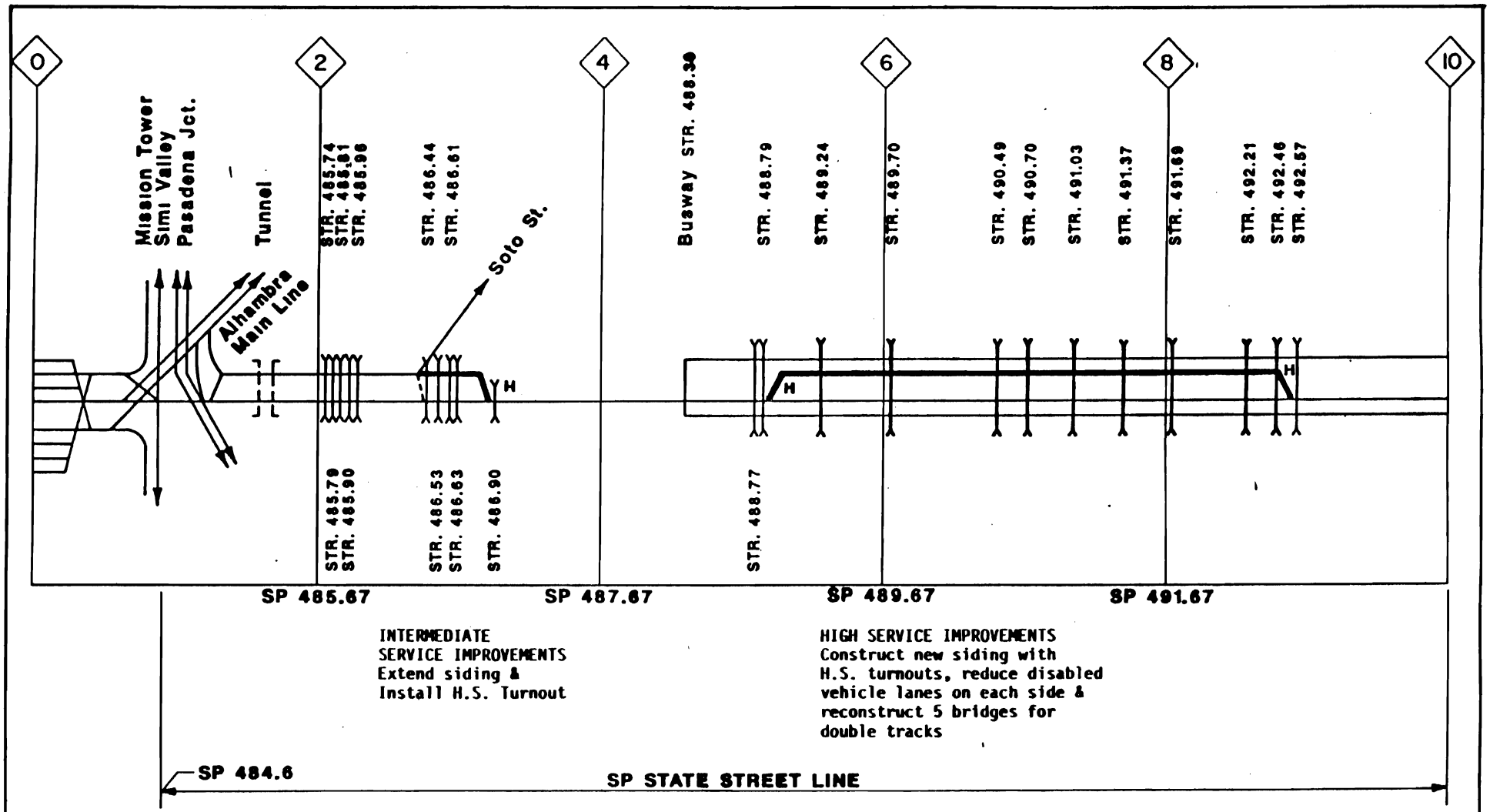

FIGURE **SAN BERNARDINO TO LOS ANGELES SERVICE** **M.P. 0 TO M.P. 10**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission

California State Department of Transportation Division of Rail

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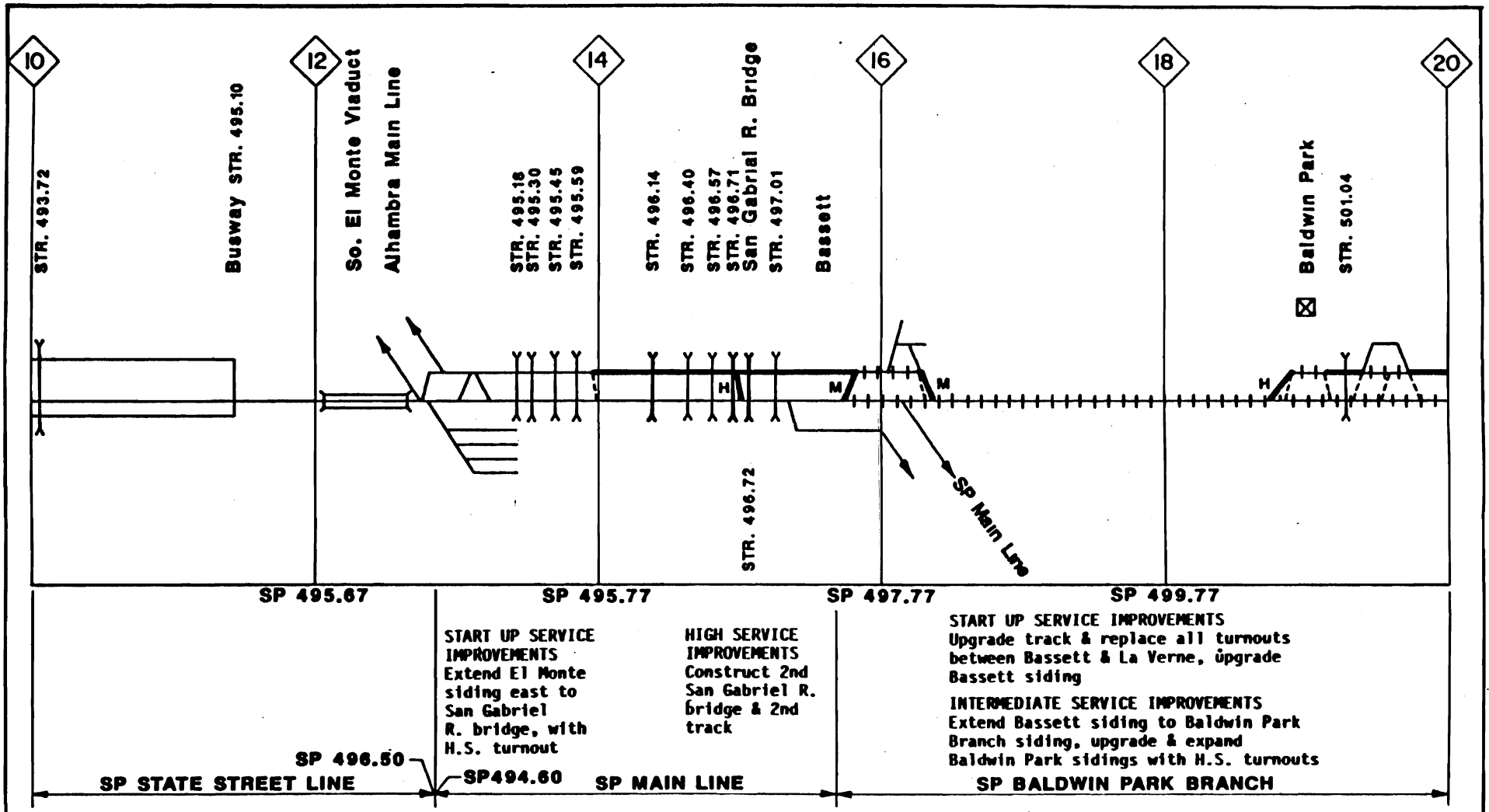

FIGURE **SAN BERNARDINO TO LOS ANGELES SERVICE** **M.P. 10 TO M.P. 20**

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Los Angeles County Transportation Commission

California State Department of Transportation Division of Rail

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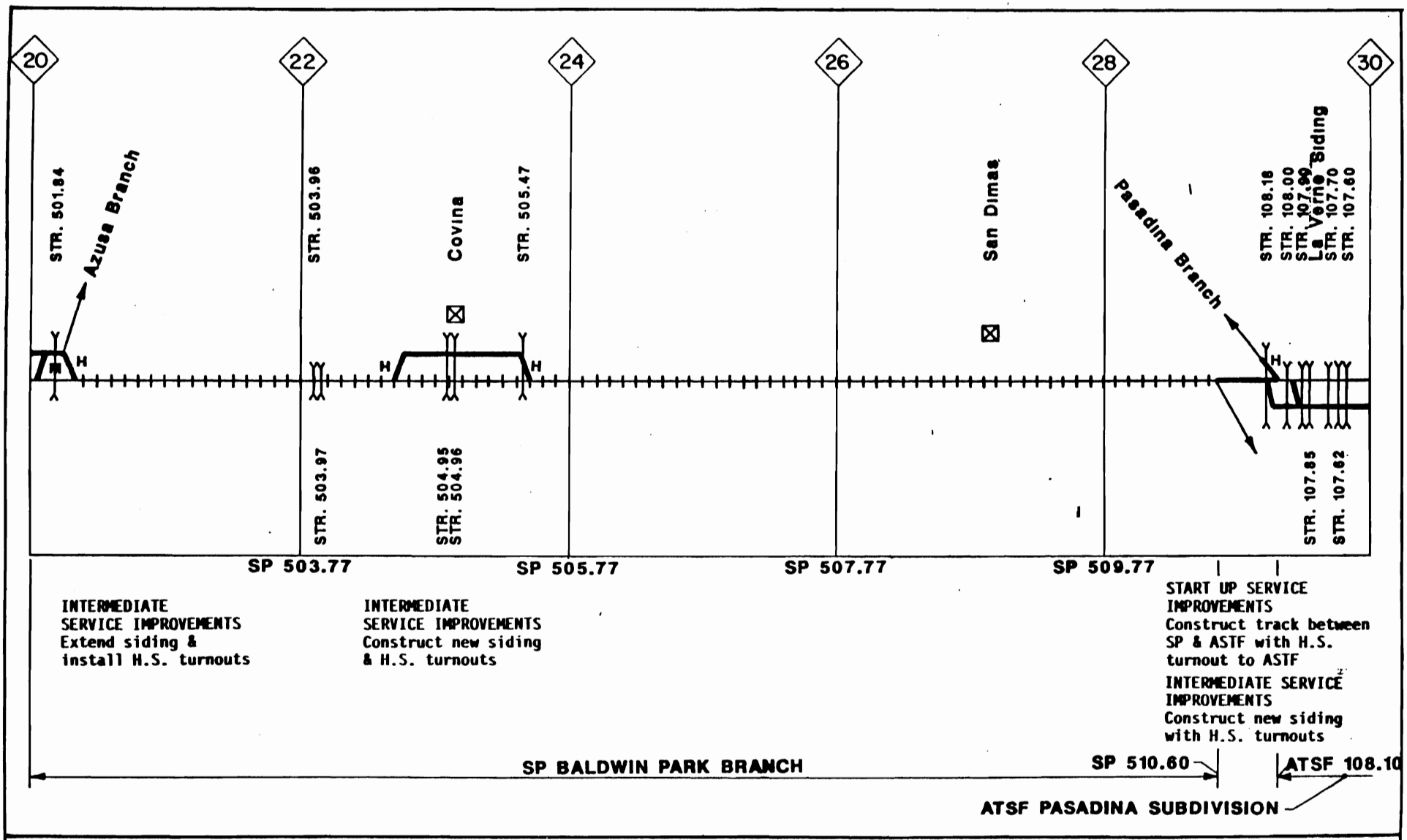

FIGURE **SAN BERNARDINO TO LOS ANGELES SERVICE** **M.P. 20 TO M.P. 30**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission

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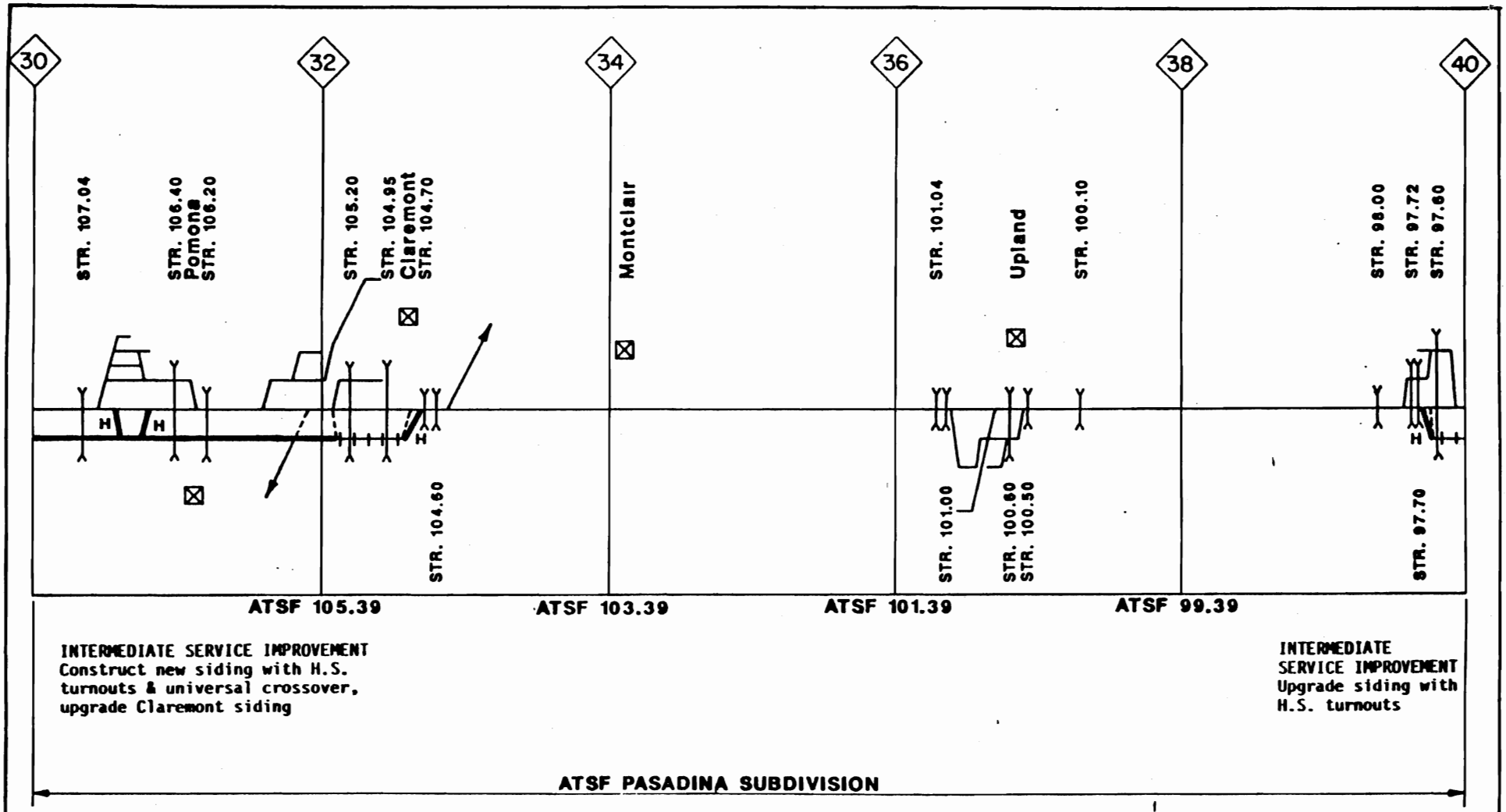

FIGURE **SAN BERNARDINO TO LOS ANGELES SERVICE** **M.P. 30 TO M.P. 40**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission
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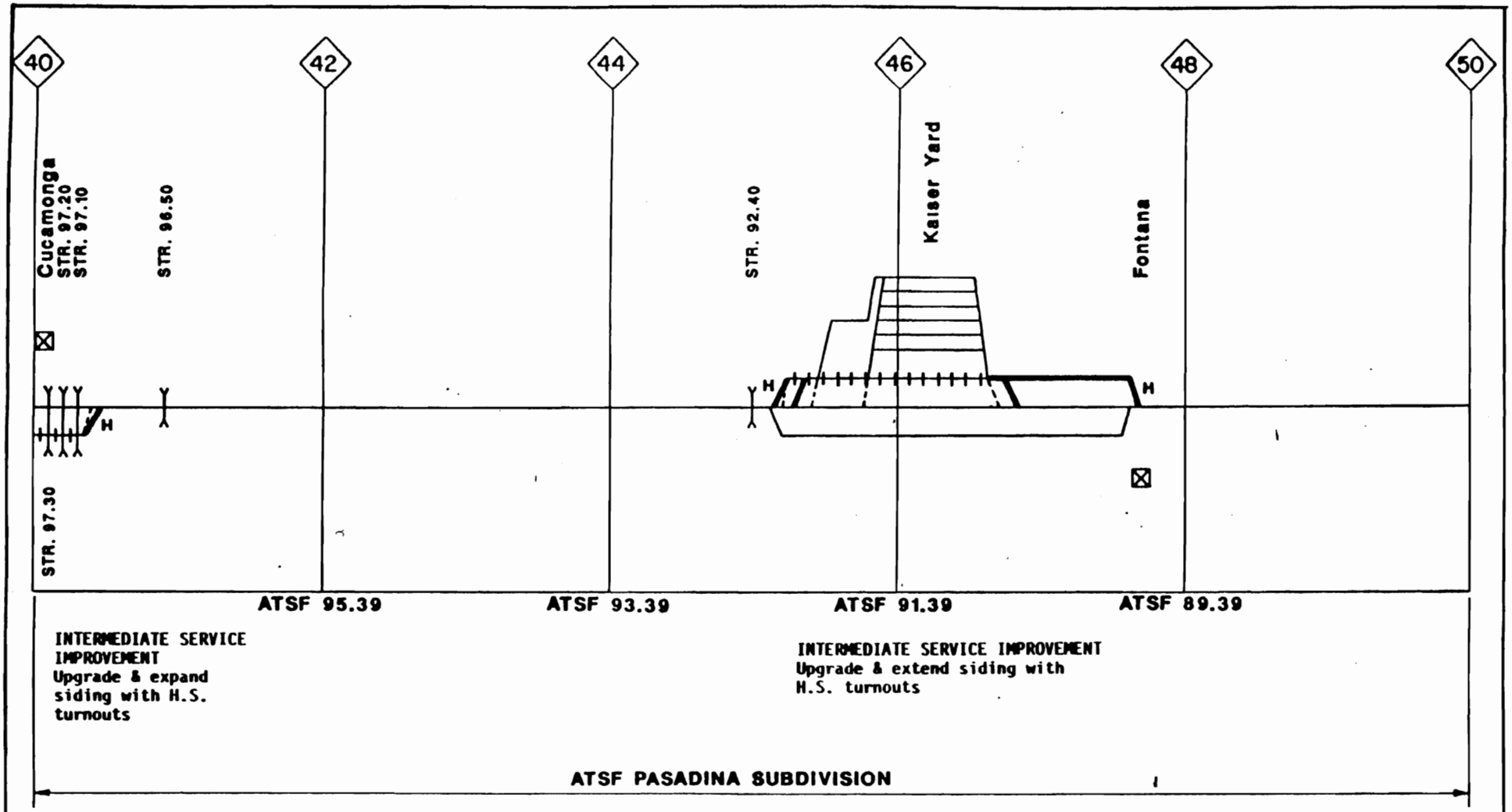

FIGURE **SAN BERNARDINO TO LOS ANGELES SERVICE** **M.P. 40 TO M.P. 50**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

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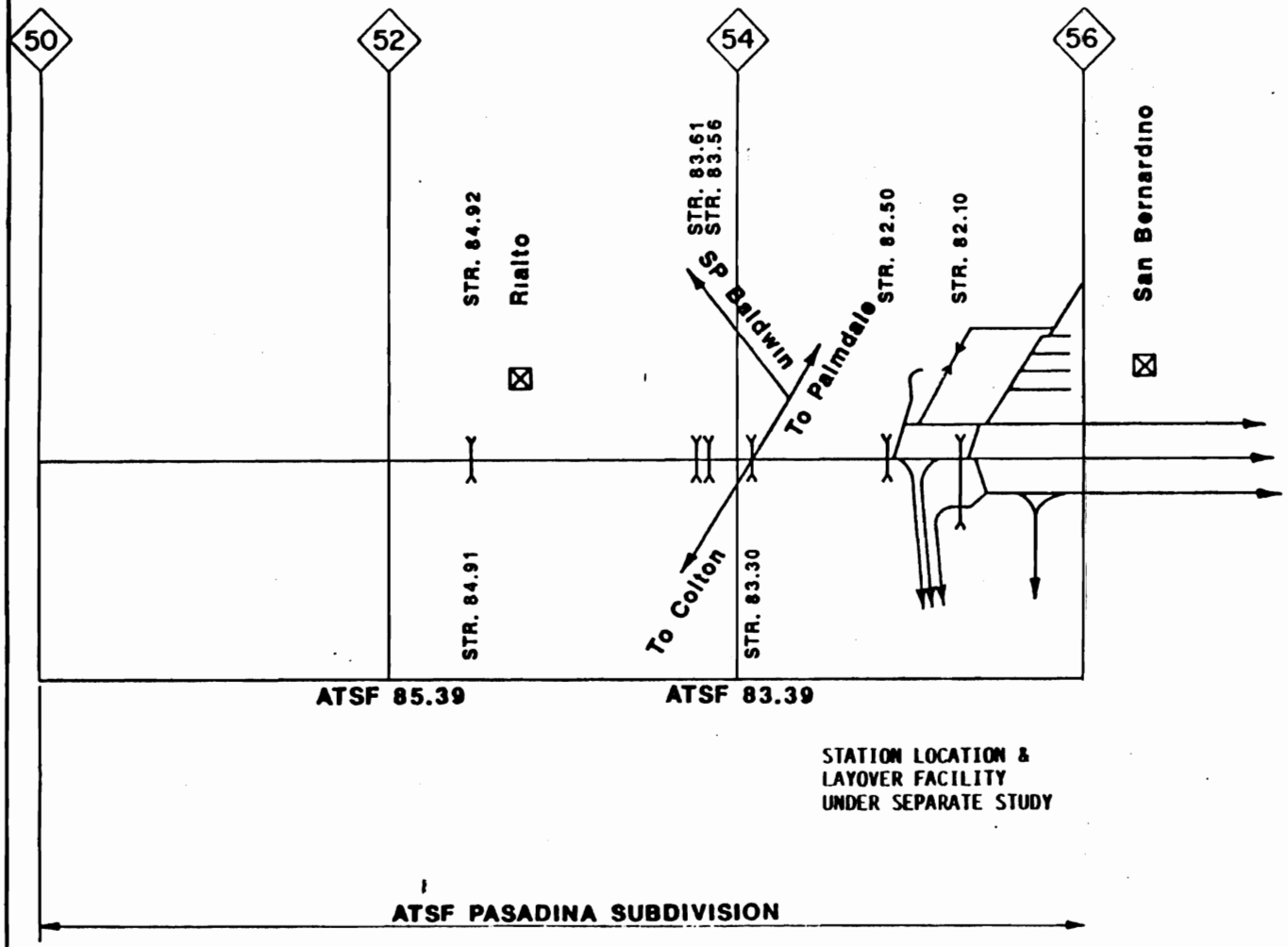

FIGURE **SAN BERNARDINO TO LOS ANGELES SERVICE** **M.P. 50 TO M.P. 56**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

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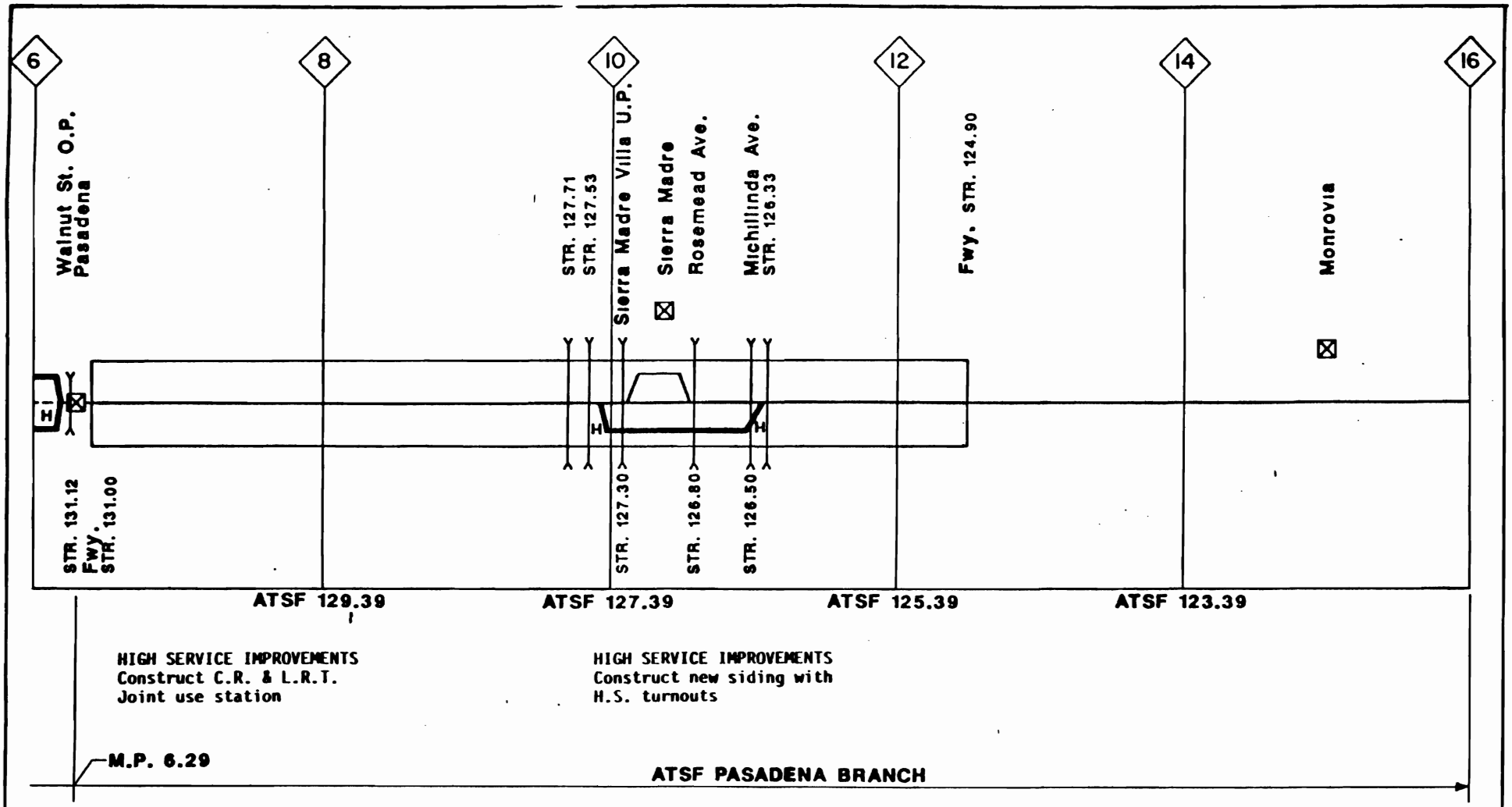

FIGURE SAN BERNADINO TO LOS ANGELES SERVICE – PASADENA BRANCH M.P. 6 TO M.P. 16

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

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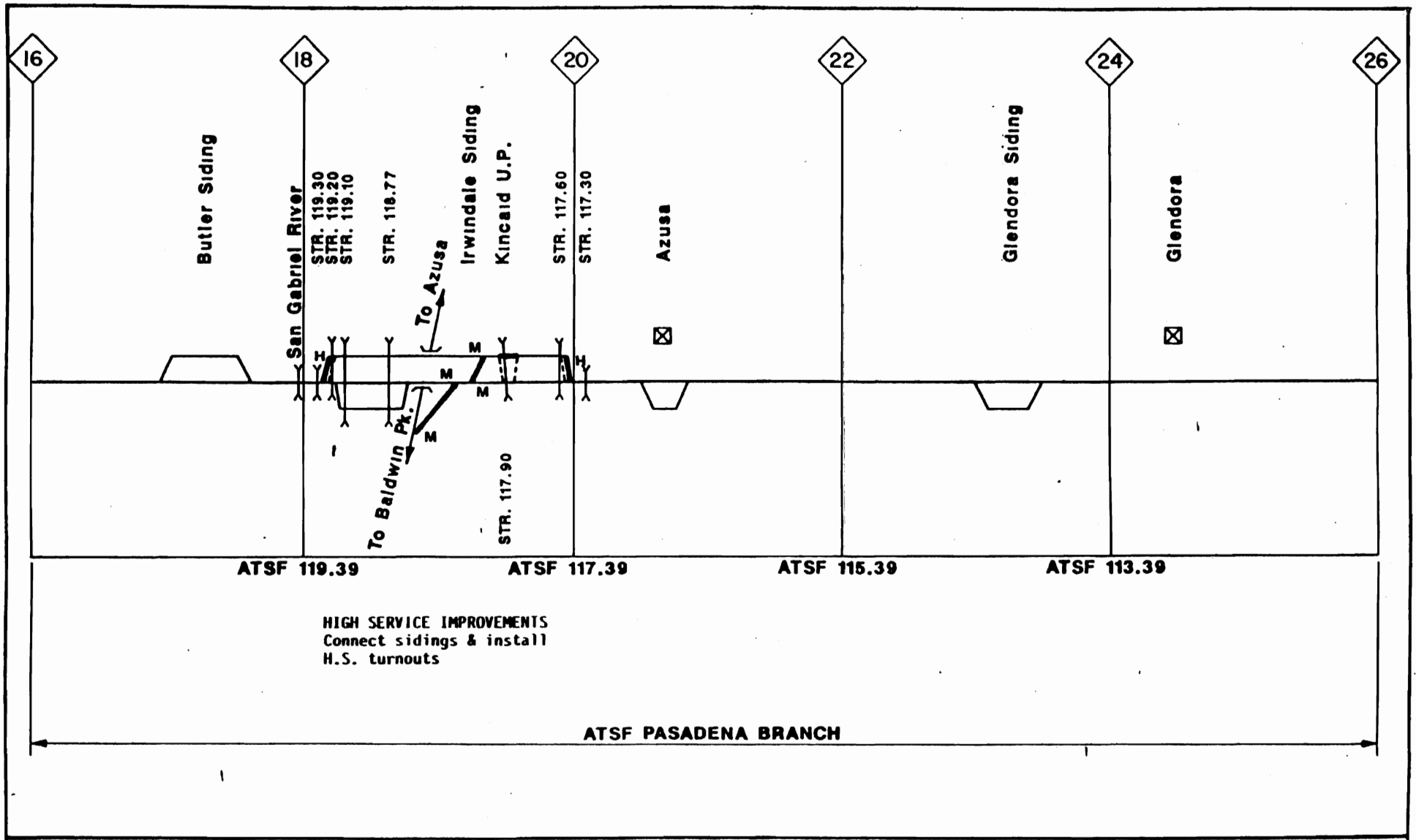

FIGURE SAN BERNADINO TO LOS ANGELES SERVICE - PASADENA BRANCH **M.P. 16 TO M.P. 26**

L.A.U.P.T. ACCESS STUDY - FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission

California State Department of Transportation Division of Rail

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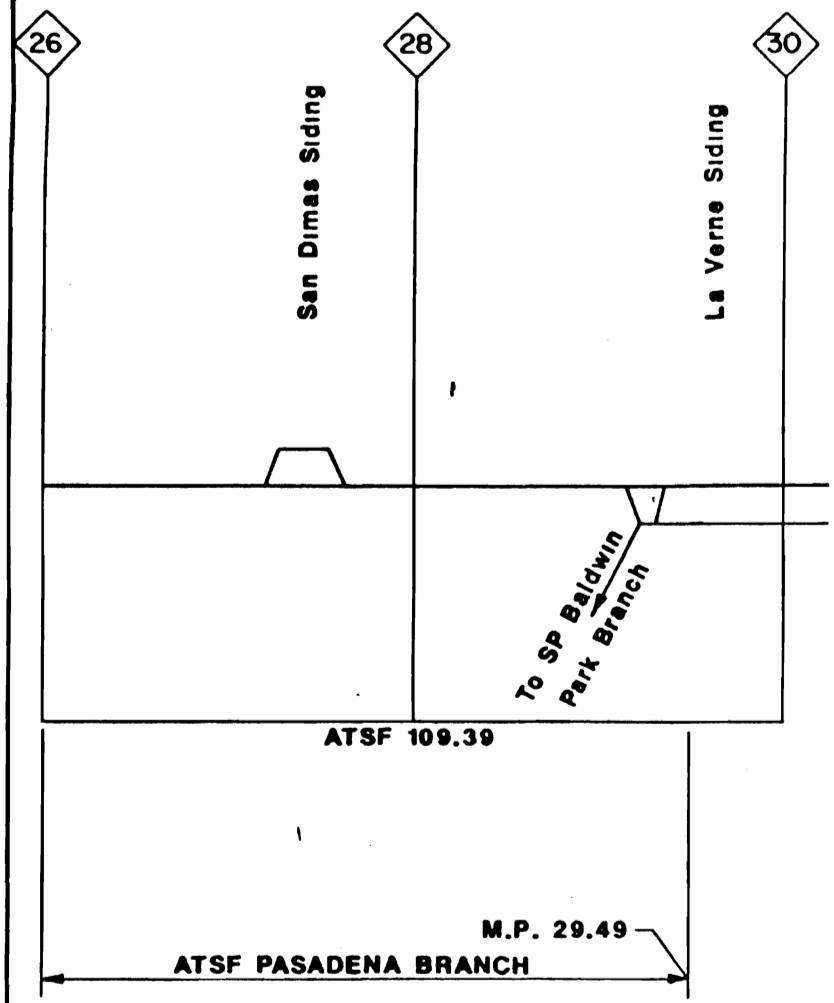

FIGURE SAN BERNADINO TO LOS ANGELES SERVICE – PASADENA BRANCH **M.P. 26 TO M.P. 30**

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission

California State Department of Transportation Division of Rail

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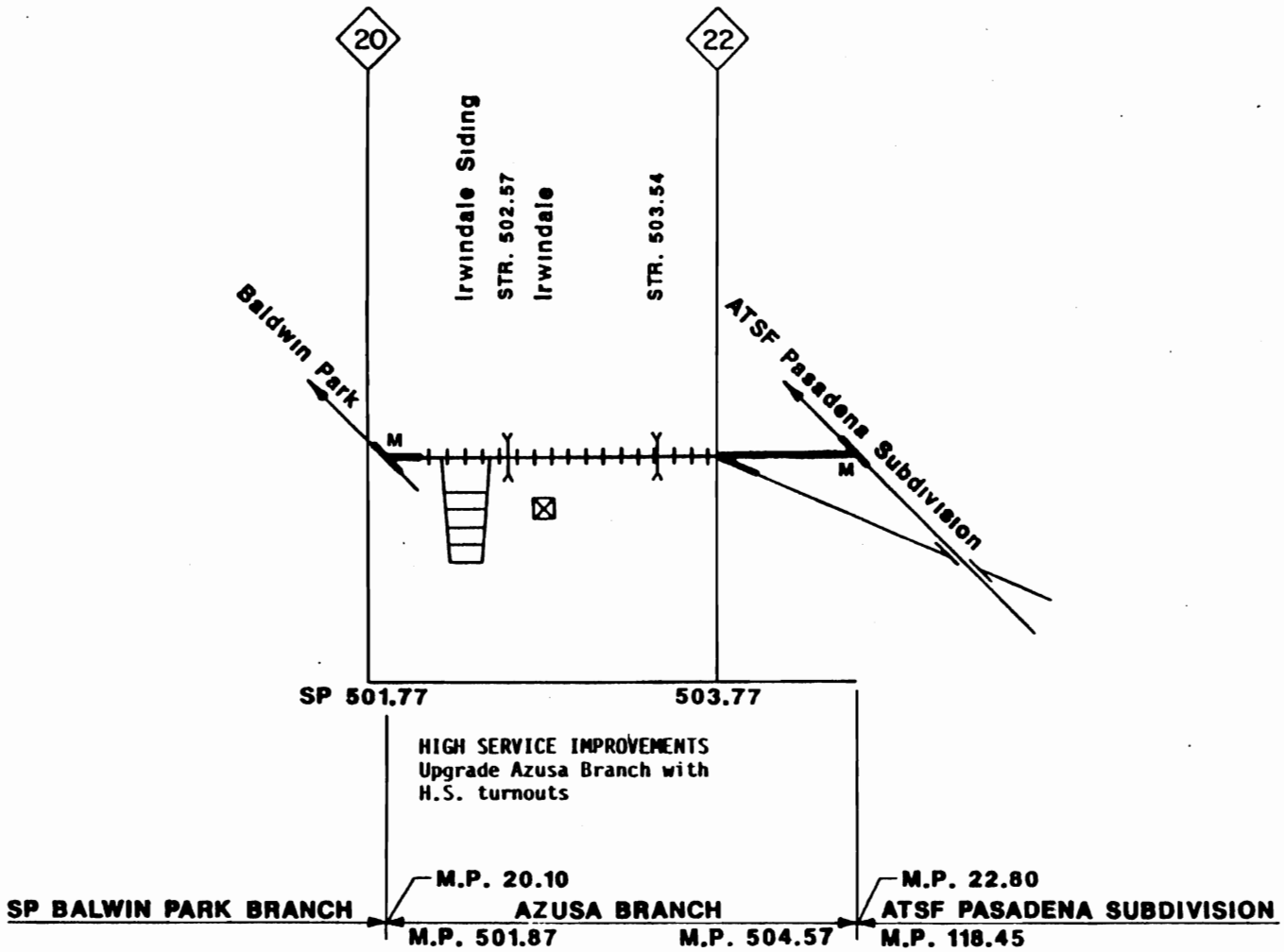

FIGURE SAN BERNADINO TO LOS ANGELES SERVICE – AZUSA BRANCH M.P. 20 TO M.P. 22.80

L.A.U.P.T. ACCESS STUDY – FACILITY IMPROVEMENTS

Los Angeles County Transportation Commission

California State Department of Transportation Division of Rail

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APPENDIX D

SPEED PROFILES AND RUNNING TIMES[1]

[1]LACTC has adopted a policy which allows local municipalities to establish stations if they meet certain criteria. The consultant team developed the following scenarios which illustrate potential networks and running times. These scenarios may not correspond to the actual system which is implemented.

1. VENTURA COUNTY LINE

MAXIMUM SPEED AND LIMITED STATION STOPS

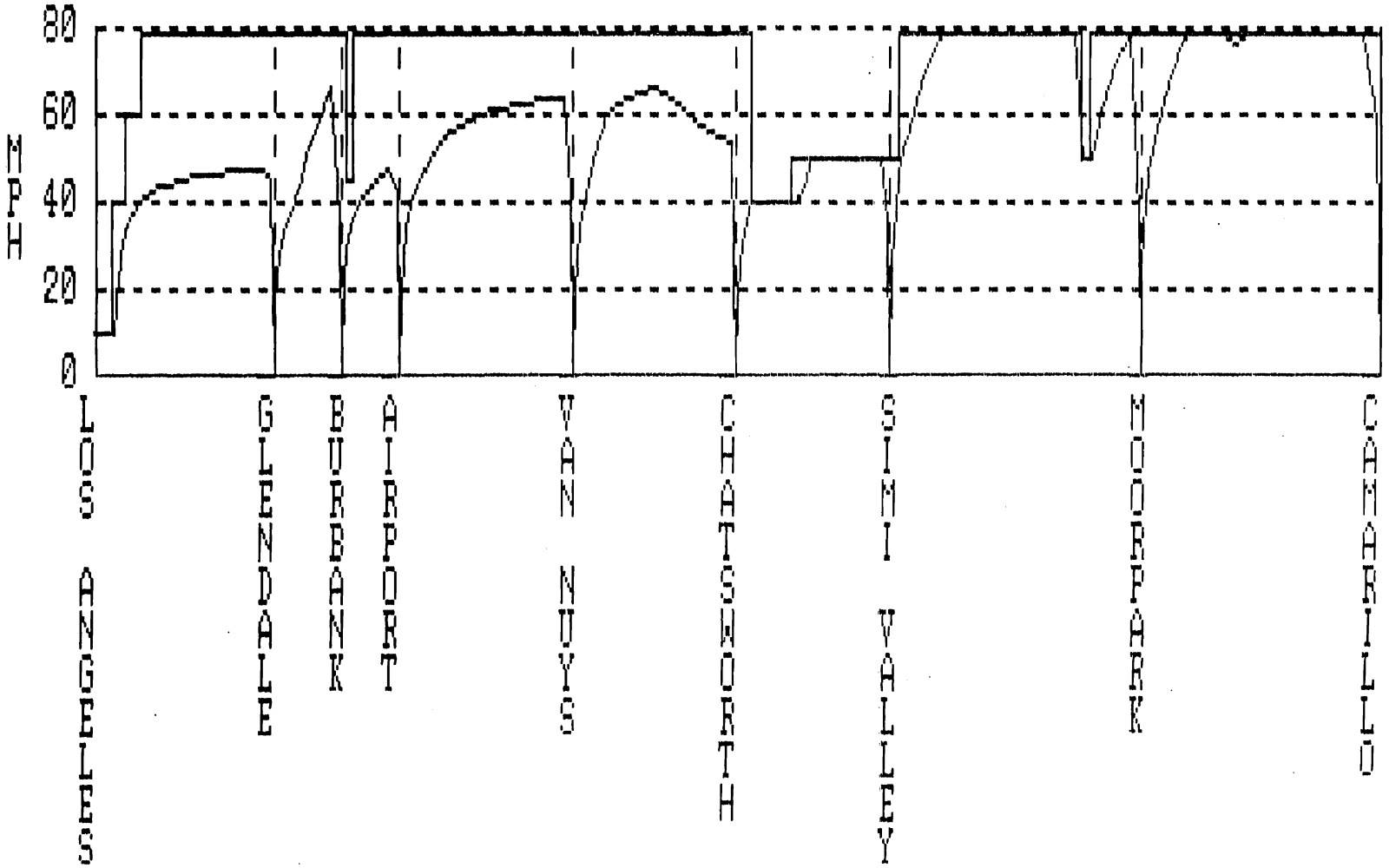
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
OUTBOUND LOS ANGELES TO VENTURA COUNTY

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
LOS ANGELES	TO	GLENDALE	7.95	7.95	15.93	15.93	29.95
GLENDALE	TO	BURBANK	3.05	11.00	5.07	21.00	36.08
BURBANK	TO	AIRPORT	2.60	13.60	4.68	25.68	33.35
AIRPORT	TO	VAN NUYS	7.80	21.40	9.51	35.19	49.22
VAN NUYS	TO	CHATSWORTH	7.30	28.70	8.79	43.98	49.83
CHATSWORTH	TO	SIMI VALLEY	6.90	35.60	10.45	54.43	39.63
SIMI VALLEY	TO	MOORPARK	11.25	46.85	10.86	65.29	62.14

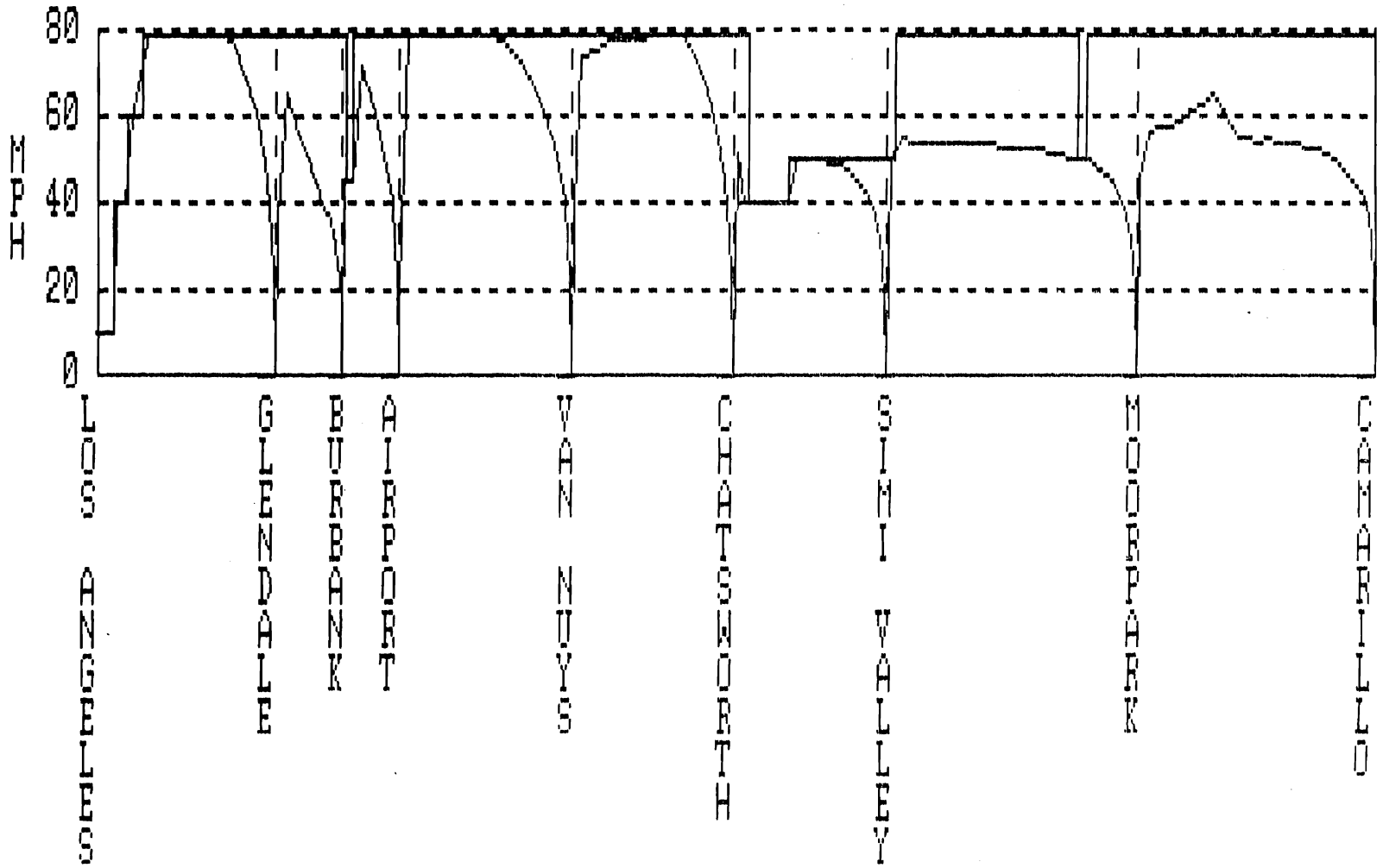
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
INBOUND TO LOS ANGELES

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
MOORPARK	TO	SIMI VALLEY	11.25	11.25	14.43	14.43	46.78
SIMI VALLEY	TO	CHATSWORTH	6.90	18.15	10.53	24.96	39.33
CHATSWORTH	TO	VAN NUYS	7.30	25.45	7.33	32.29	59.77
VAN NUYS	TO	AIRPORT	7.80	33.25	7.91	40.20	59.15
AIRPORT	TO	BURBANK	2.60	35.85	3.98	44.18	39.19
BURBANK	TO	GLENDALE	3.05	38.90	5.09	49.27	35.96
GLENDALE	TO	LOS ANGELES	7.95	46.85	11.48	60.75	41.56

LOS ANGELES - VENTURA COUNTY OUTBOUND SERVICE



VENTURA COUNTY - LOS ANGELES INBOUND SERVICE



2. VENTURA COUNTY LINE

MAXIMUM SPEEDS AND ADDITIONAL STATION STOPS

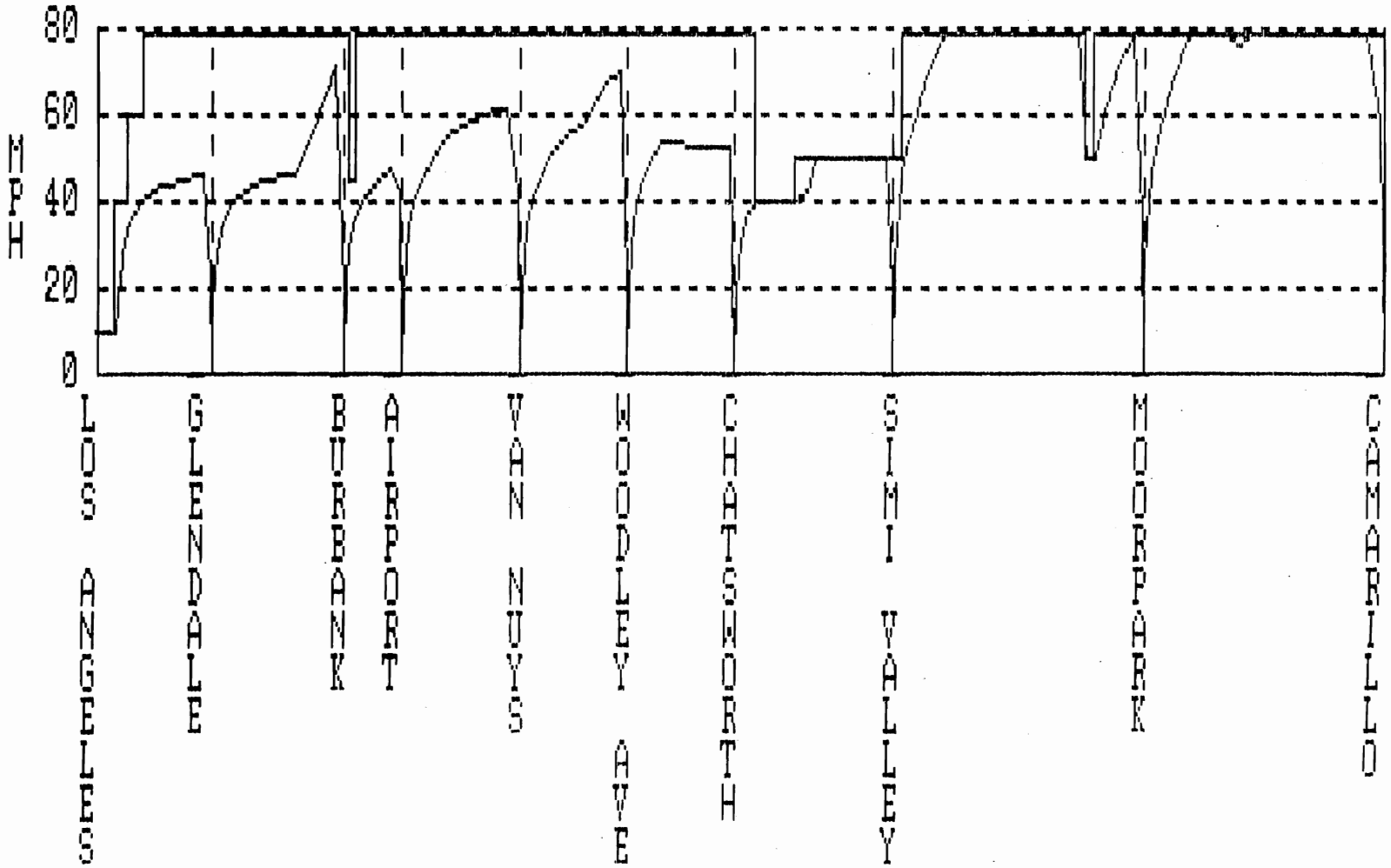
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
OUTBOUND LOS ANGELES TO VENTURA COUNTY

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
LOS ANGELES	TO	GLENDALE	5.05	5.05	12.23	12.23	24.77
GLENDALE	TO	BURBANK	5.95	11.00	8.86	21.09	40.32
BURBANK	TO	AIRPORT	2.60	13.60	4.68	25.77	33.35
AIRPORT	TO	VAN NUYS	5.30	18.90	7.14	32.91	44.56
VAN NUYS	TO	WOODLEY AVE	4.80	23.70	6.49	39.40	44.37
WOODLEY AVE	TO	CHATSWORTH	4.80	28.50	6.83	46.23	42.17
CHATSWORTH	TO	SIMI VALLEY	7.10	35.60	10.74	56.97	39.66
SIMI VALLEY	TO	MOORPARK	11.25	46.85	10.86	67.83	62.14

F59PH LOCOMOTIVE PUSHING EIGHT COACHES
INBOUND TO LOS ANGELES

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
MOORPARK	TO	SIMI VALLEY	11.25	11.25	14.43	14.43	46.78
SIMI VALLEY	TO	CHATSWORTH	7.10	18.35	10.75	25.18	39.63
CHATSWORTH	TO	WOODLEY AVE	4.80	23.15	5.37	30.55	53.60
WOODLEY AVE	TO	VAN NUYS	4.80	27.95	5.87	36.42	49.07
VAN NUYS	TO	AIRPORT	5.30	33.25	6.00	42.42	53.00
AIRPORT	TO	BURBANK	2.60	35.85	3.98	46.40	39.19
BURBANK	TO	GLENDALE	5.95	41.80	7.35	53.75	48.58
GLENDALE	TO	LOS ANGELES	5.05	46.85	9.28	63.03	32.64

LOS ANGELES - VENTURA COUNTY OUTBOUND SERVICE
ADDITIONAL STATIONS



3. SANTA CLARITA LINE

MAXIMUM SPEED

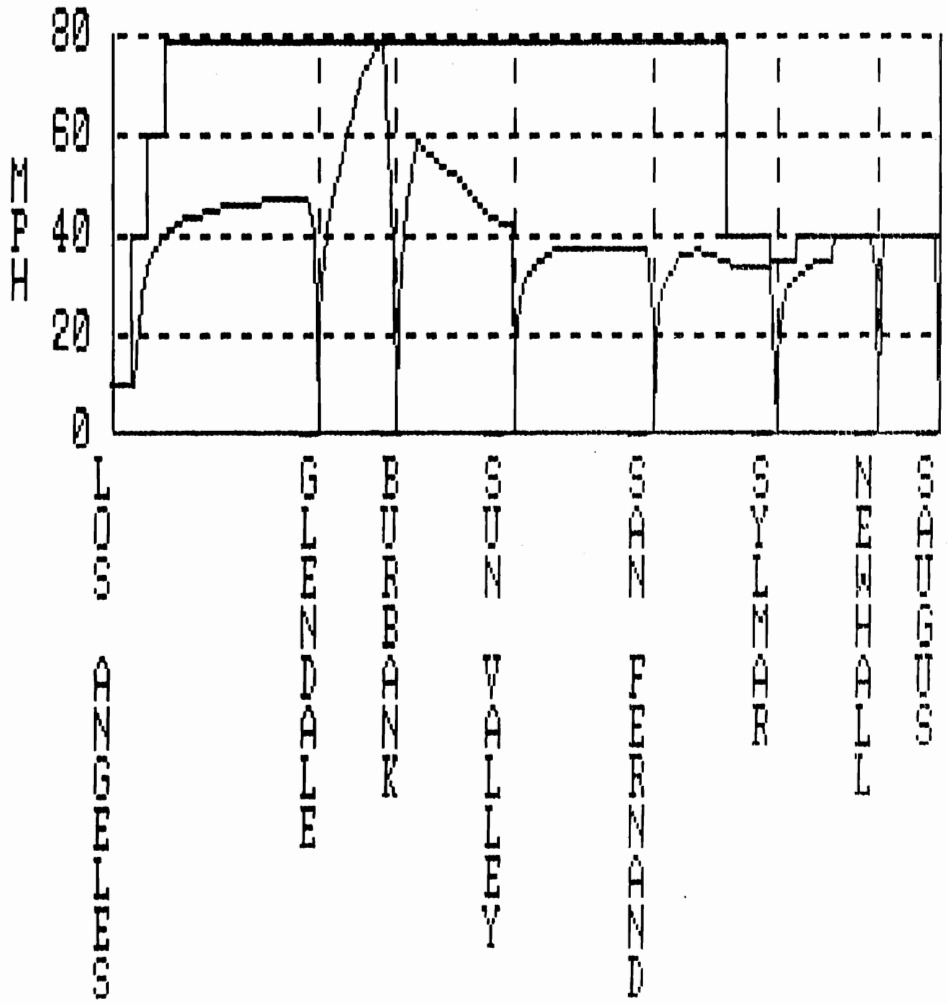
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
OUTBOUND LOS ANGELES TO SANTA CLARITA

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
LOS ANGELES	TO	GLENDALE	7.95	7.95	15.95	15.95	29.91
GLENDALE	TO	BURBANK	3.05	11.00	4.18	20.13	43.82
BURBANK	TO	SUN VALLEY	4.57	15.57	6.56	26.69	41.82
SUN VALLEY	TO	SAN FERNANDO	5.43	21.00	10.00	36.69	32.58
SAN FERNANDO	TO	SYLMAR	4.75	25.75	9.33	46.02	30.56
SYLMAR	TO	NEWHALL	3.93	29.68	7.79	53.81	30.26
NEWHALL	TO	SAUGUS	2.39	32.07	4.01	57.82	35.78

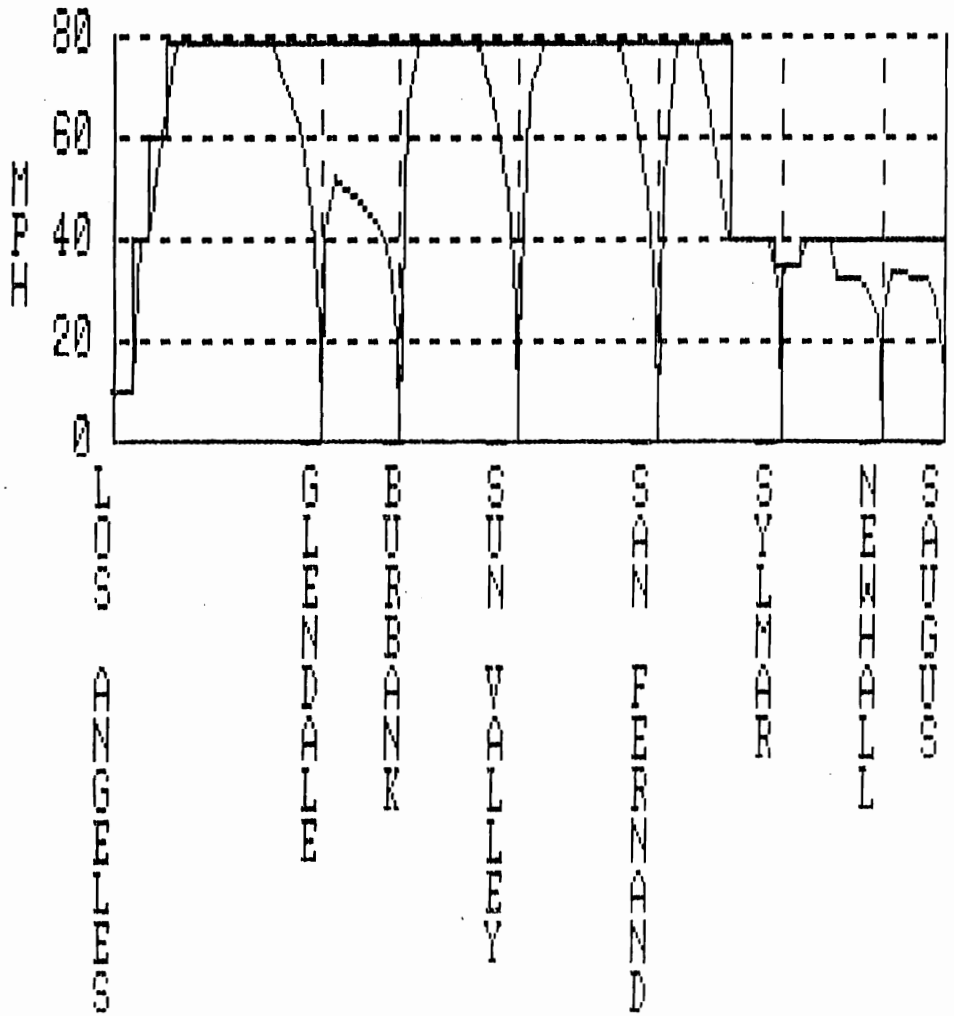
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
INBOUND SANTA CLARITA TO LOS ANGELES

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
SAUGUS	TO	NEWHALL	2.39	2.39	5.46	5.46	26.24
NEWHALL	TO	SYLMAR	3.93	6.32	7.98	13.44	29.54
SYLMAR	TO	SAN FERNANDO	4.75	11.07	6.65	20.09	42.84
SAN FERNANDO	TO	SUN VALLEY	5.43	16.50	5.72	25.81	56.99
SUN VALLEY	TO	BURBANK	4.57	21.07	4.98	30.79	55.03
BURBANK	TO	GLENDALE	3.05	24.12	5.10	35.89	35.90
GLENDALE	TO	LOS ANGELES	7.95	32.07	11.46	47.35	41.64

LOS ANGELES - SANTA CLARITA SERVICE
OUTBOUND



SANTA CLARITA - LOS ANGELES SERVICE
INBOUND



4. SAN BERNARDINO LINE

MAXIMUM SPEEDS/LIMITED STATION STOPS

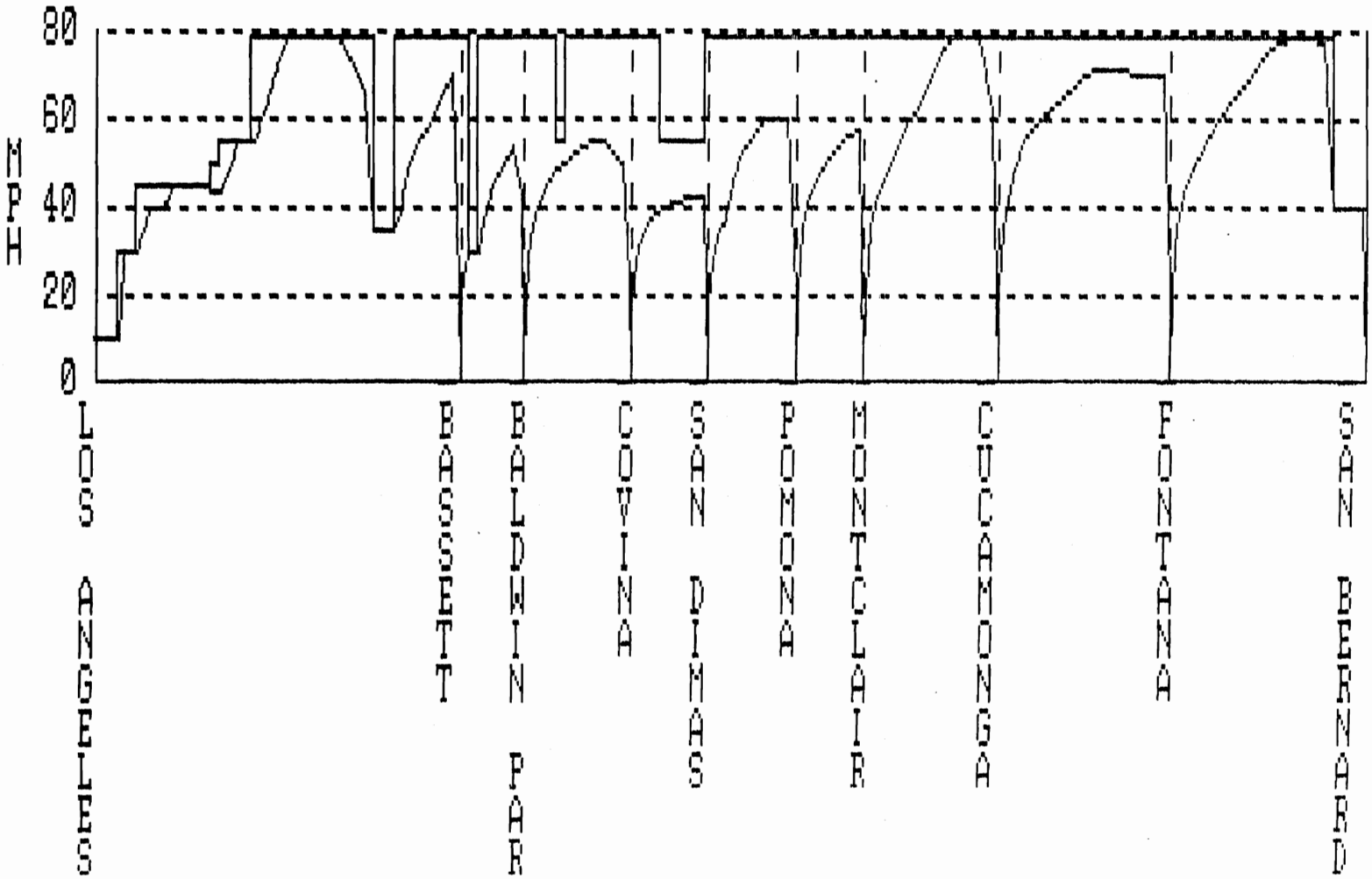
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
OUTBOUND LOS ANGELES TO SAN BERNARDINO VIA POMONA

Station to Station		Distance		Time		Average Speed mph
		Between Stations	Accum. Total	Between Stations	Accum. Total	
LOS ANGELES	TO BASSETT	16.15	16.15	24.92	24.92	38.88
BASSETT	TO BALDWIN PARK	2.85	19.00	5.26	30.18	32.52
BALDWIN PARK	TO COVINA	4.75	23.75	6.90	37.08	41.29
COVINA	TO SAN DIMAS	3.40	27.15	6.26	43.34	32.57
SAN DIMAS	TO POMONA	3.95	31.10	5.98	49.32	39.60
POMONA	TO MONTCLAIR	3.00	34.10	4.80	54.12	37.48
MONTCLAIR	TO CUCAMONGA	5.95	40.05	7.00	61.12	51.02
CUCAMONGA	TO FONTANA	7.65	47.70	8.42	69.54	54.54
FONTANA	TO SAN BERNARDI	8.65	56.35	9.58	79.12	54.19

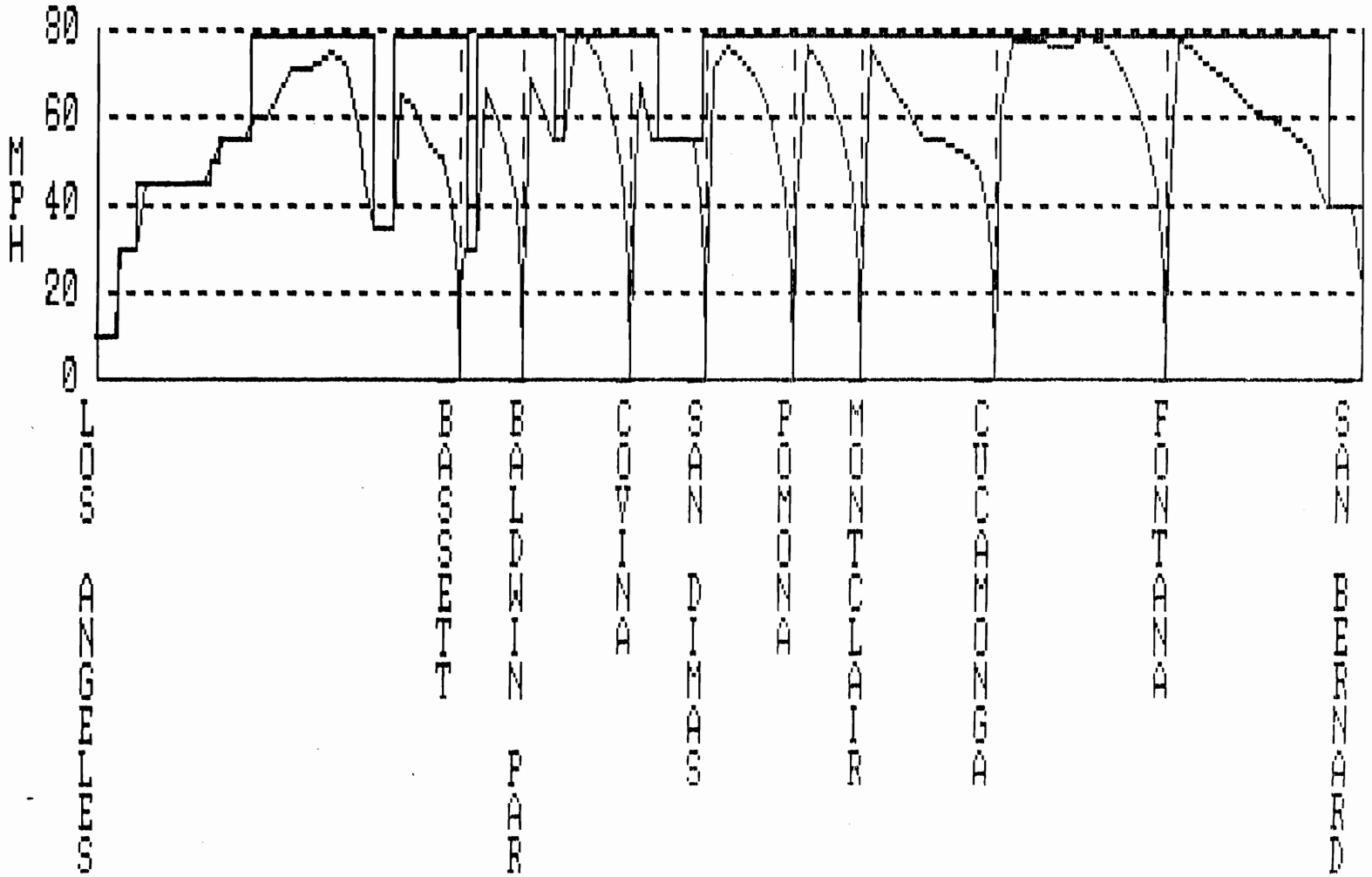
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
INBOUND SAN BERNARDINO TO LOS ANGELES VIA POMONA

Station to Station		Distance		Time		Average Speed mph
		Between Stations	Accum. Total	Between Stations	Accum. Total	
SAN BERNARDI	TO FONTANA	8.65	8.65	10.34	10.34	50.20
FONTANA	TO CUCAMONGA	7.65	16.30	7.73	18.07	59.40
CUCAMONGA	TO MONTCLAIR	5.95	22.25	7.47	25.54	47.79
MONTCLAIR	TO POMONA	3.00	25.25	4.09	29.63	43.97
POMONA	TO SAN DIMAS	3.95	29.20	4.90	34.53	48.39
SAN DIMAS	TO COVINA	3.40	32.60	4.78	39.31	42.65
COVINA	TO BALDWIN PARK	4.75	37.35	5.61	44.92	50.79
BALDWIN PARK	TO BASSETT	2.85	40.20	4.84	49.76	35.34
BASSETT	TO LOS ANGELES	16.15	56.35	23.77	73.53	40.77

LOS ANGELES - SAN BERNARDINO OUTBOUND SERVICE



SAN BERNARDINO - LOS ANGELES INBOUND SERVICE



5. SAN BERNARDINO LINE

MAXIMUM SPEED LIMIT ADDITIONAL STATION STOPS

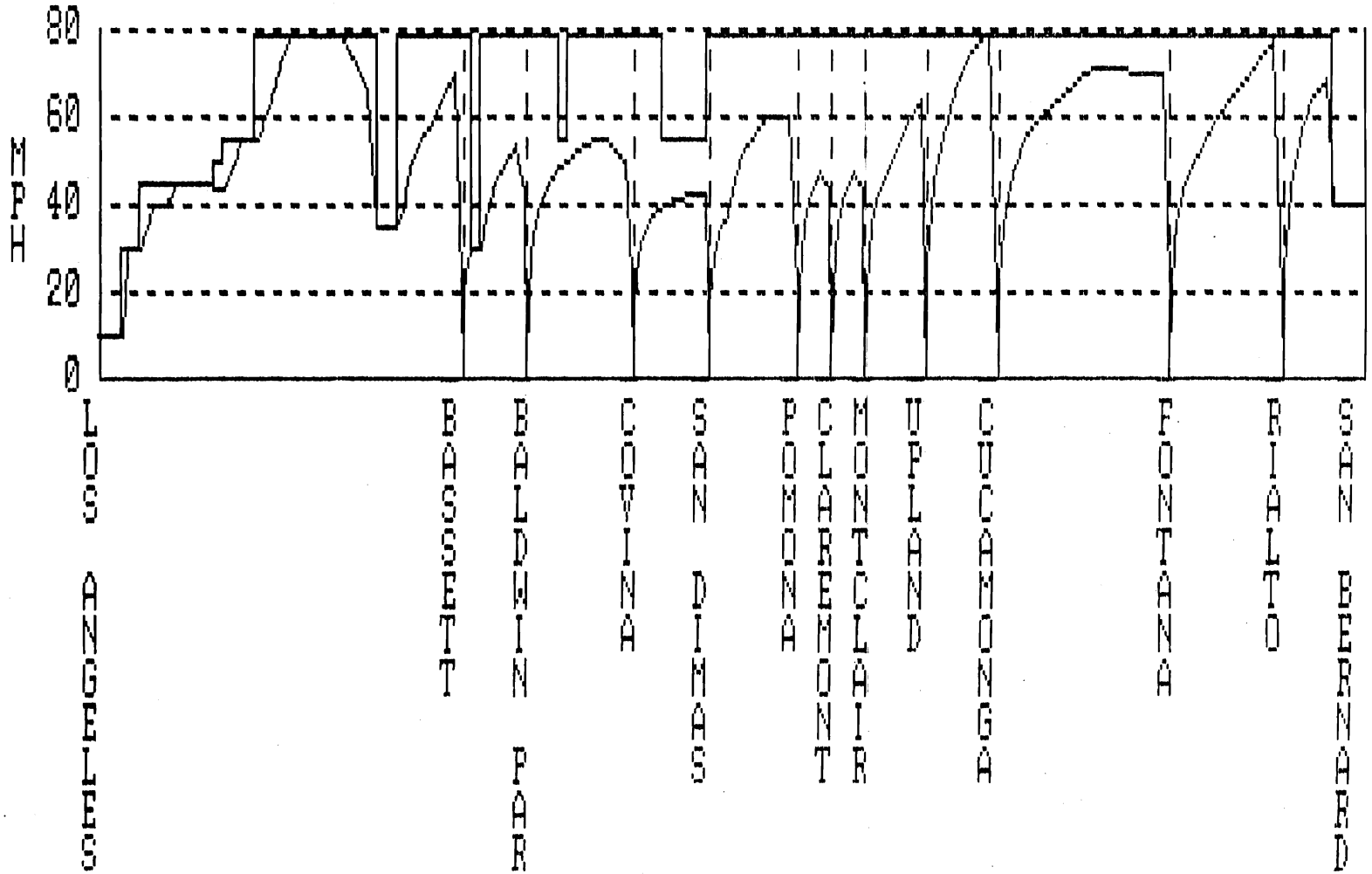
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
OUTBOUND LOS ANGELES TO SAN BERNARDINO VIA POMONA

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
LOS ANGELES	TO	BASSETT	16.15	16.15	24.92	24.92	38.88
BASSETT	TO	BALDWIN PARK	2.85	19.00	5.26	30.18	32.52
BALDWIN PARK	TO	COVINA	4.75	23.75	6.90	37.08	41.29
COVINA	TO	SAN DIMAS	3.40	27.15	6.26	43.34	32.57
SAN DIMAS	TO	POMONA	3.95	31.10	5.98	49.32	39.60
POMONA	TO	CLAREMONT	1.50	32.60	3.15	52.47	28.60
CLAREMONT	TO	MONTCLAIR	1.50	34.10	3.14	55.61	28.69
MONTCLAIR	TO	UPLAND	2.75	36.85	4.46	60.07	37.03
UPLAND	TO	CUCAMONGA	3.20	40.05	4.13	64.20	46.53
CUCAMONGA	TO	FONTANA	7.65	47.70	8.42	72.62	54.54
FONTANA	TO	RIALTO	5.05	52.75	6.35	78.97	47.72
RIALTO	TO	SAN BERNARDI	3.60	56.35	4.99	83.96	43.28

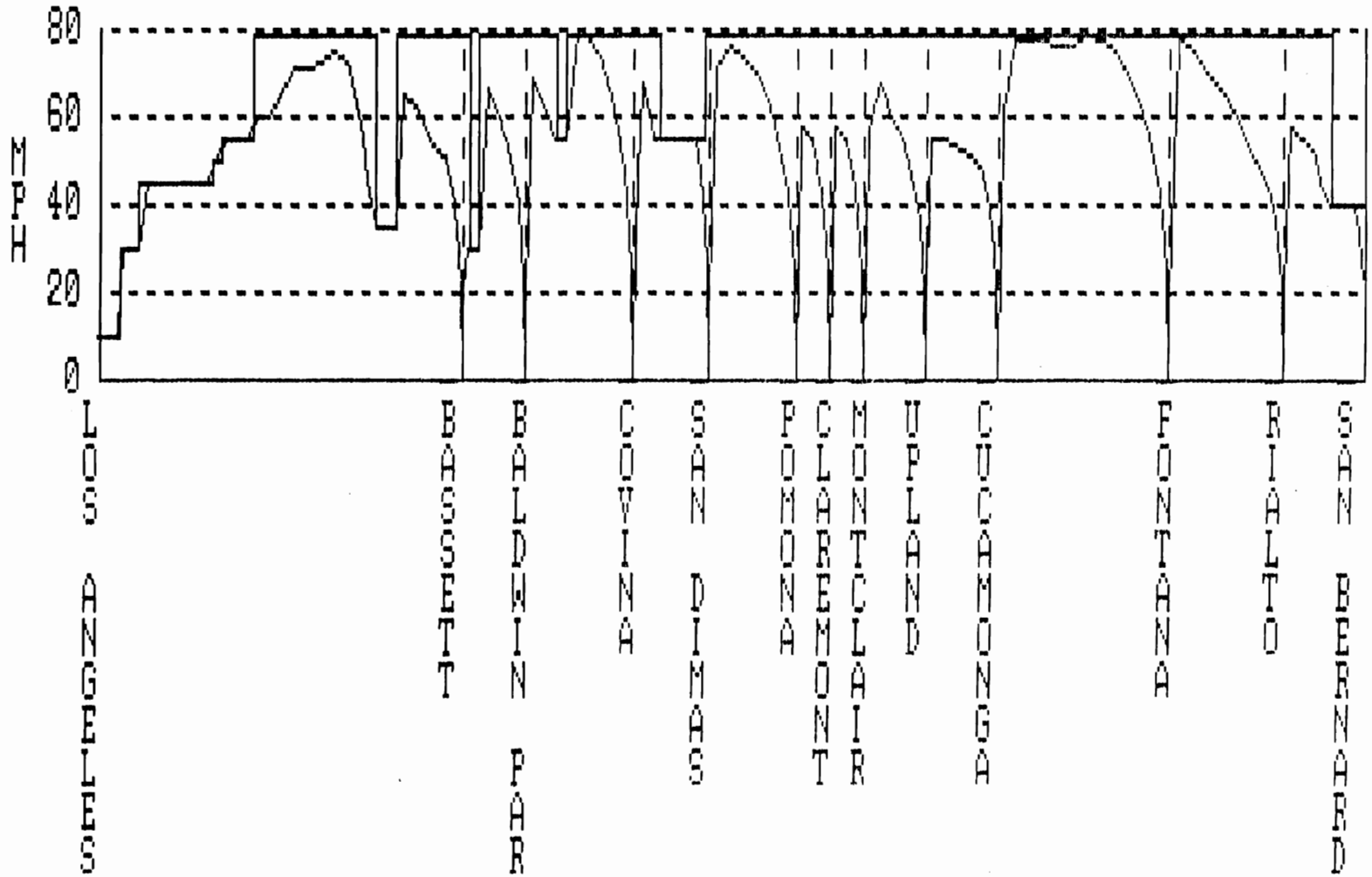
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
INBOUND SAN BERNARDINO TO LOS ANGELES VIA POMONA

Station to Station			Distance		Time		Average
			Between Stations	Accum. Total	Between Stations	Accum. Total	Speed mph
SAN BERNARDI	TO	RIALTO	3.60	3.60	5.79	5.79	37.33
RIALTO	TO	FONTANA	5.05	8.65	6.34	12.13	47.82
FONTANA	TO	CUCAMONGA	7.65	16.30	7.73	19.86	59.40
CUCAMONGA	TO	UPLAND	3.20	19.50	4.85	24.71	39.59
UPLAND	TO	MONTCLAIR	2.75	22.25	4.21	28.92	39.24
MONTCLAIR	TO	CLAREMONT	1.50	23.75	2.82	31.74	31.88
CLAREMONT	TO	POMONA	1.50	25.25	2.83	34.57	31.82
POMONA	TO	SAN DIMAS	3.95	29.20	4.90	39.47	48.39
SAN DIMAS	TO	COVINA	3.40	32.60	4.78	44.25	42.65
COVINA	TO	BALDWIN PARK	4.75	37.35	5.61	49.86	50.79
BALDWIN PARK	TO	BASSETT	2.85	40.20	4.84	54.70	35.34
BASSETT	TO	LOS ANGELES	16.15	56.35	23.77	78.47	40.77

SAN BERNARDINO - LOS ANGELES OUTBOUND SERVICE
ADDITIONAL STATIONS



LOS ANGELES - SAN BERNARDINO INBOUND SERVICE
ADDITIONAL STATIONS



6. SAN GABRIEL VALLEY VIA AZUSA LINE

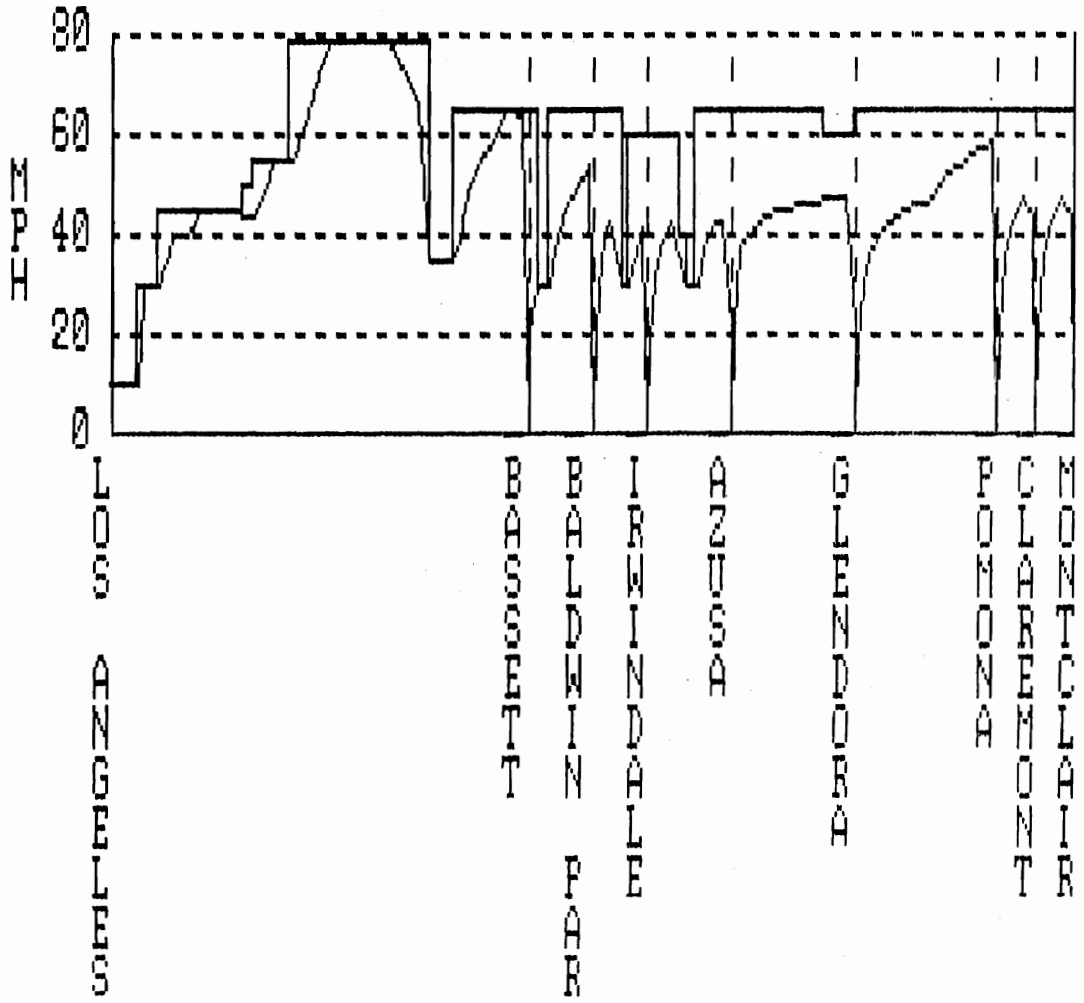
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
OUTBOUND LOS ANGELES TO SAN GABRIEL VALLEY VIA AZUSA

Station to Station			Distance		Time		Average Speed mph
			Between Stations	Accum. Total	Between Stations	Accum. Total	
LOS ANGELES	TO	BASSETT	16.15	16.15	24.95	24.95	38.84
BASSETT	TO	BALDWIN PARK	2.55	18.70	4.93	29.88	31.04
BALDWIN PARK	TO	IRWINDALE	2.10	20.80	4.40	34.28	28.65
IRWINDALE	TO	AZUSA	3.30	24.10	6.31	40.59	31.37
AZUSA	TO	GLENDORA	4.80	28.90	7.49	48.08	38.44
GLENDORA	TO	POMONA	5.50	34.40	8.18	56.26	40.35
POMONA	TO	CLAREMONT	1.50	35.90	3.15	59.41	28.60
CLAREMONT	TO	MONTCLAIR	1.50	37.40	3.14	62.55	28.69

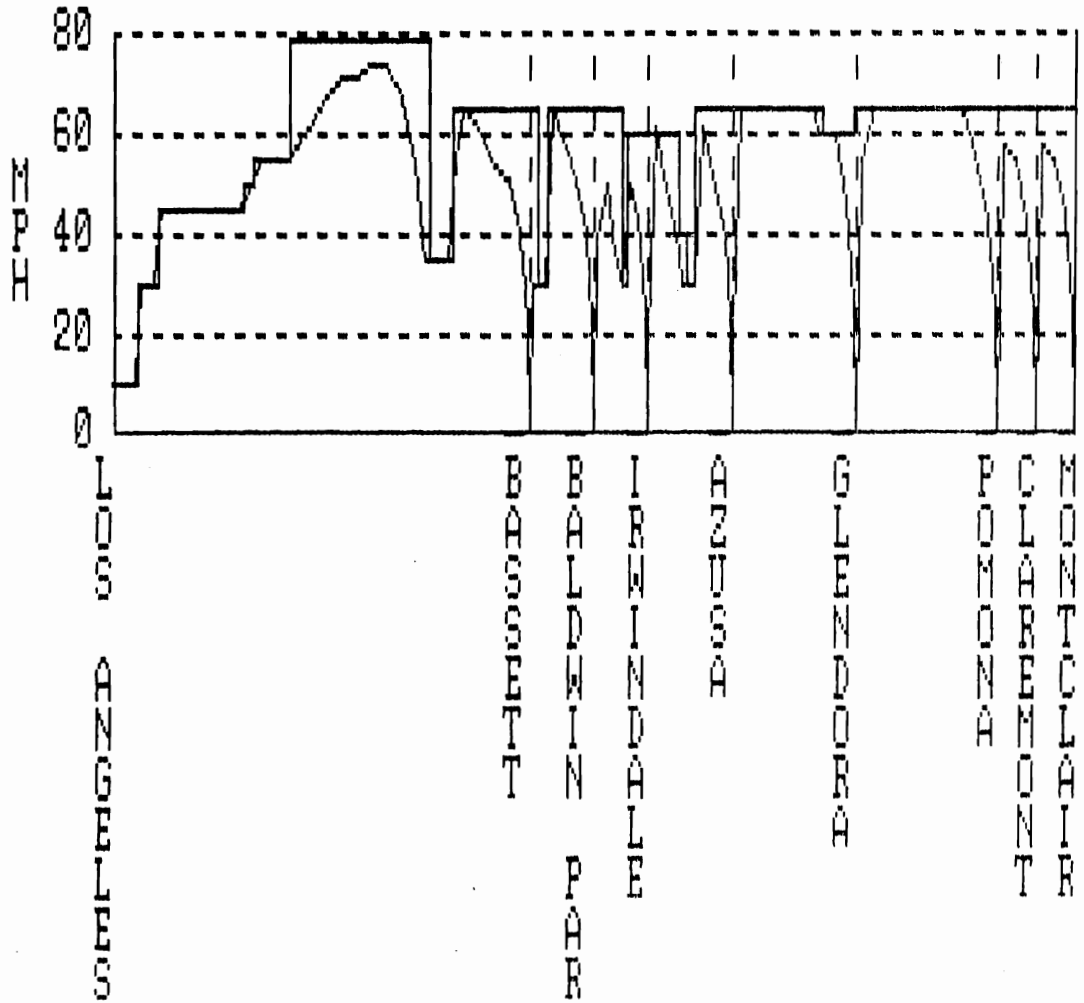
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
INBOUND SAN GABRIEL VALLEY TO LOS ANGELES VIA AZUSA

Station to Station			Distance		Time		Average Speed mph
			Between Stations	Accum. Total	Between Stations	Accum. Total	
MONTCLAIR	TO	CLAREMONT	1.50	1.50	2.82	2.82	31.88
CLAREMONT	TO	POMONA	1.50	3.00	2.83	5.65	31.82
POMONA	TO	GLENDORA	5.50	8.50	6.55	12.20	50.41
GLENDORA	TO	AZUSA	4.80	13.30	5.83	18.03	49.36
AZUSA	TO	IRWINDALE	3.30	16.60	5.59	23.62	35.44
IRWINDALE	TO	BALDWIN PARK	2.10	18.70	4.04	27.66	31.22
BALDWIN PARK	TO	BASSETT	2.55	21.25	4.57	32.23	33.50
BASSETT	TO	LOS ANGELES	16.15	37.40	23.77	56.00	40.77

LOS ANGELES - SAN GABRIEL VALLEY SERVICE
VIA AZUSA



SAN GABRIEL VALLEY - LOS ANGELES SERVICE
VIA AZUSA



7. SAN GABRIEL TO PASADENA

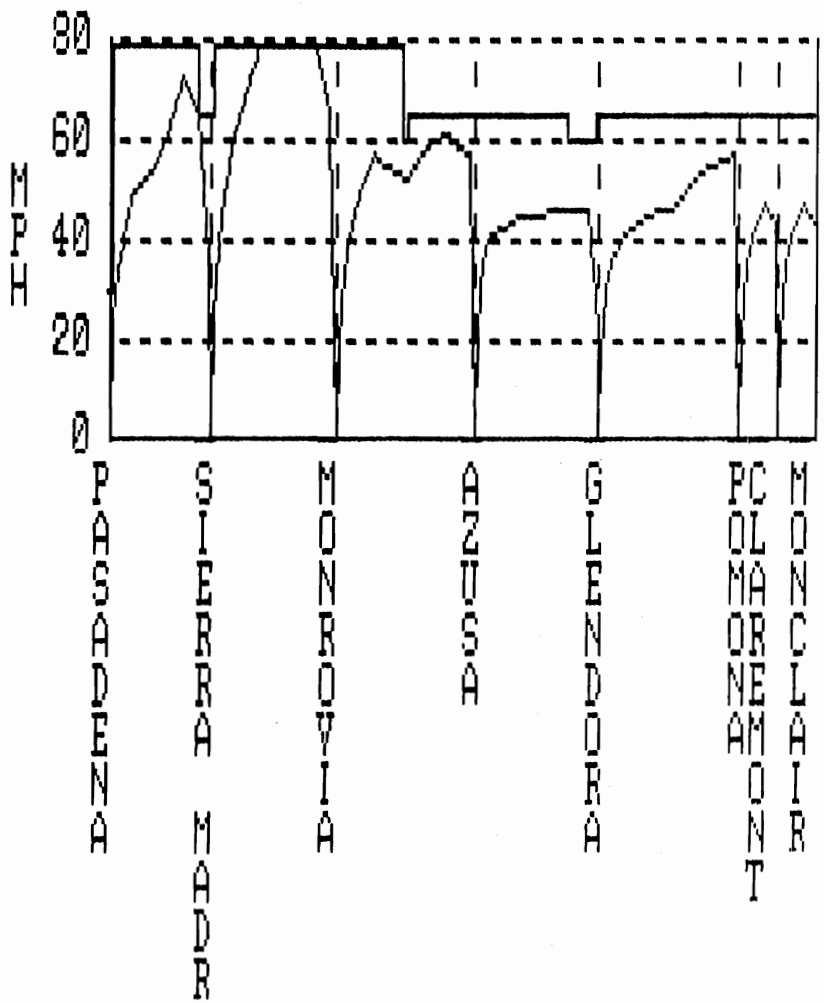
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
OUTBOUND PASADENA TO SAN GABRIEL VALLEY

Station to Station		Distance		Time		Average Speed mph
		Between Stations	Accum. Total	Between Stations	Accum. Total	
PASADENA	TO SIERRA MADRE	3.90	3.90	5.39	5.39	43.41
SIERRA MADRE	TO MONROVIA	4.90	8.80	5.36	10.75	54.83
MONROVIA	TO AZUSA	5.40	14.20	7.21	17.96	44.94
AZUSA	TO GLENDORA	4.80	19.00	7.50	25.46	38.38
GLENDORA	TO POMONA	5.50	24.50	8.23	33.69	40.08
POMONA	TO CLAREMONT	1.50	26.00	3.15	36.84	28.60
CLAREMONT	TO MONCLAIR	1.50	27.50	2.64	39.48	34.12

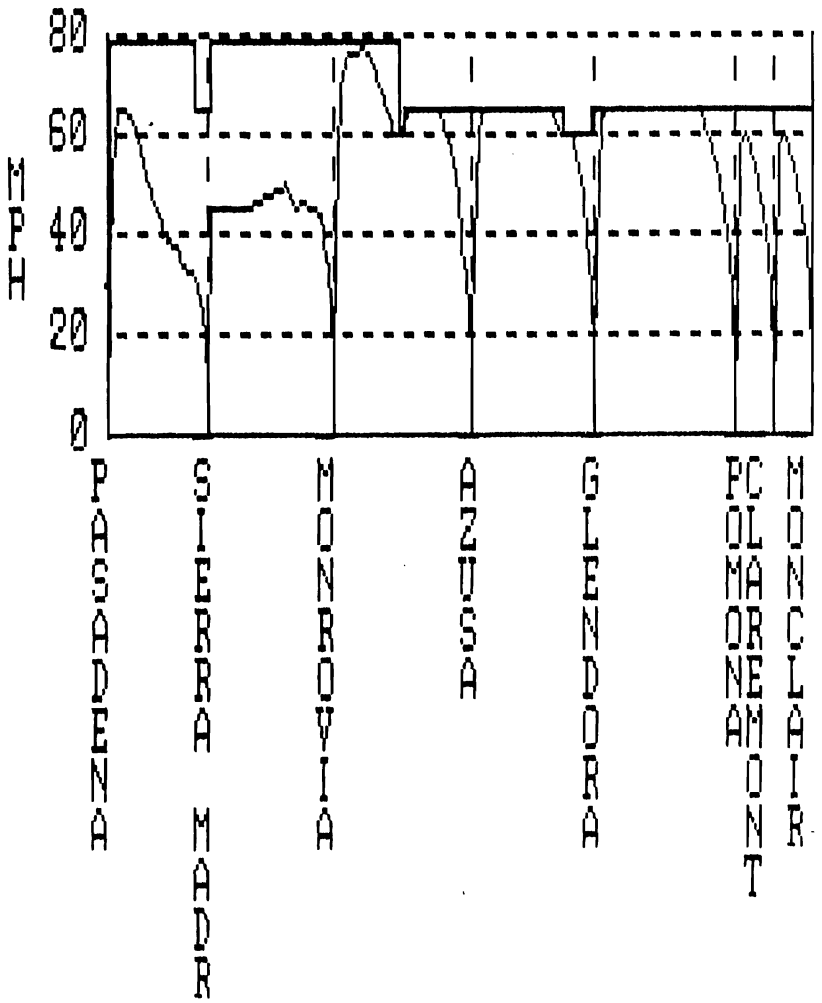
F59PH LOCOMOTIVE PUSHING EIGHT COACHES
INBOUND SAN GABRIEL VALLEY TO PASADENA

Station to Station		Distance		Time		Average Speed mph
		Between Stations	Accum. Total	Between Stations	Accum. Total	
MONCLAIR	TO CLAREMONT	1.50	1.50	2.85	2.85	31.55
CLAREMONT	TO POMONA	1.50	3.00	2.86	5.71	31.49
POMONA	TO GLENDORA	5.50	8.50	6.58	12.29	50.15
GLENDORA	TO AZUSA	4.80	13.30	5.85	18.14	49.25
AZUSA	TO MONROVIA	5.40	18.70	6.36	24.50	50.93
MONROVIA	TO SIERRA MADRE	4.90	23.60	7.50	32.00	39.19
SIERRA MADRE	TO PASADENA	3.90	27.50	6.56	38.56	35.66

PASADENA - SAN GABRIEL VALLEY
OUTBOUND SERVICE



SAN GABRIEL VALLEY - PASADENA
INBOUND SERVICE

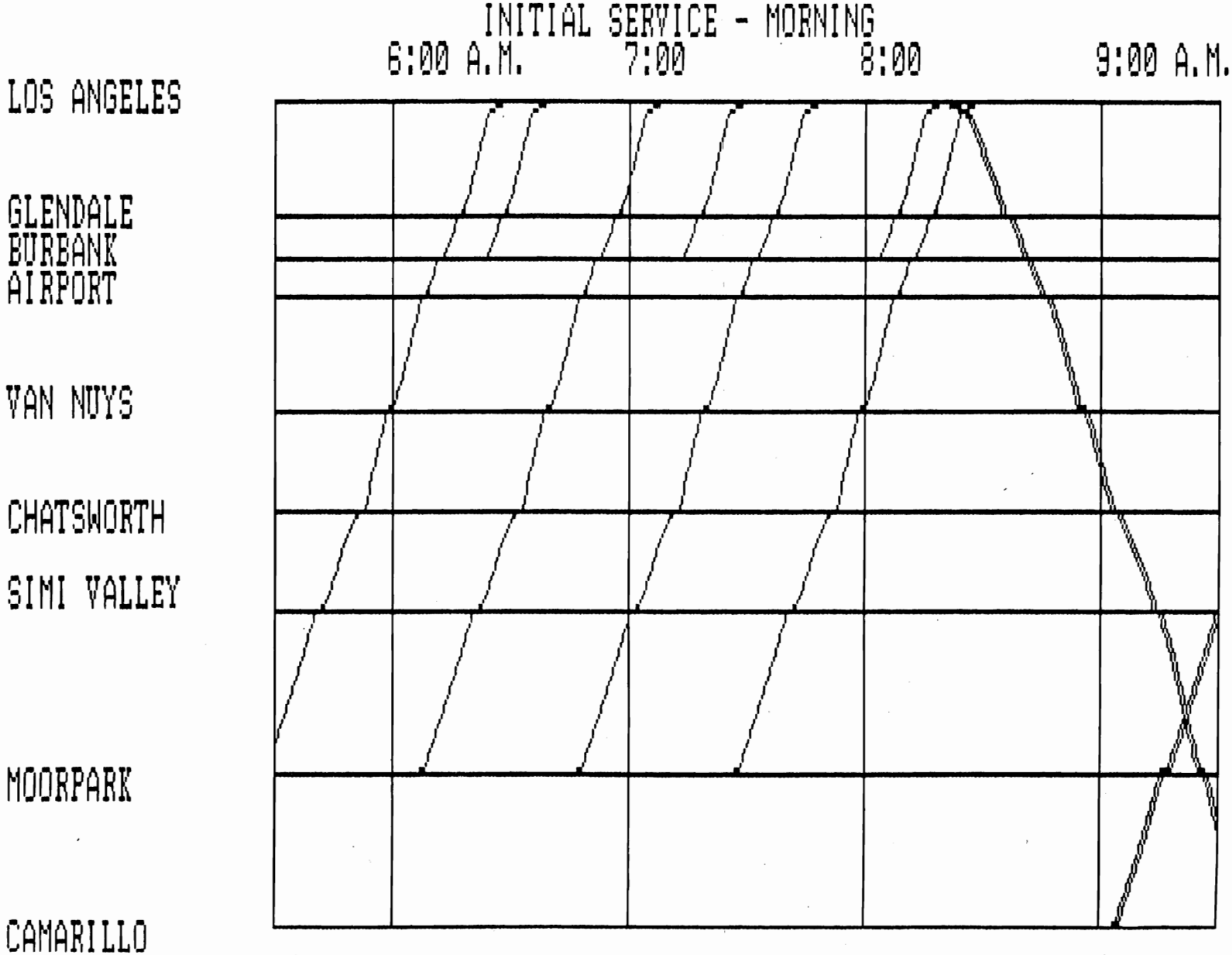


APPENDIX E

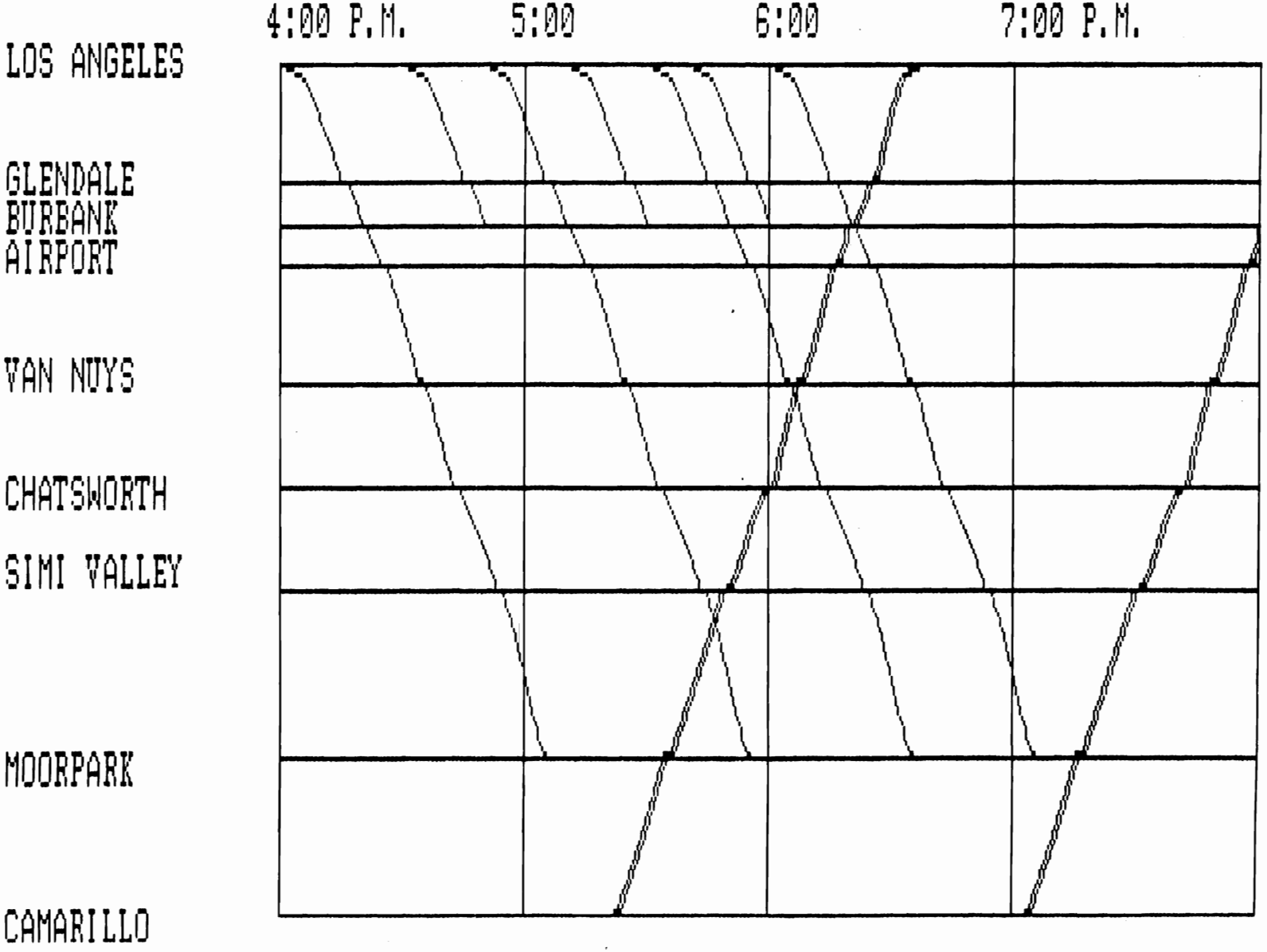
TRAIN SCHEDULE AND STRINGLINE PLANNER

1. LOS ANGELES - VENTURA COUNTY

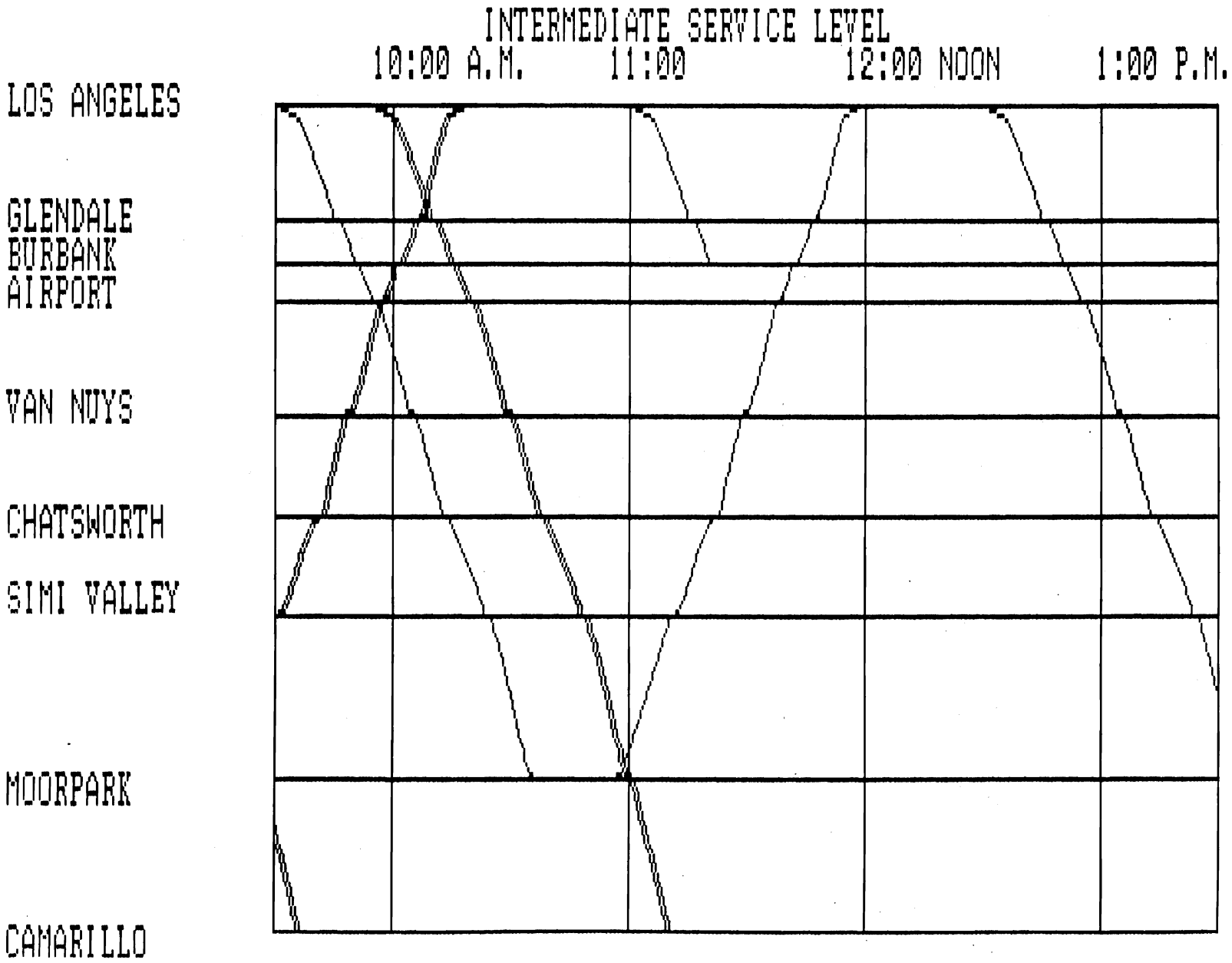
INITIAL SERVICE - MORNING



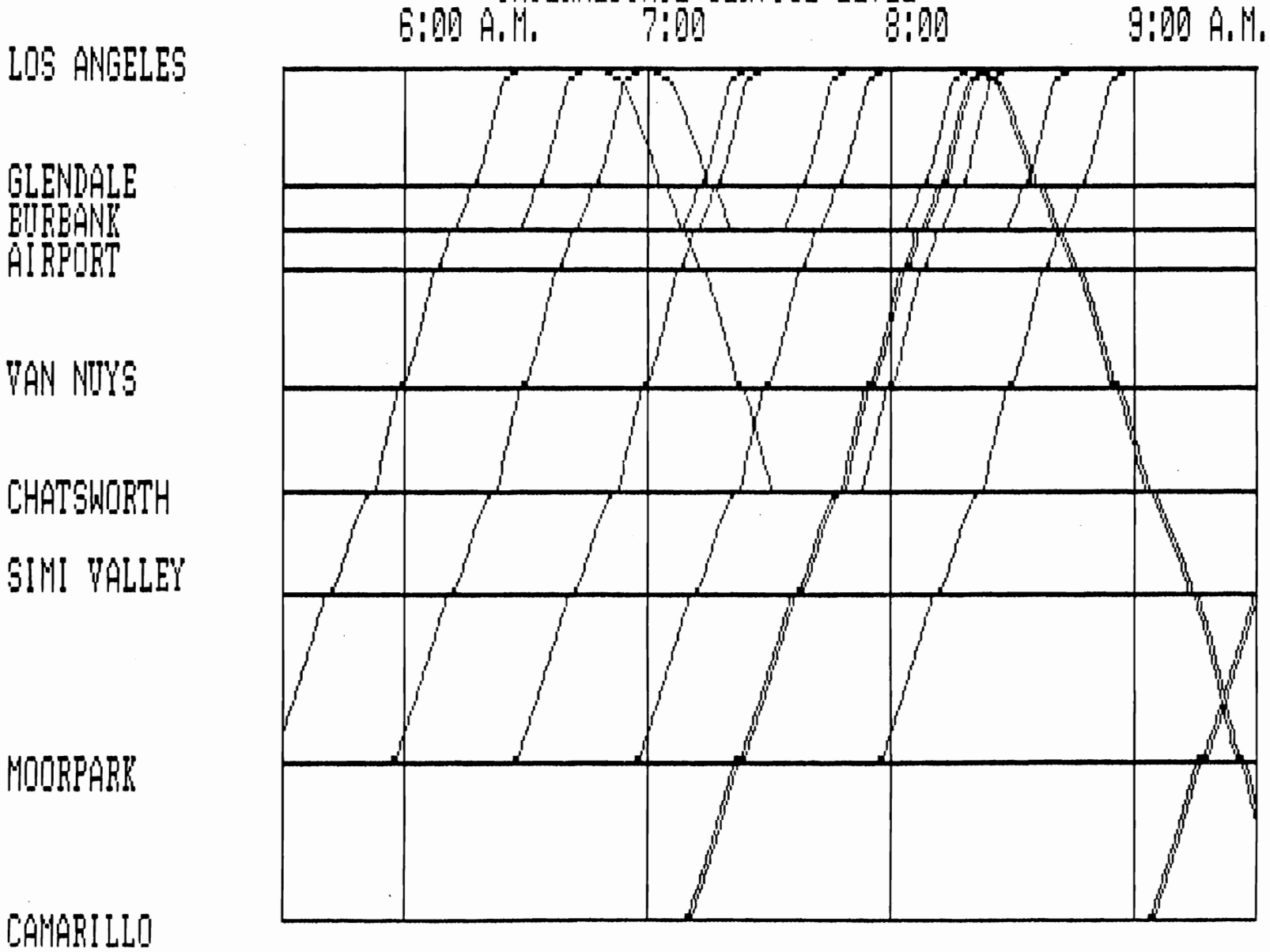
INITIAL SERVICE - EVENING



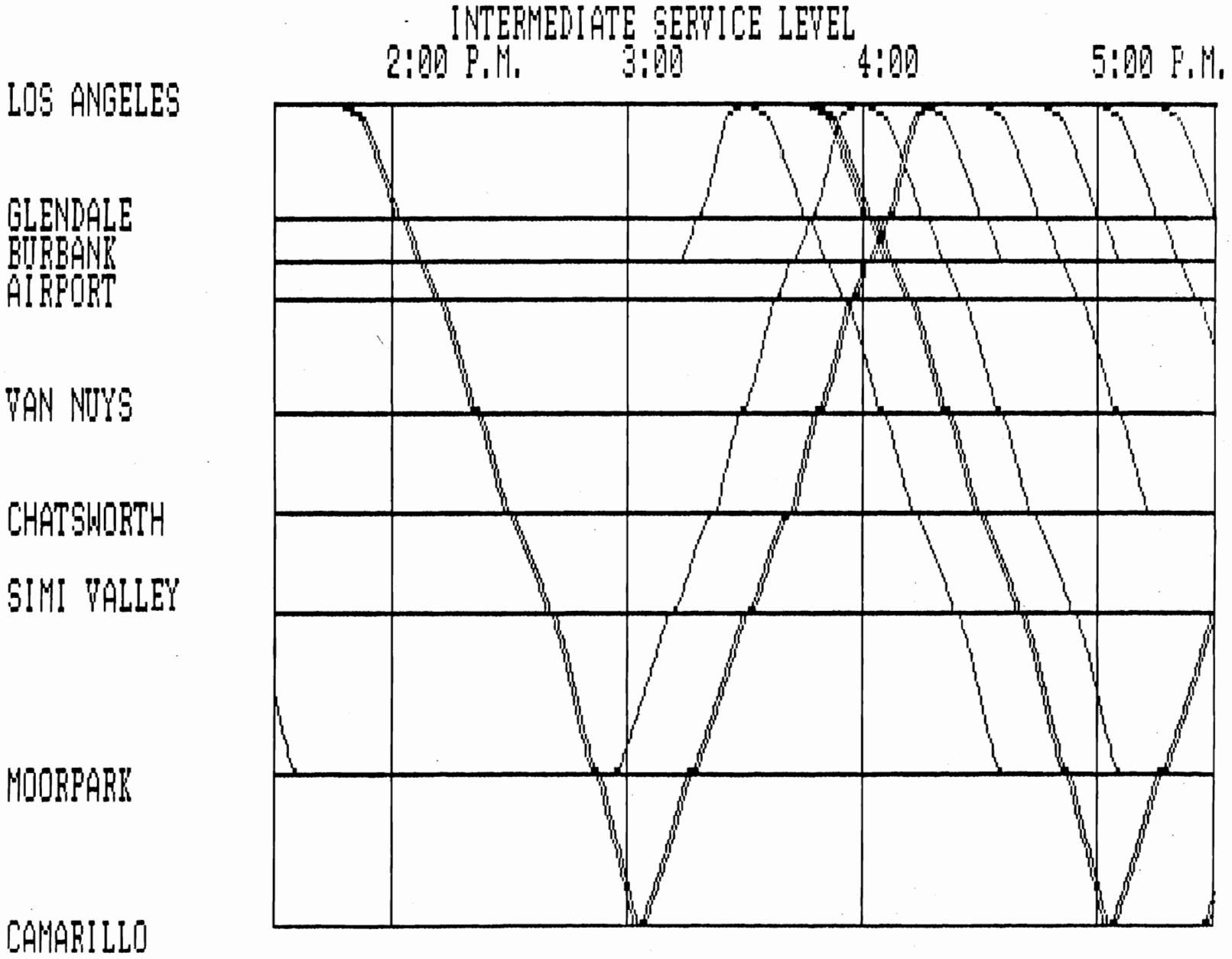
INTERMEDIATE SERVICE LEVEL



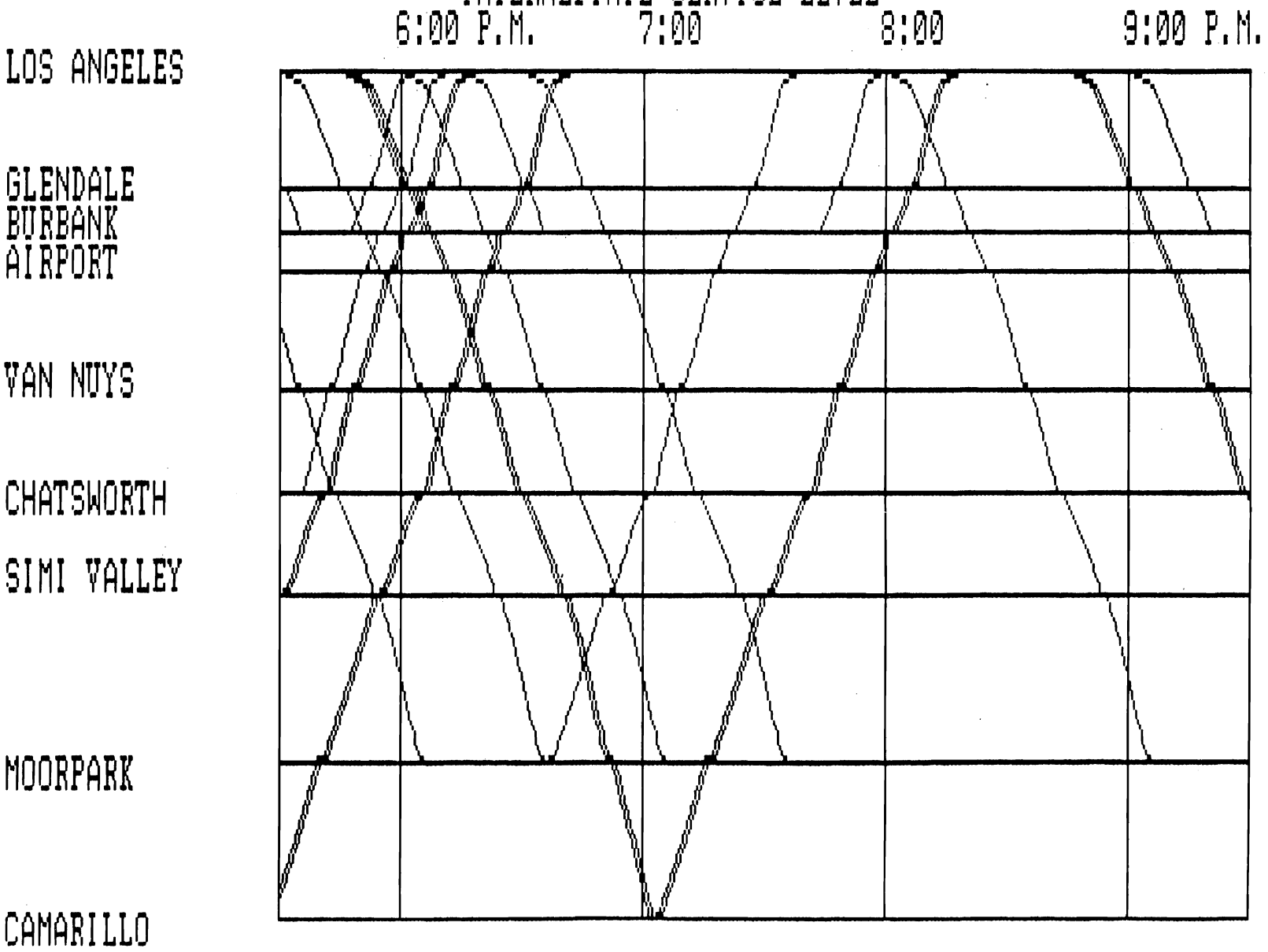
INTERMEDIATE SERVICE LEVEL



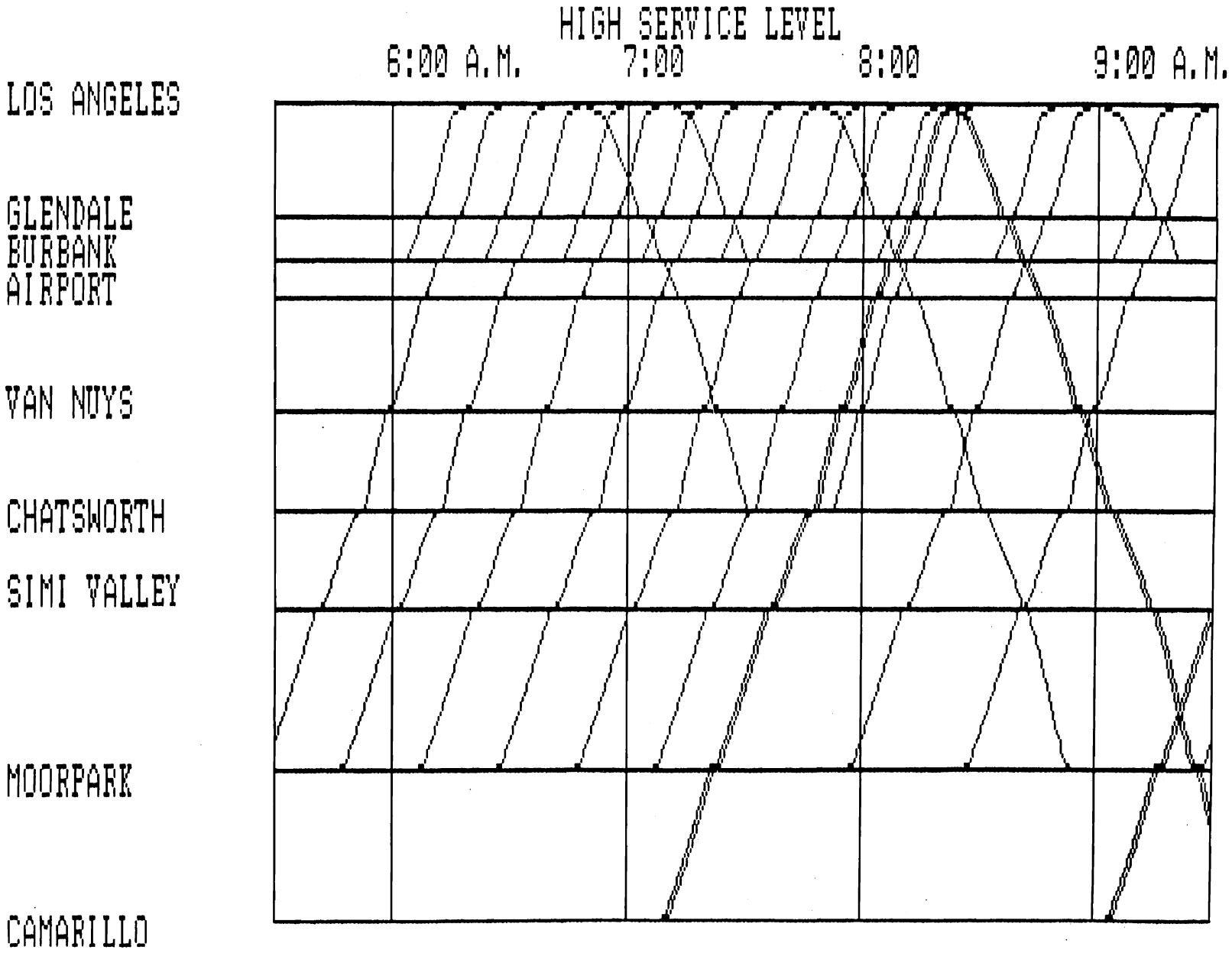
INTERMEDIATE SERVICE LEVEL



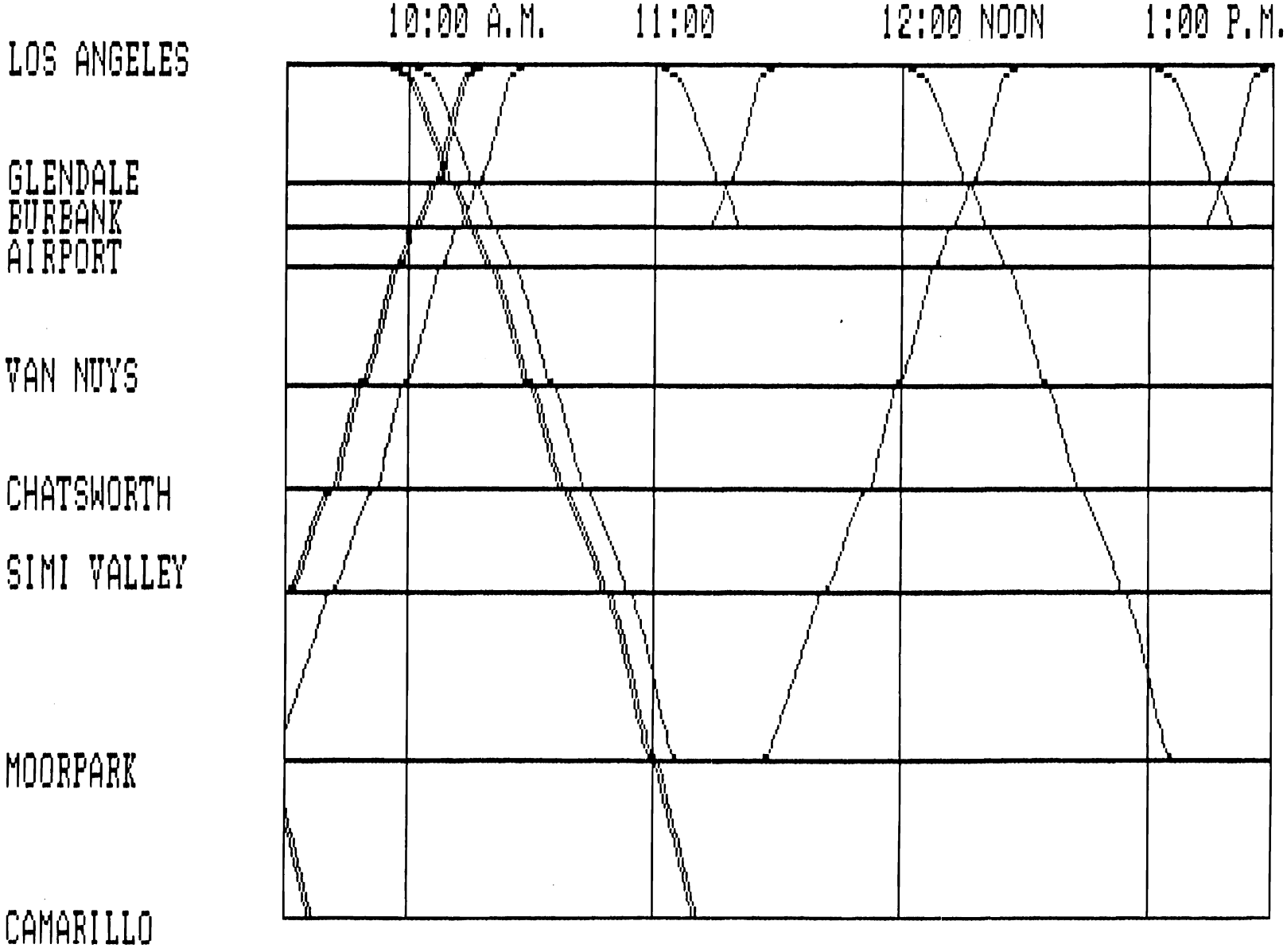
INTERMEDIATE SERVICE LEVEL



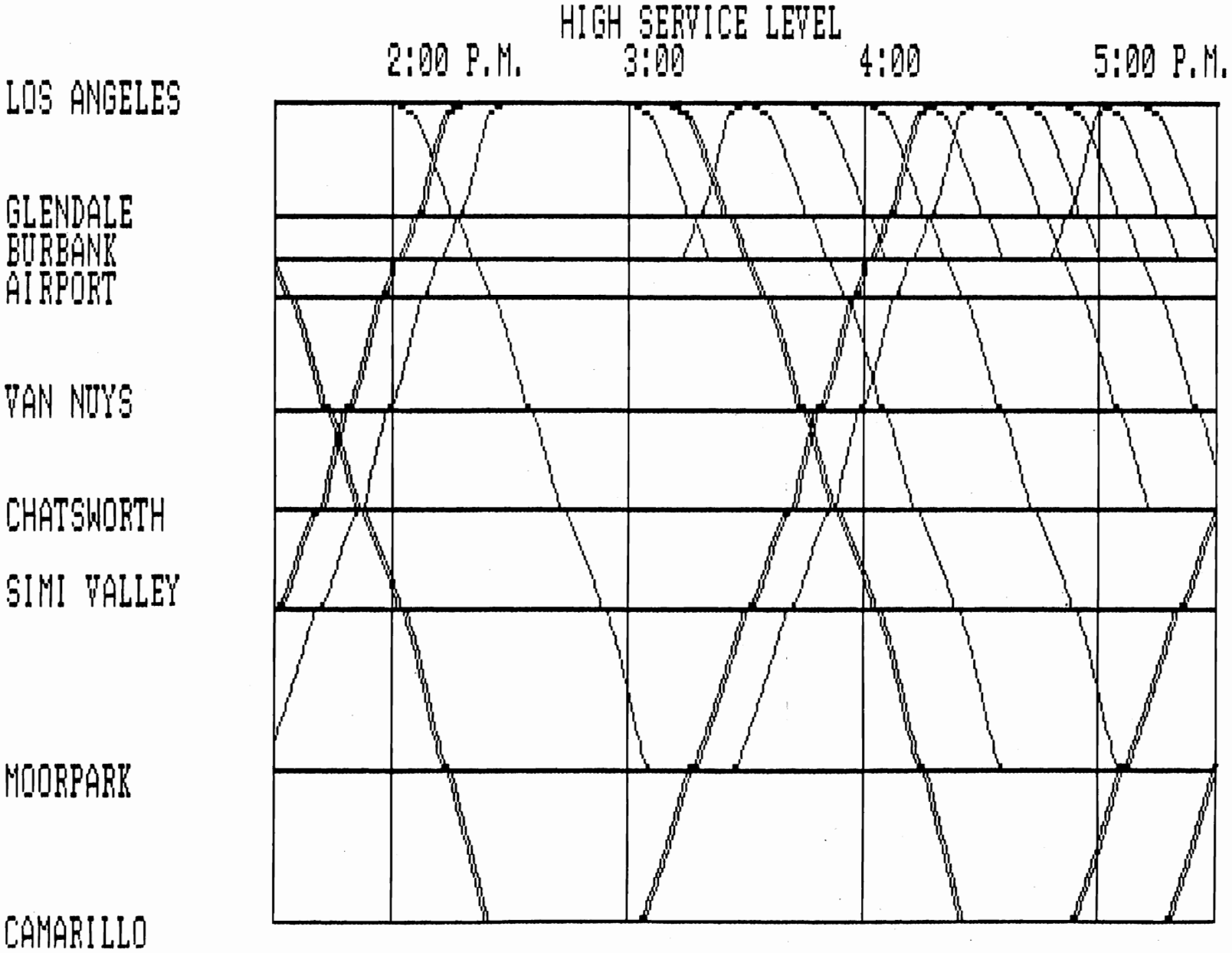
HIGH SERVICE LEVEL

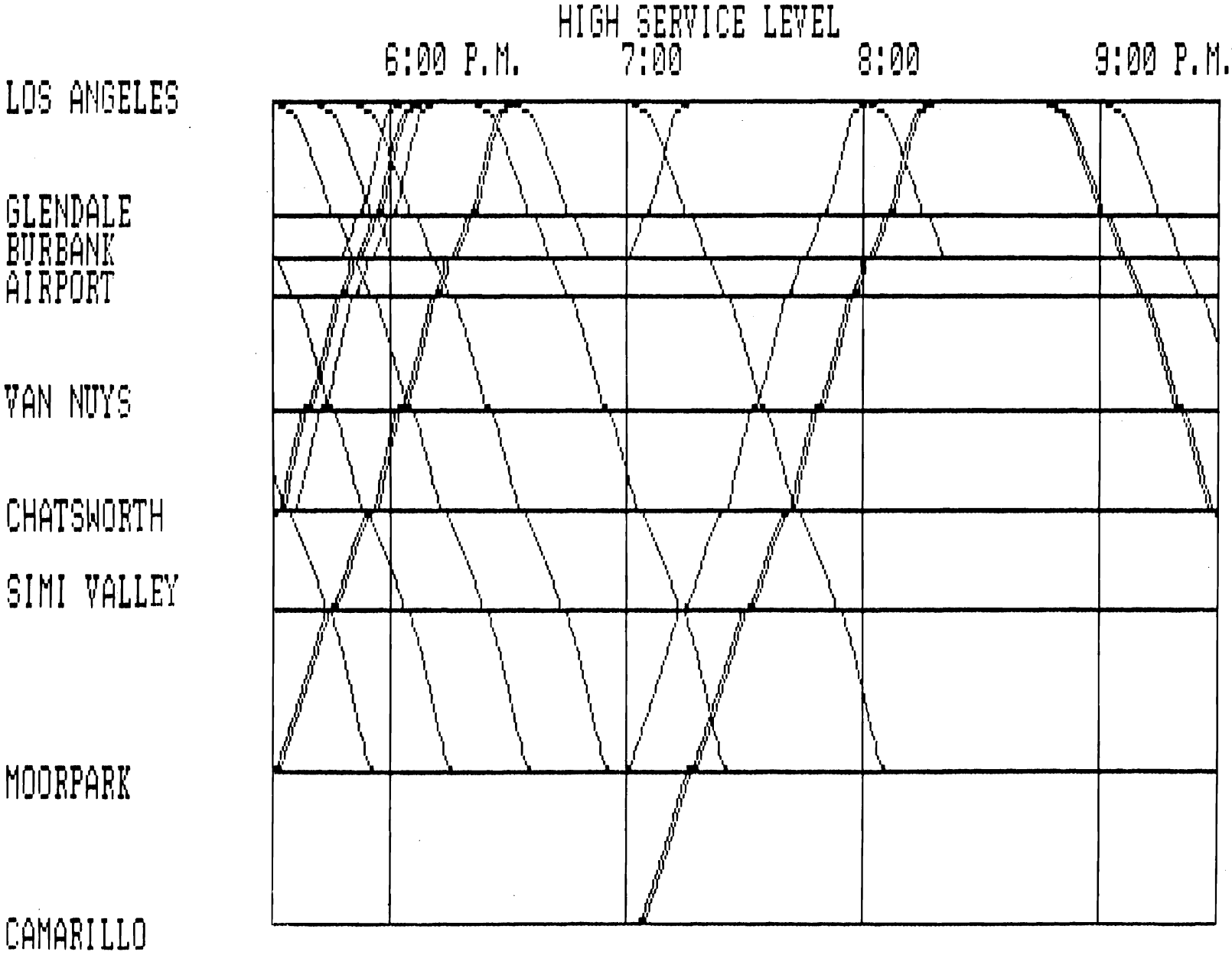


HIGH SERVICE LEVEL



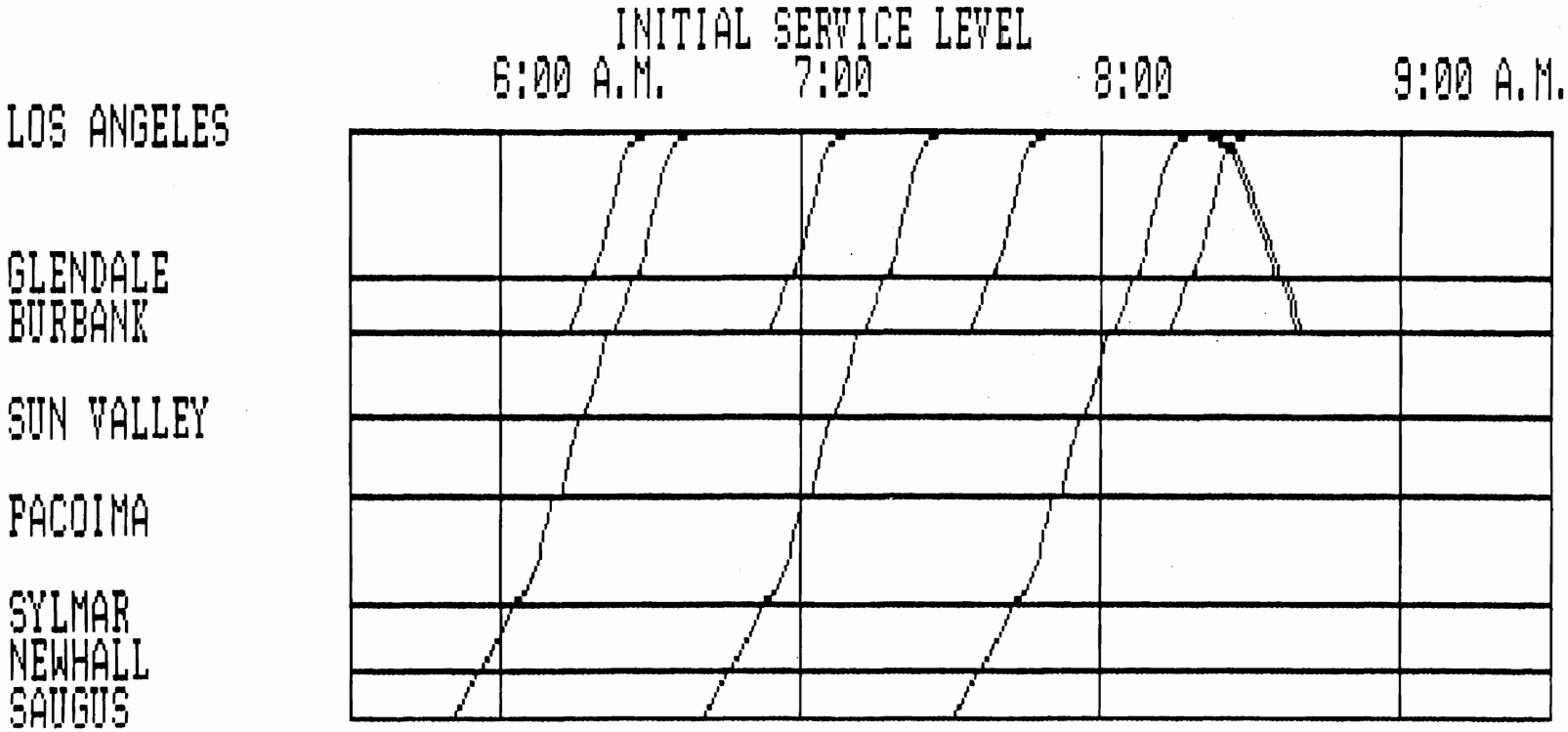
HIGH SERVICE LEVEL



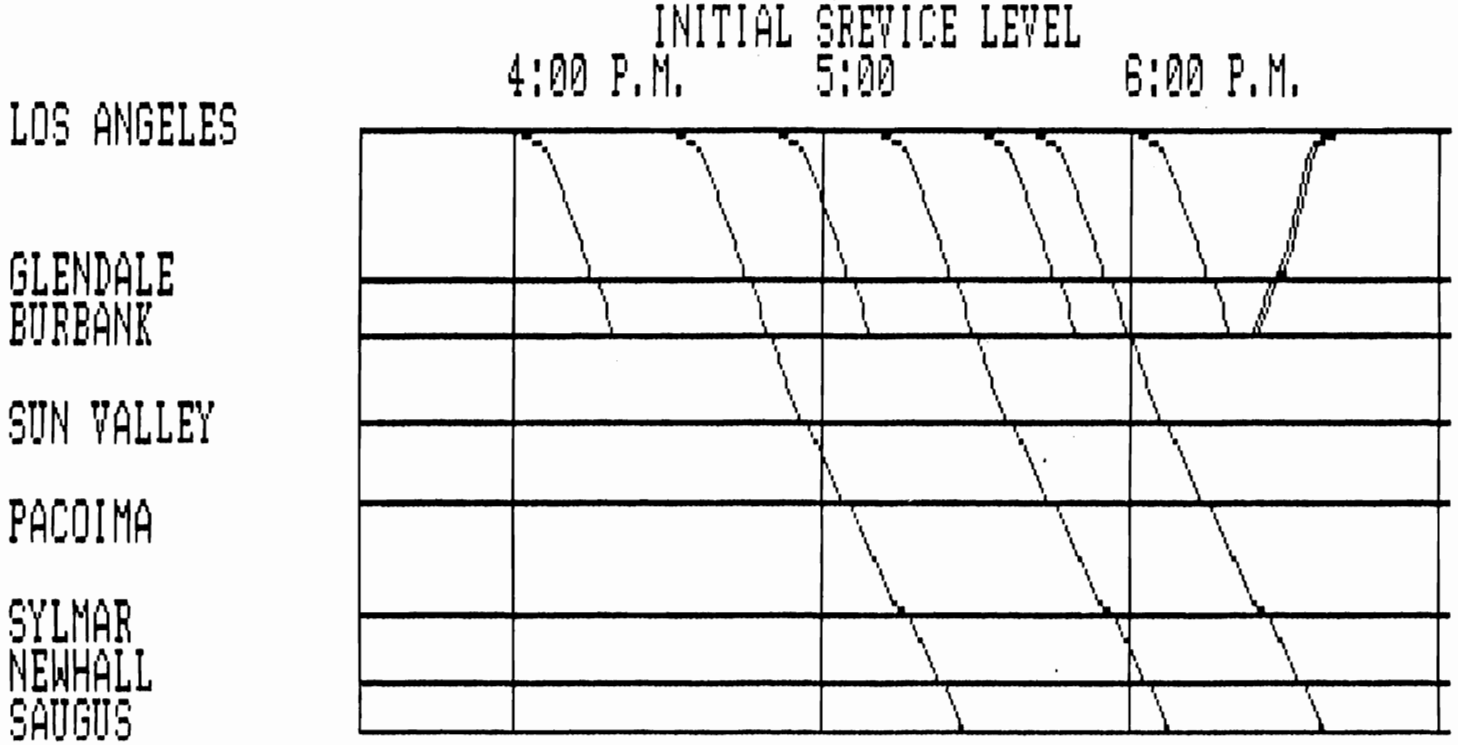

HIGH SERVICE LEVEL
6:00 P.M.
7:00
8:00
9:00 P.M.
LOS ANGELES
GLENDALE
BURBANK
AIRPORT
VAN NUYS
CHATSWORTH
SIMI VALLEY
MOORPARK
CAMARILLO

2. LOS ANGELES - SANTA CLARITA

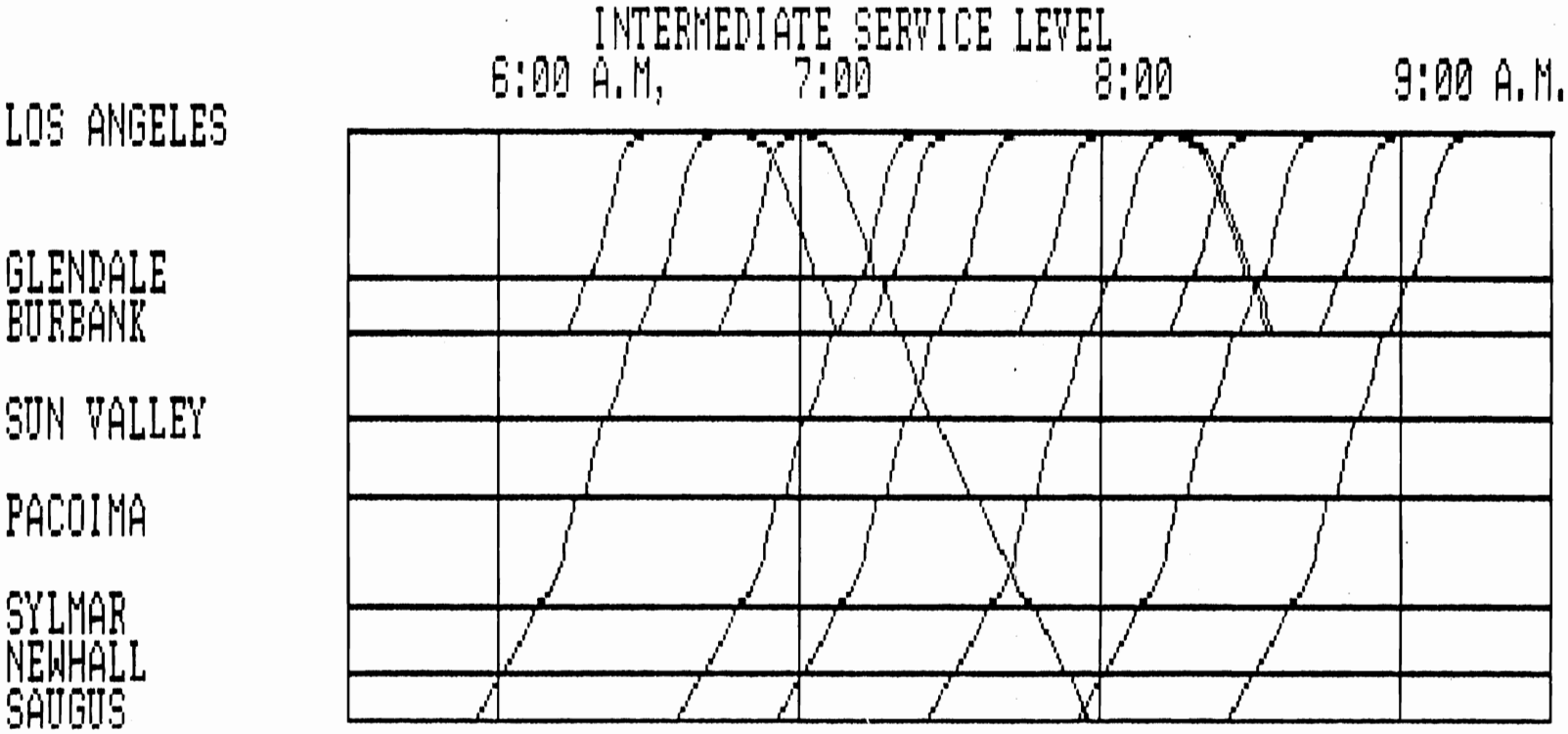
INITIAL SERVICE LEVEL



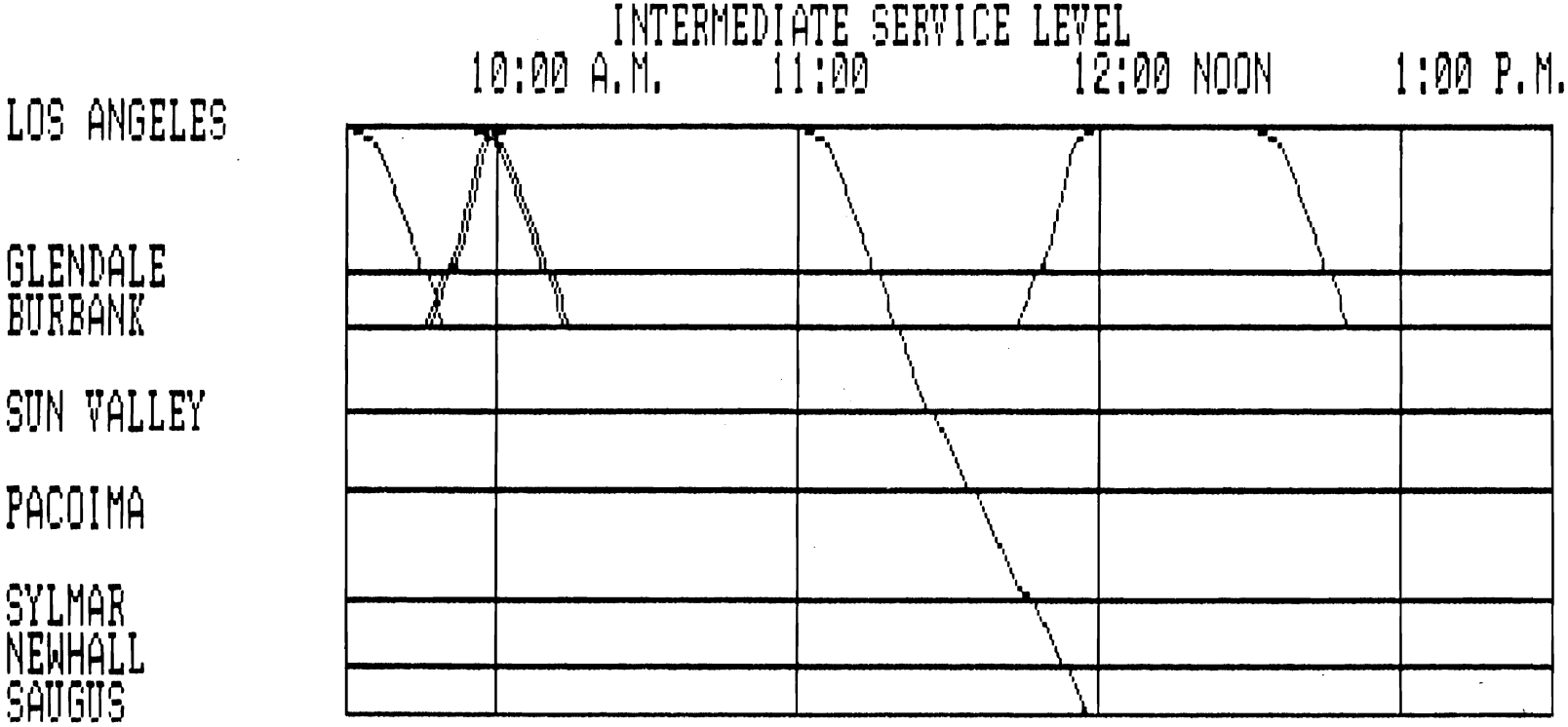
INITIAL SREVICE LEVEL



INTERMEDIATE SERVICE LEVEL



INTERMEDIATE SERVICE LEVEL



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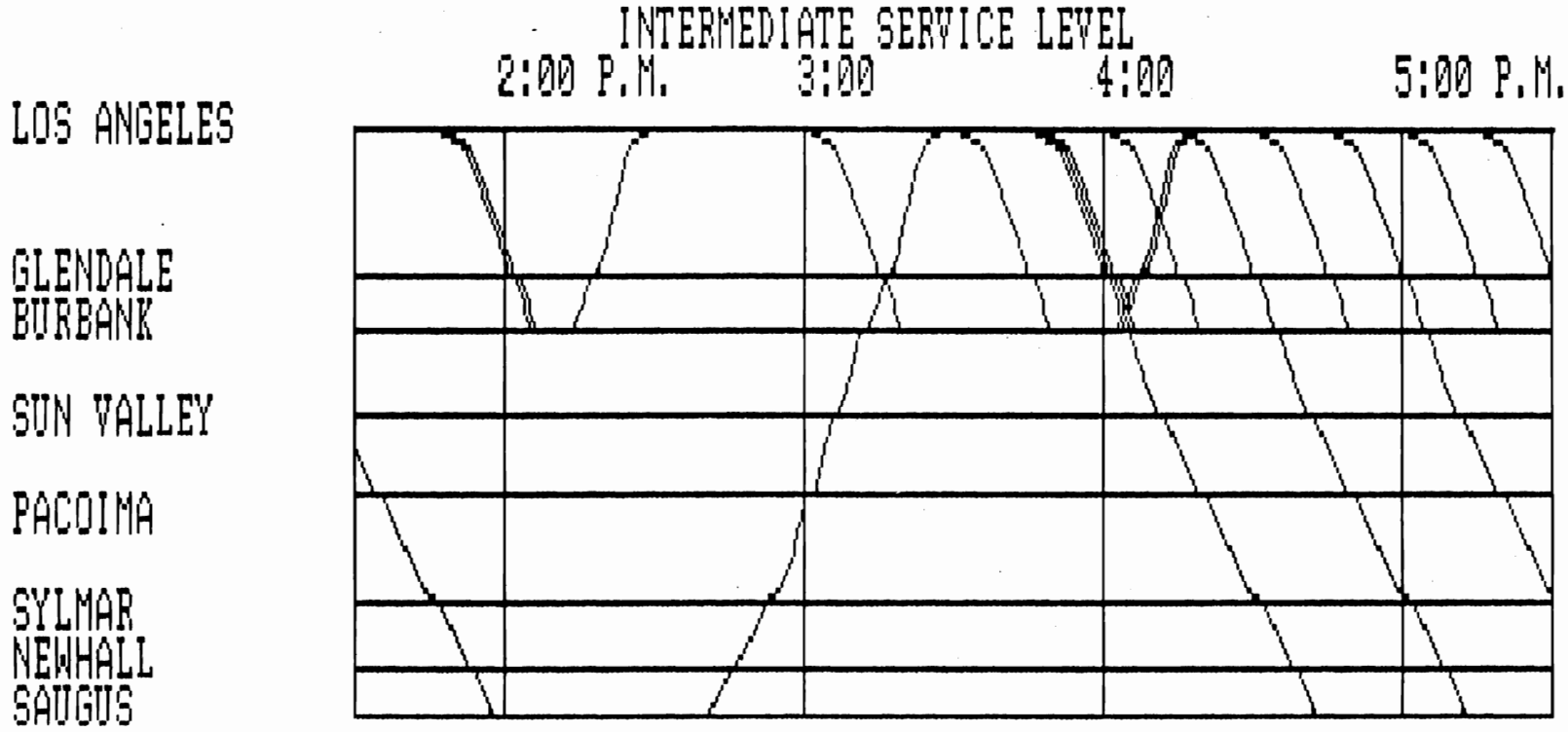

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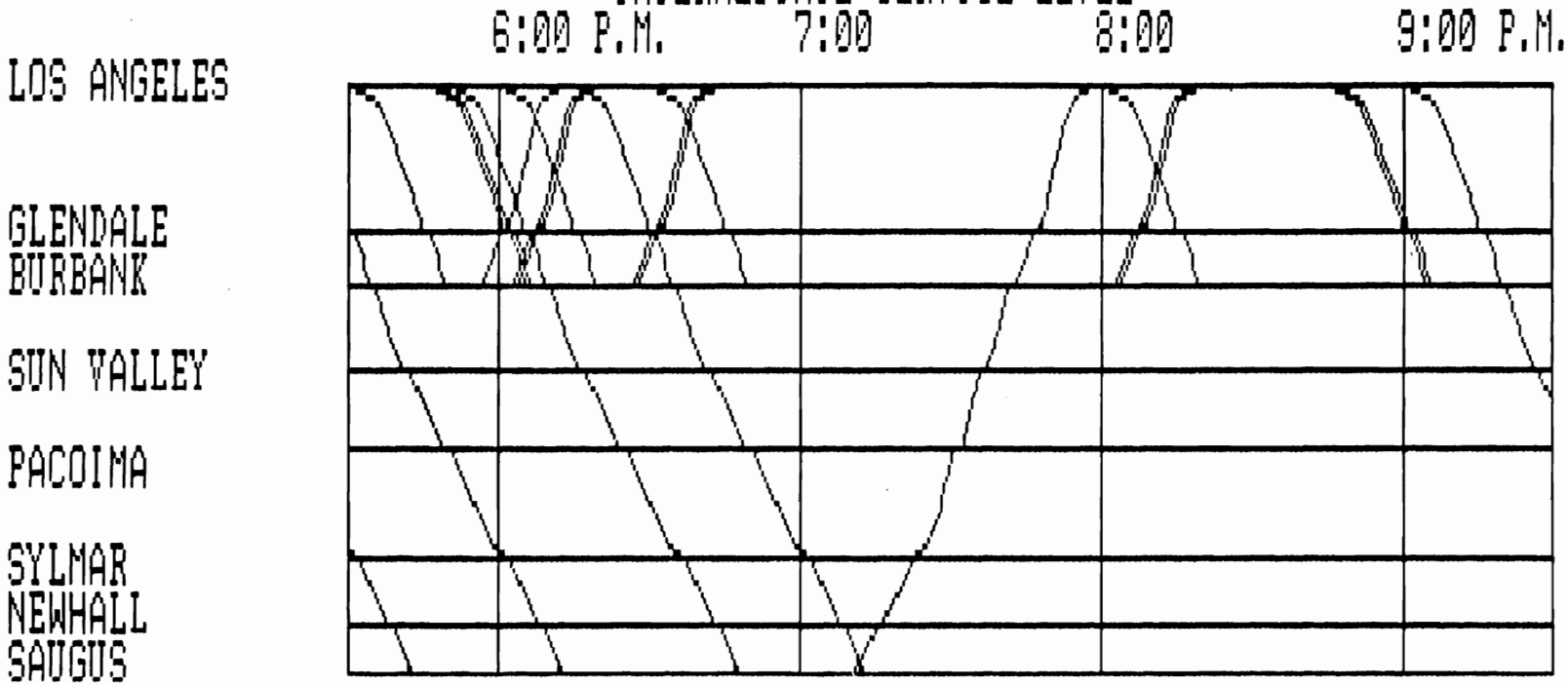
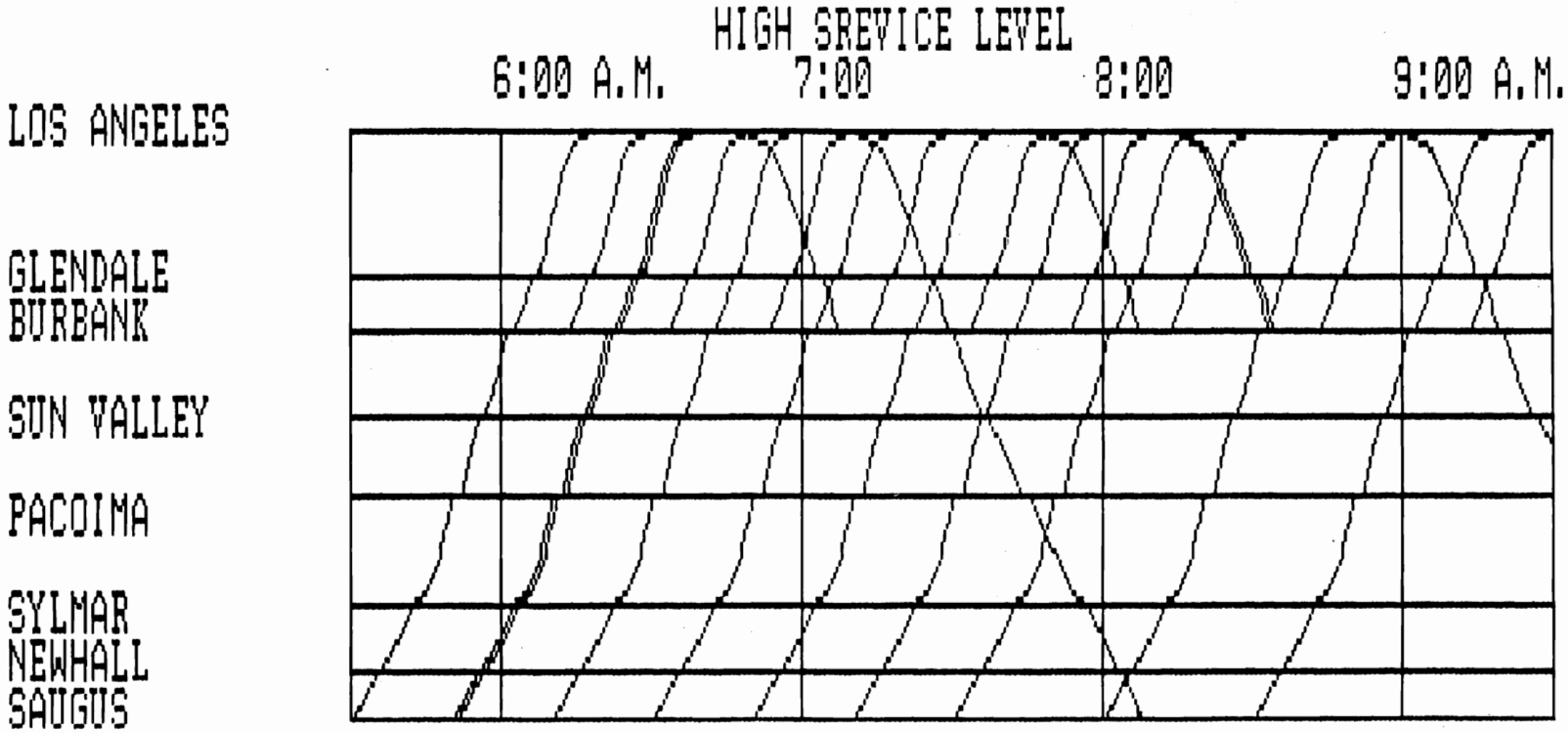


HIGH SREVICE LEVEL



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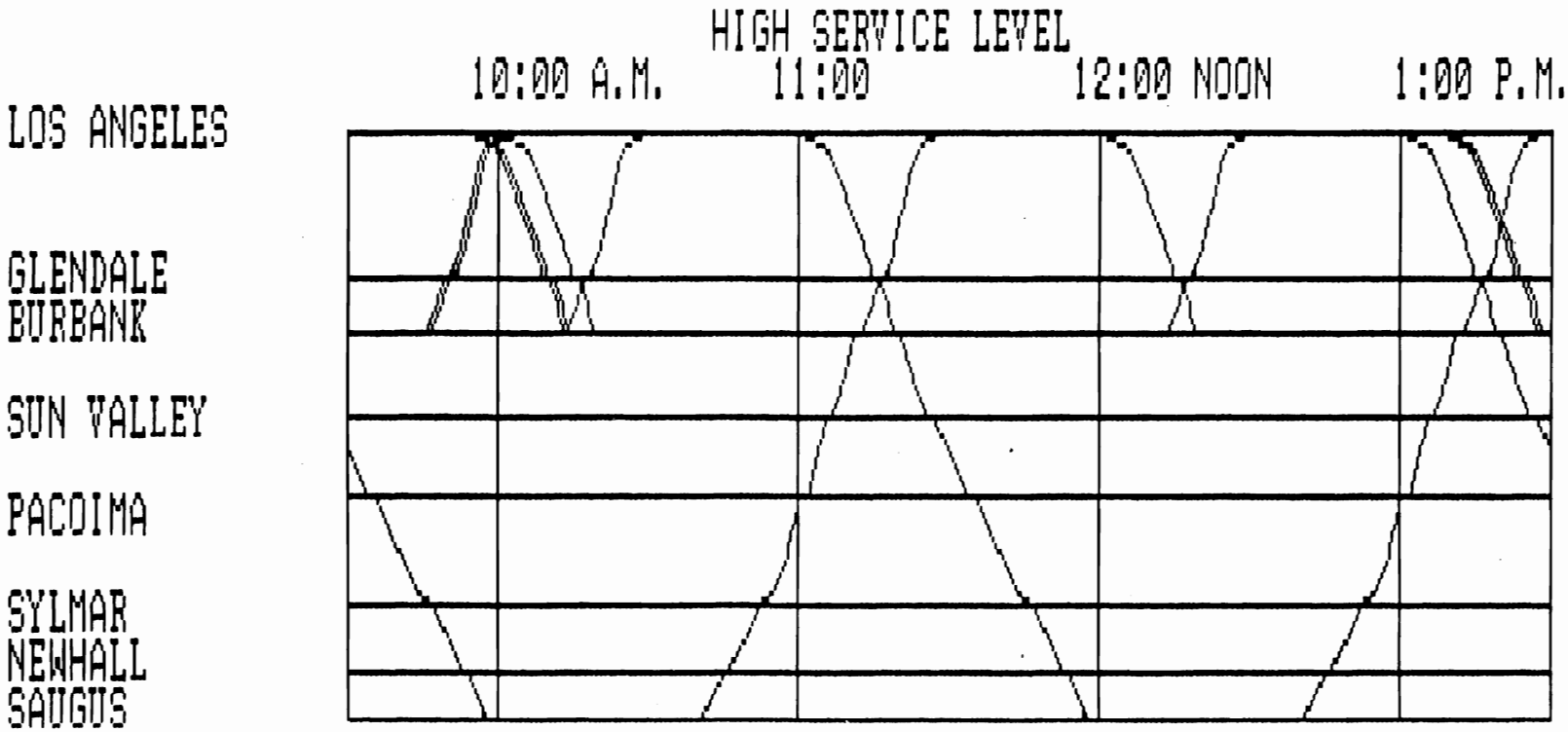

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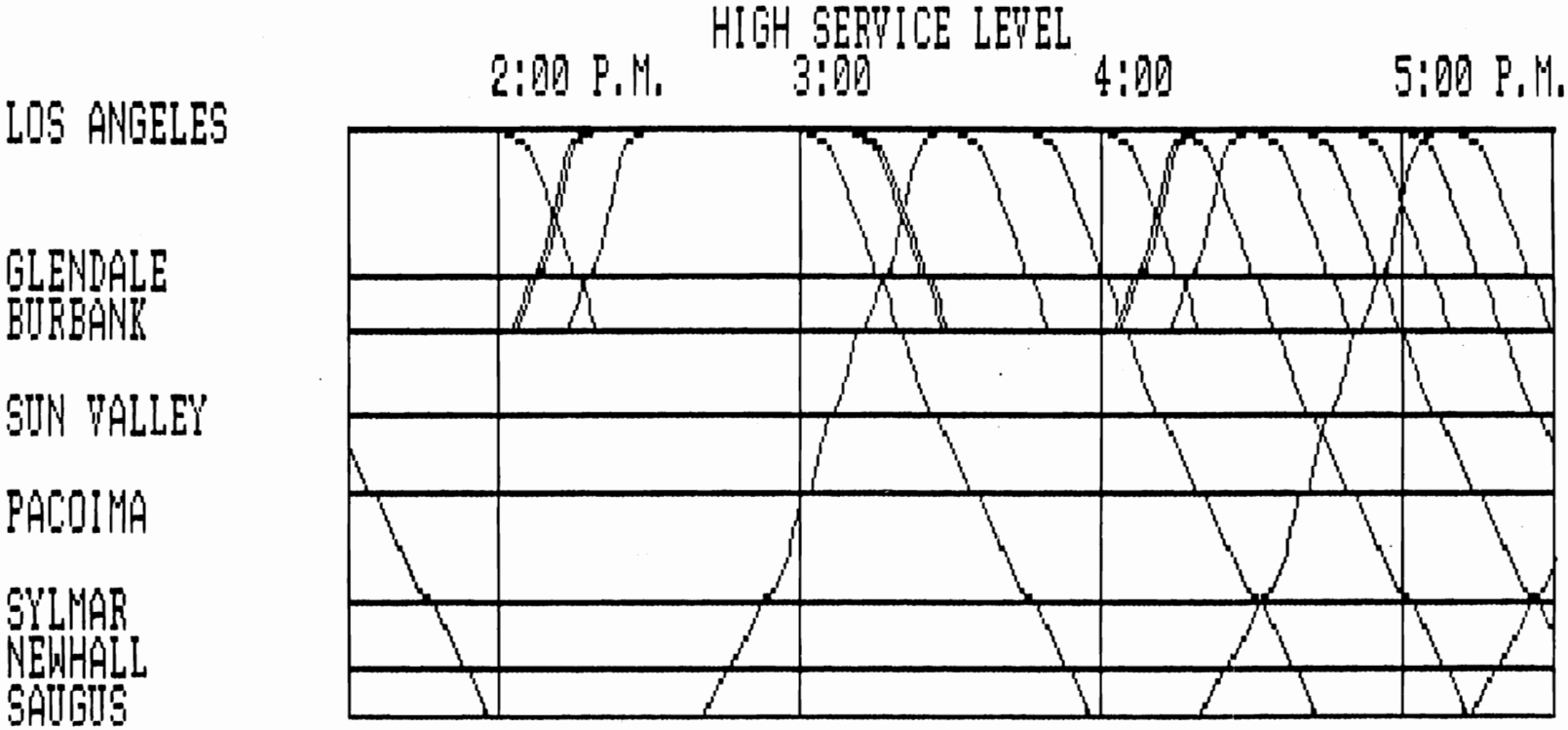

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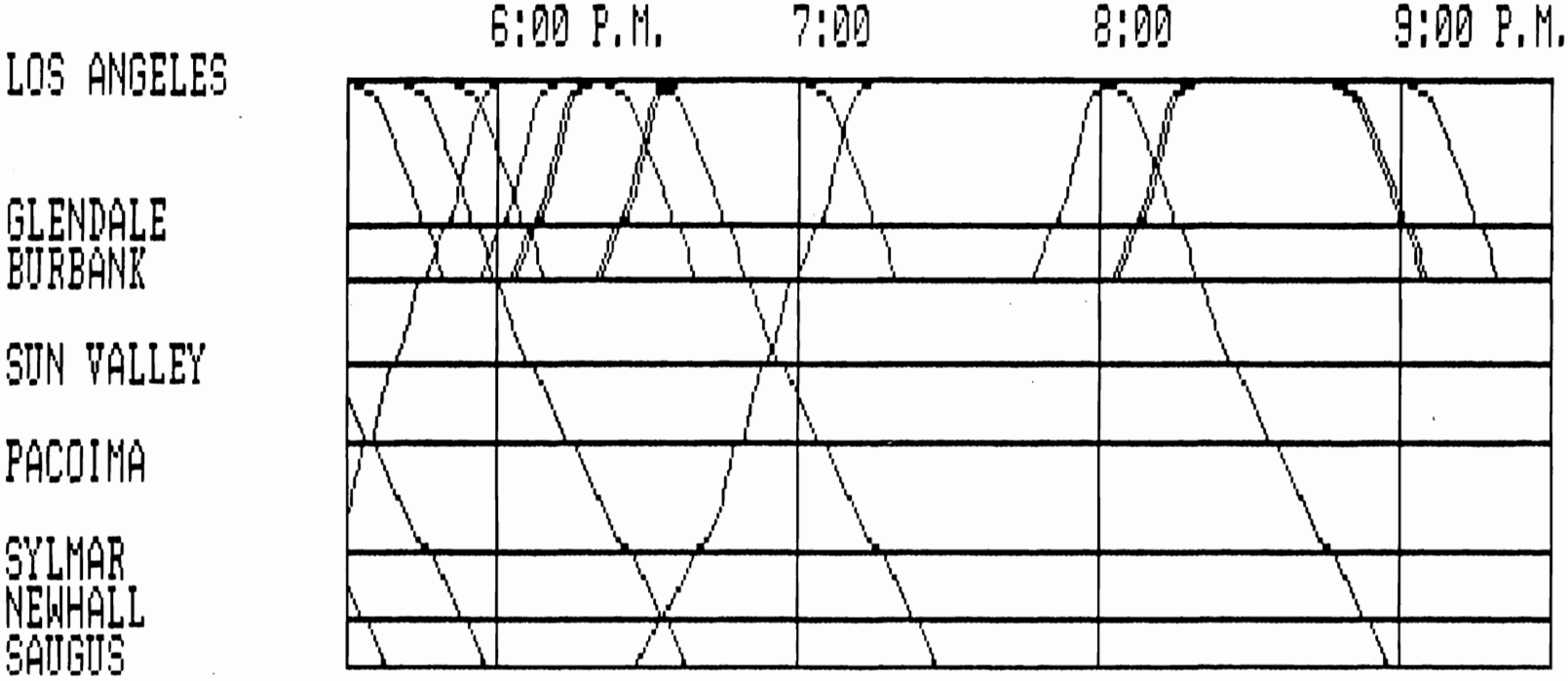
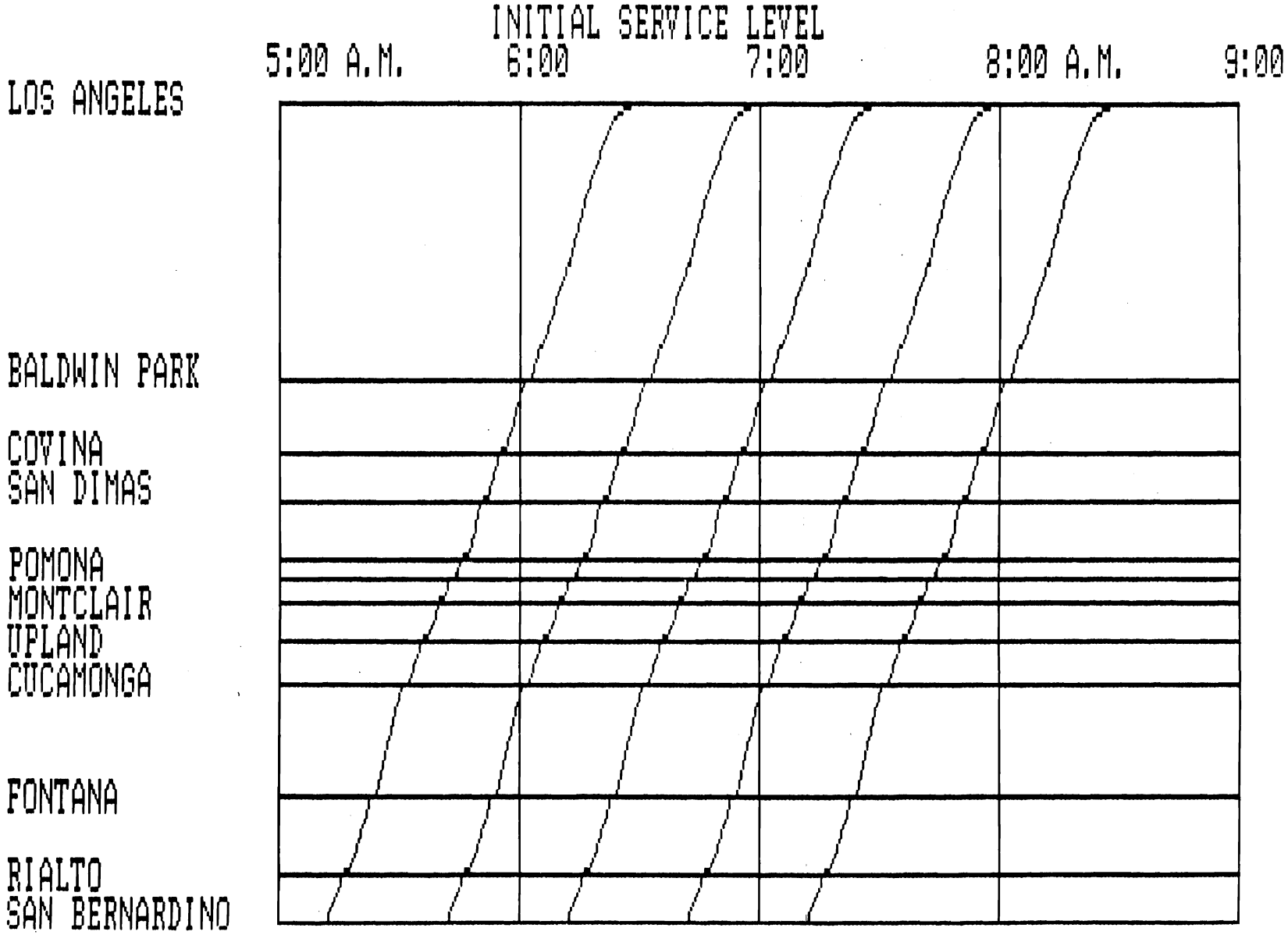
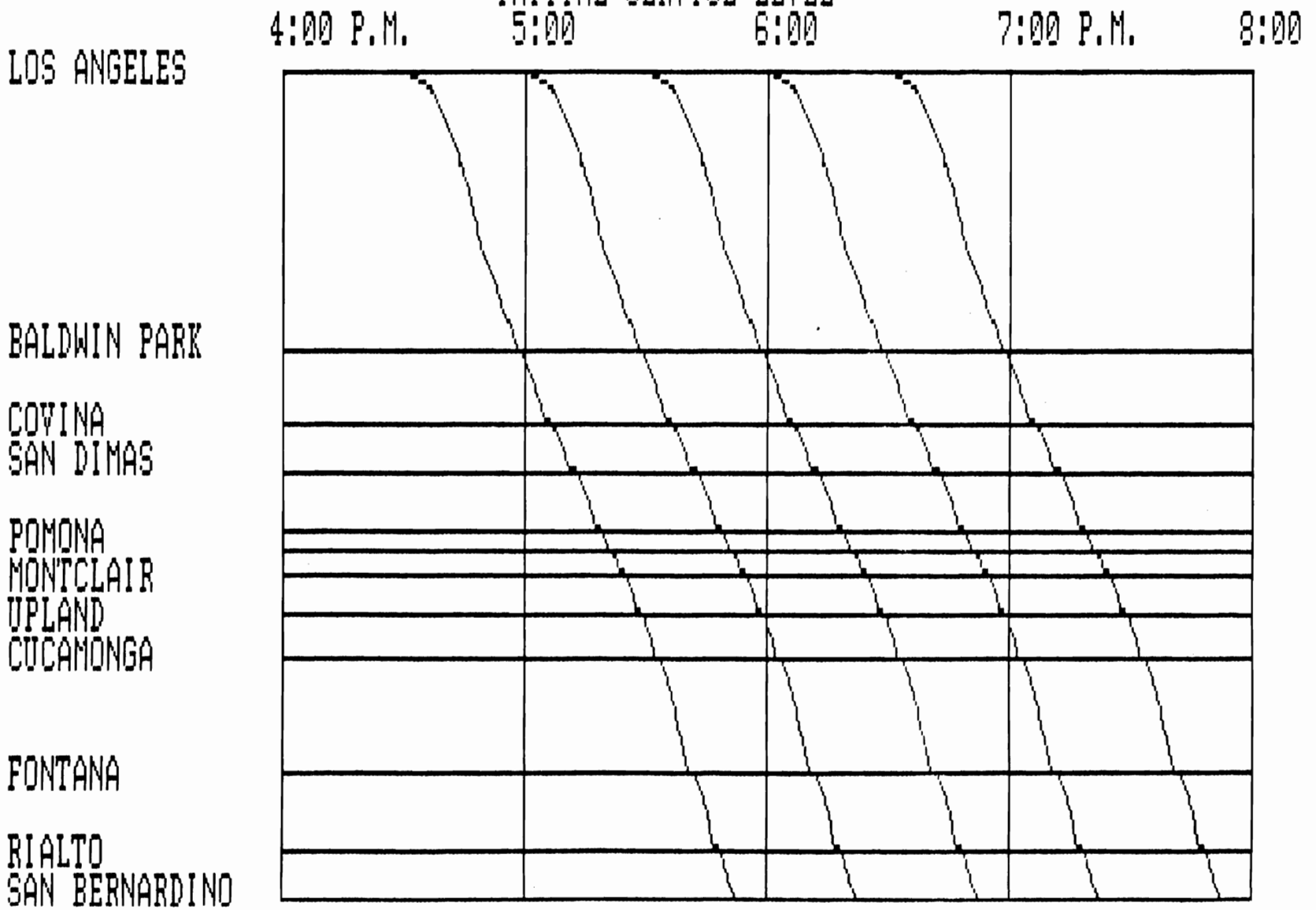


3. LOS ANGELES - SAN BERNARDINO VIA POMONA

INITIAL SERVICE LEVEL



INITIAL SERVICE LEVEL



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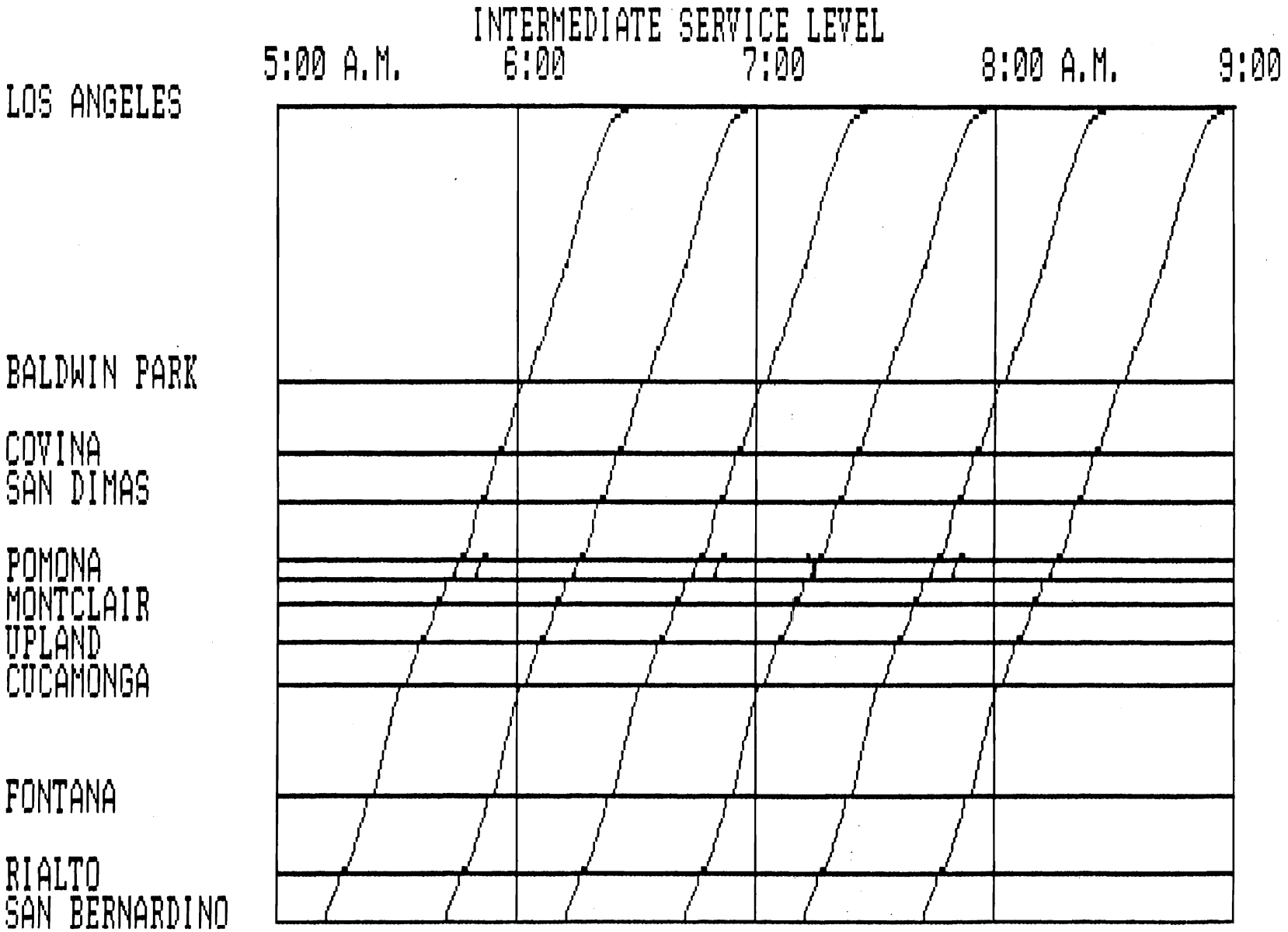

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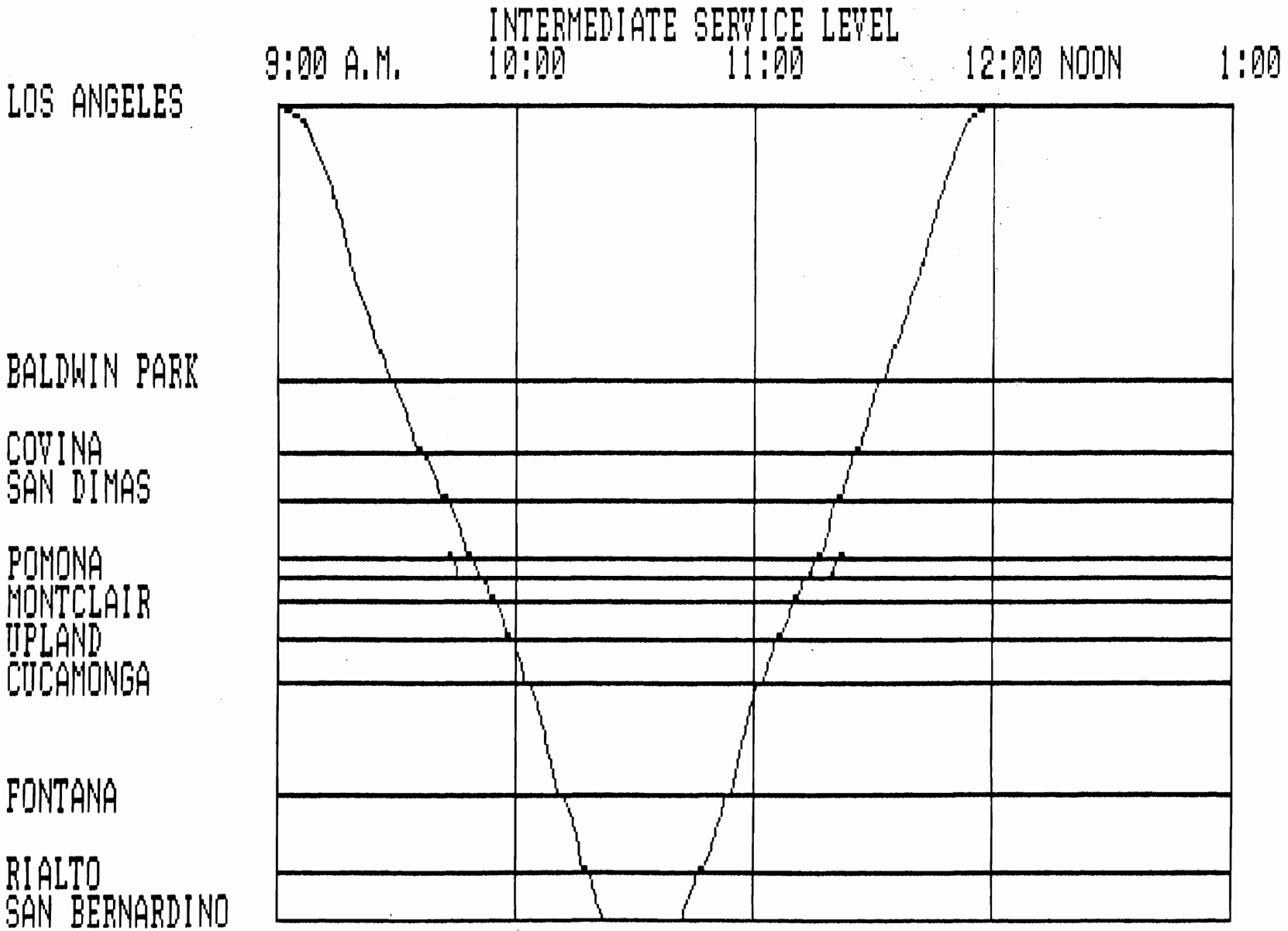

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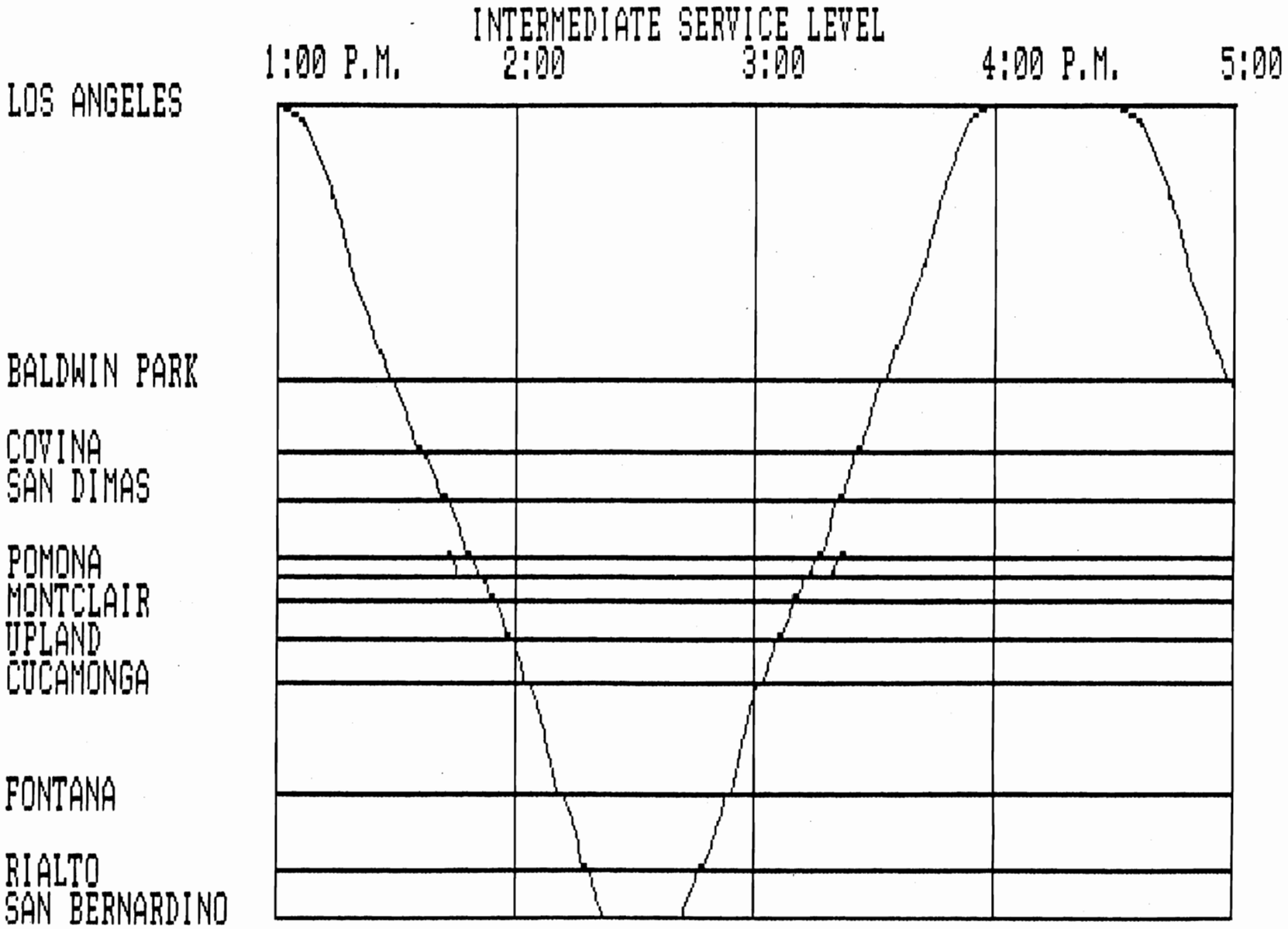

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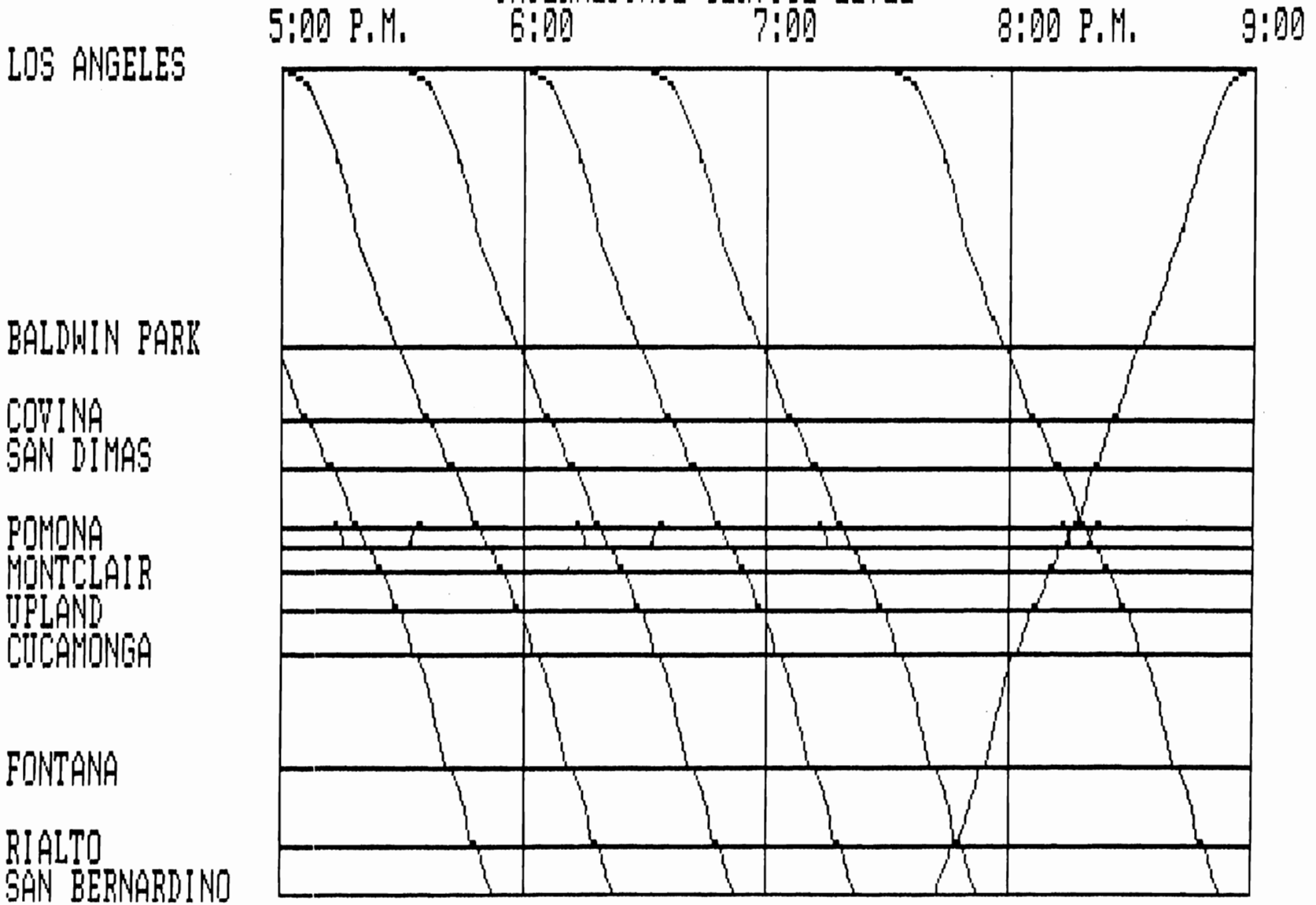

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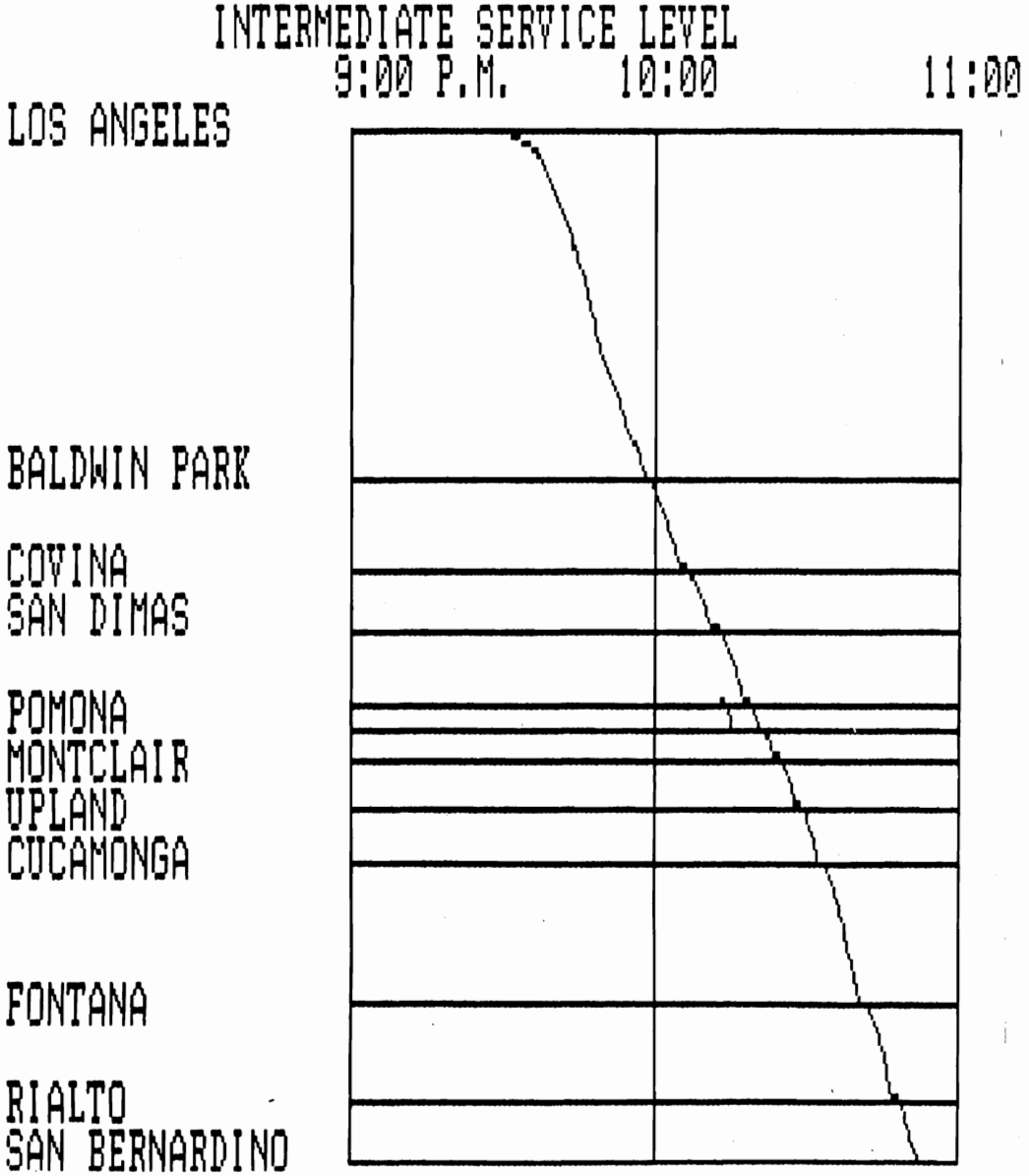

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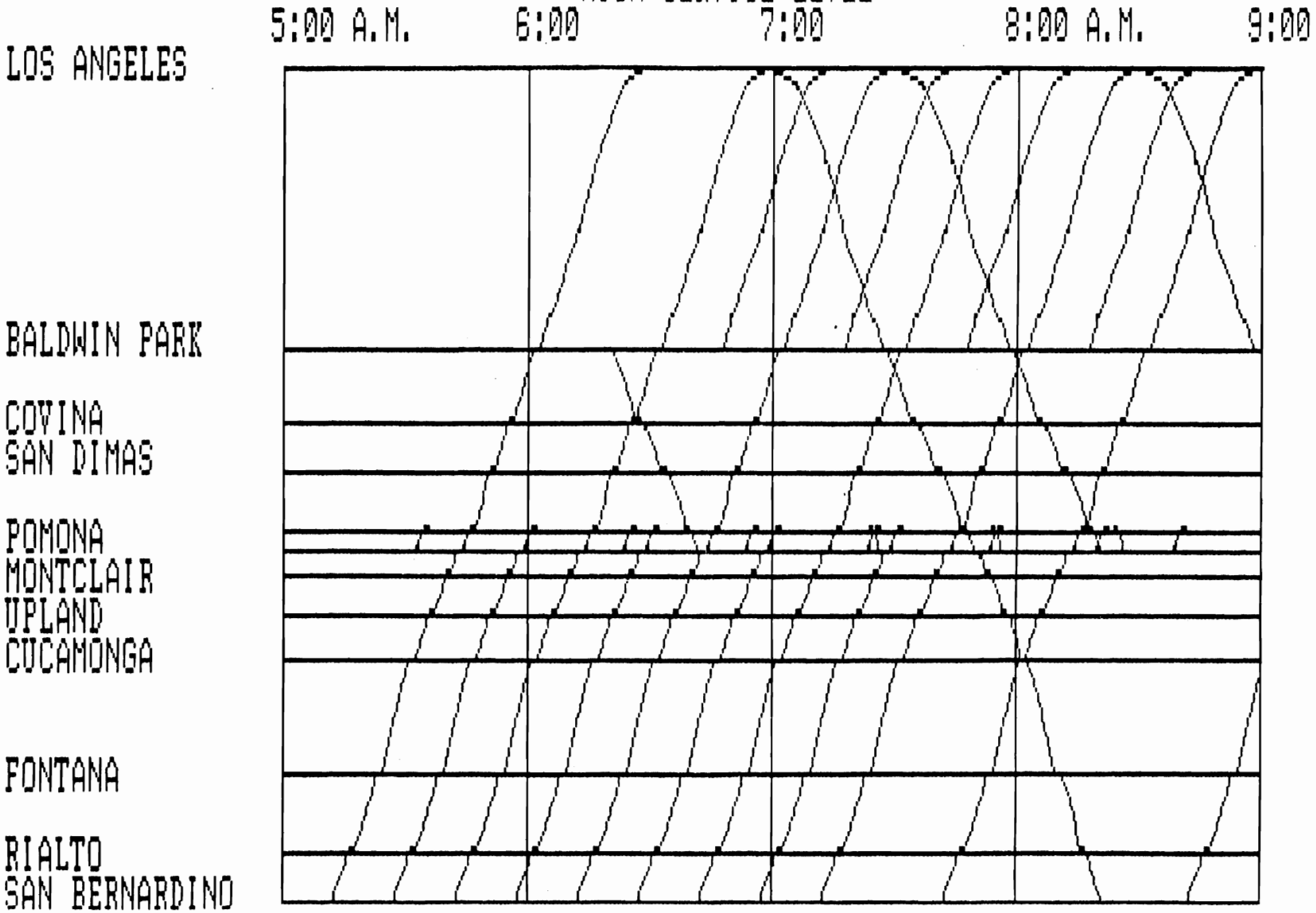
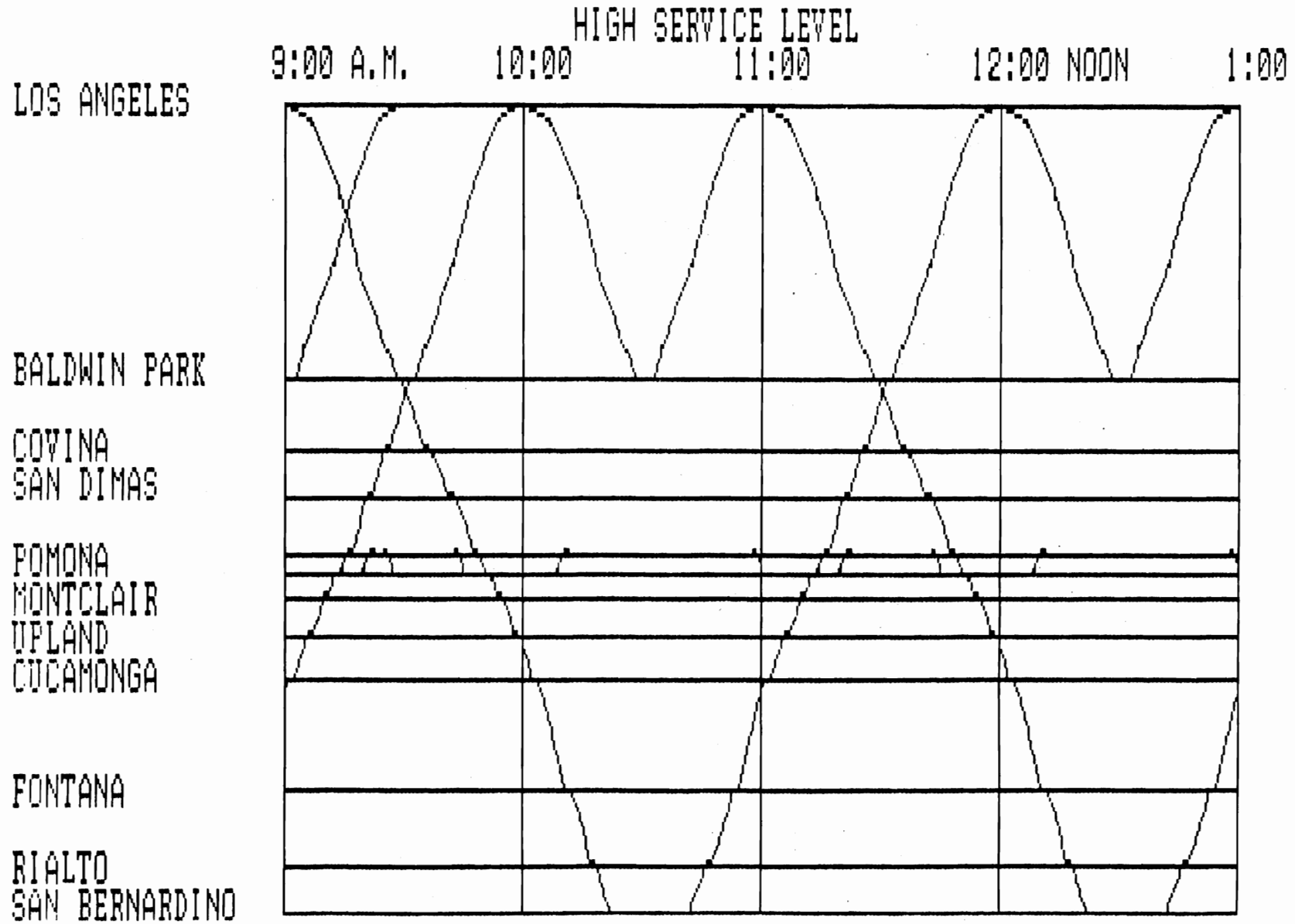
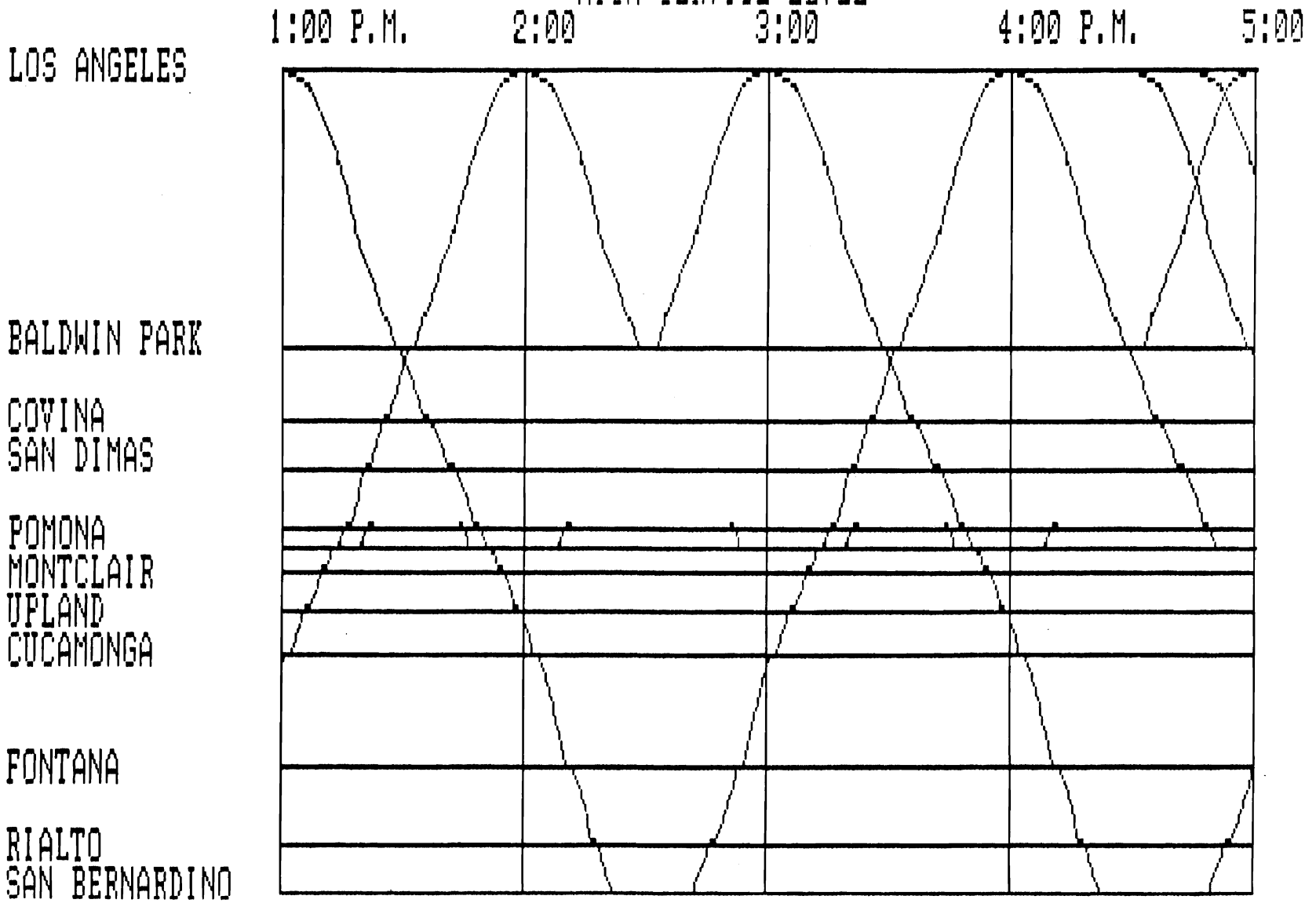



HIGH SERVICE LEVEL
9:00 A.M.
10:00
11:00
12:00 NOON
1:00
LOS ANGELES
BALDWIN PARK
COVINA
SAN DIMAS
POMONA
MONTCLAIR
UPLAND
CUCAMONGA
FONTANA
RIALTO
SAN BERNARDINO

HIGH SERVICE LEVEL



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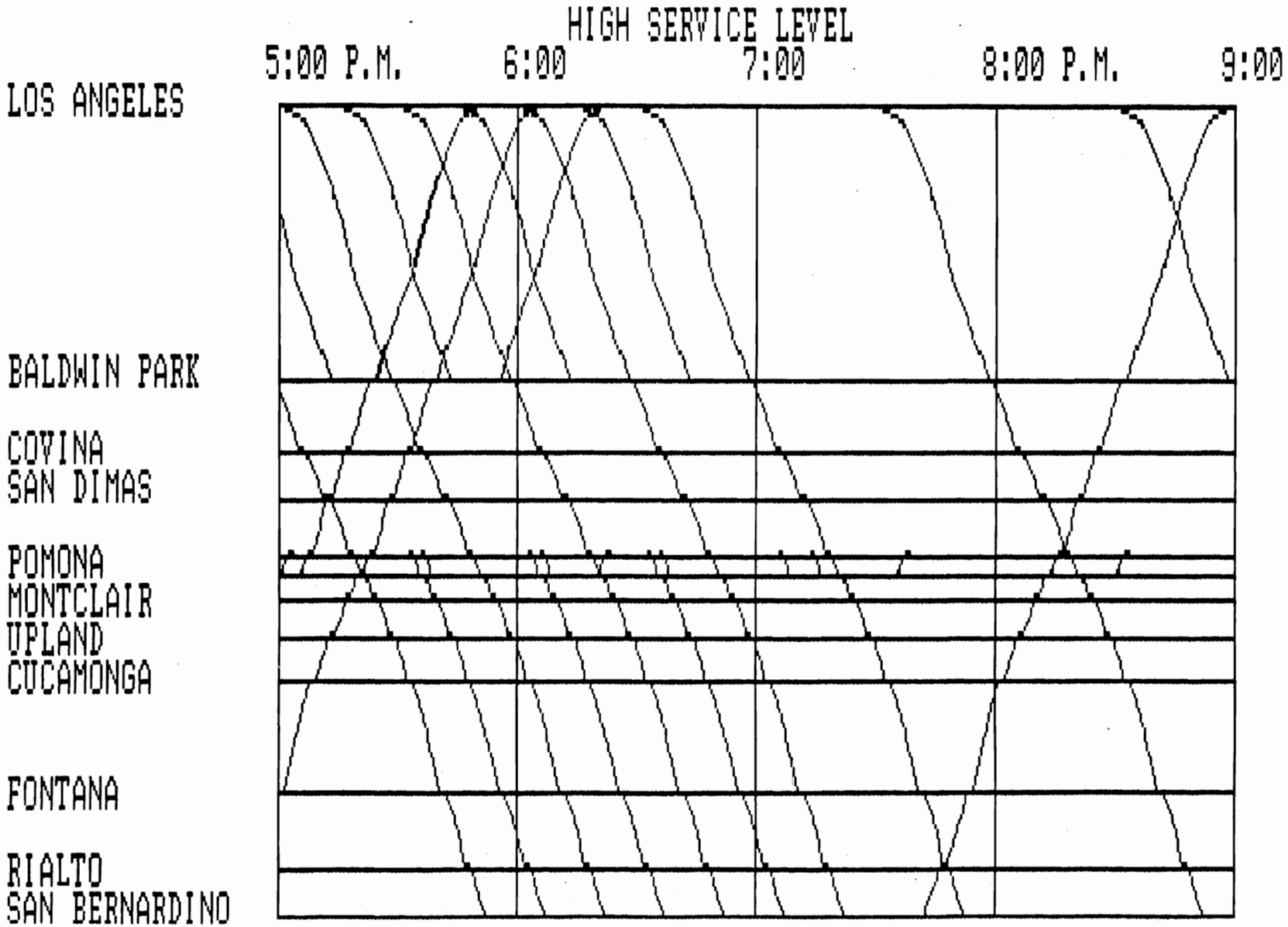

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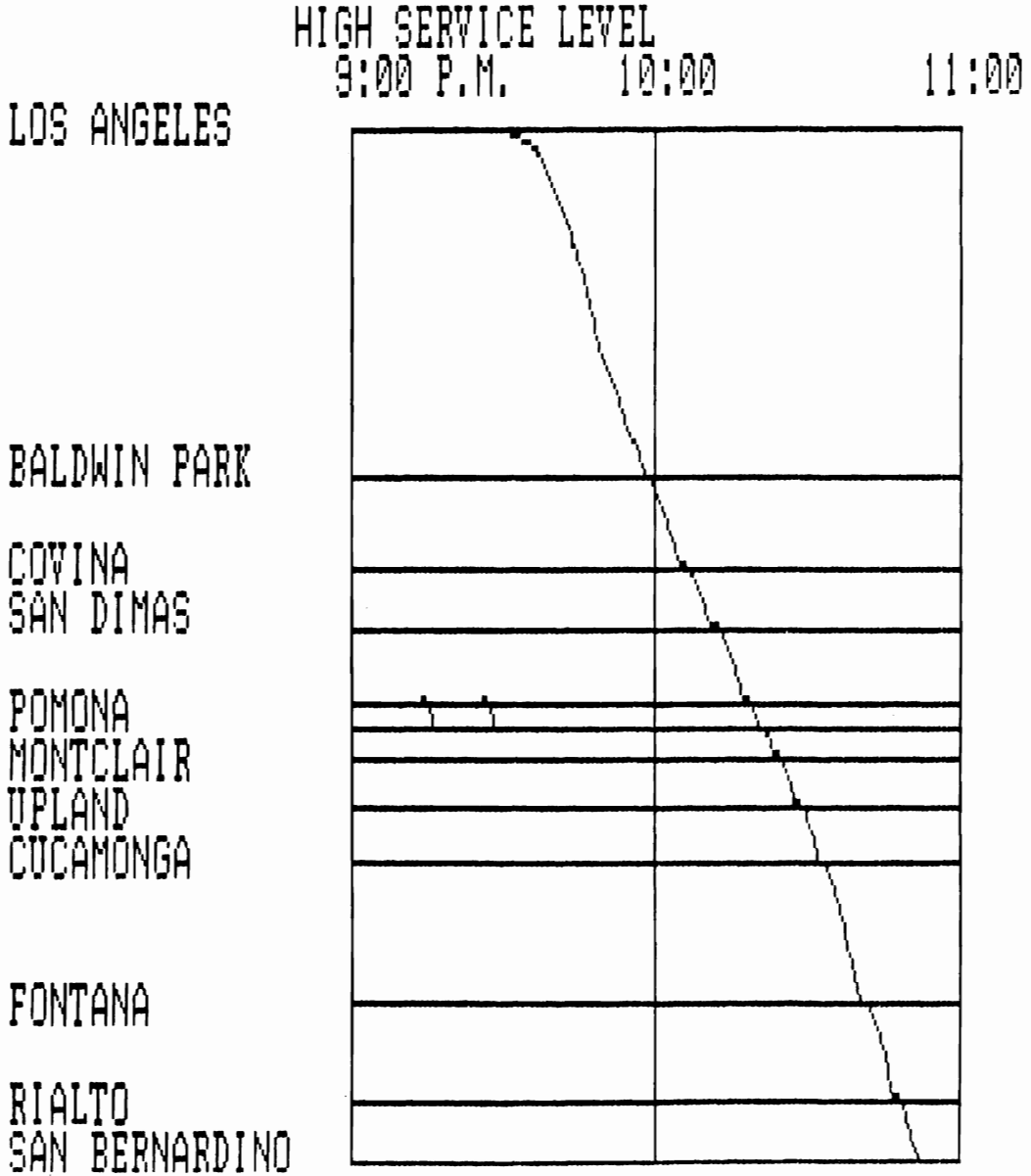
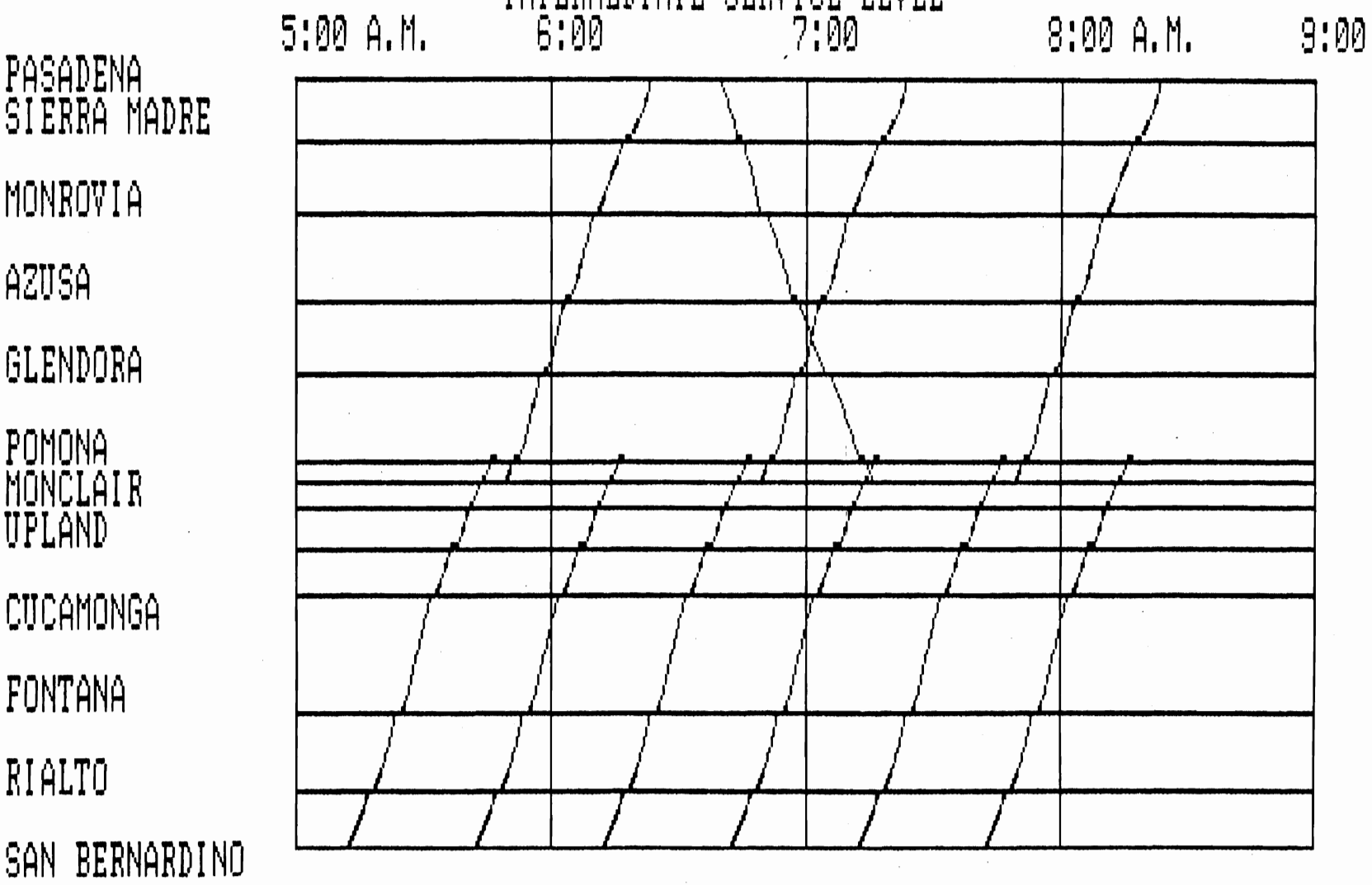


4. PASADENA - SAN BERNARDINO

INTERMEDIATE SERVICE LEVEL



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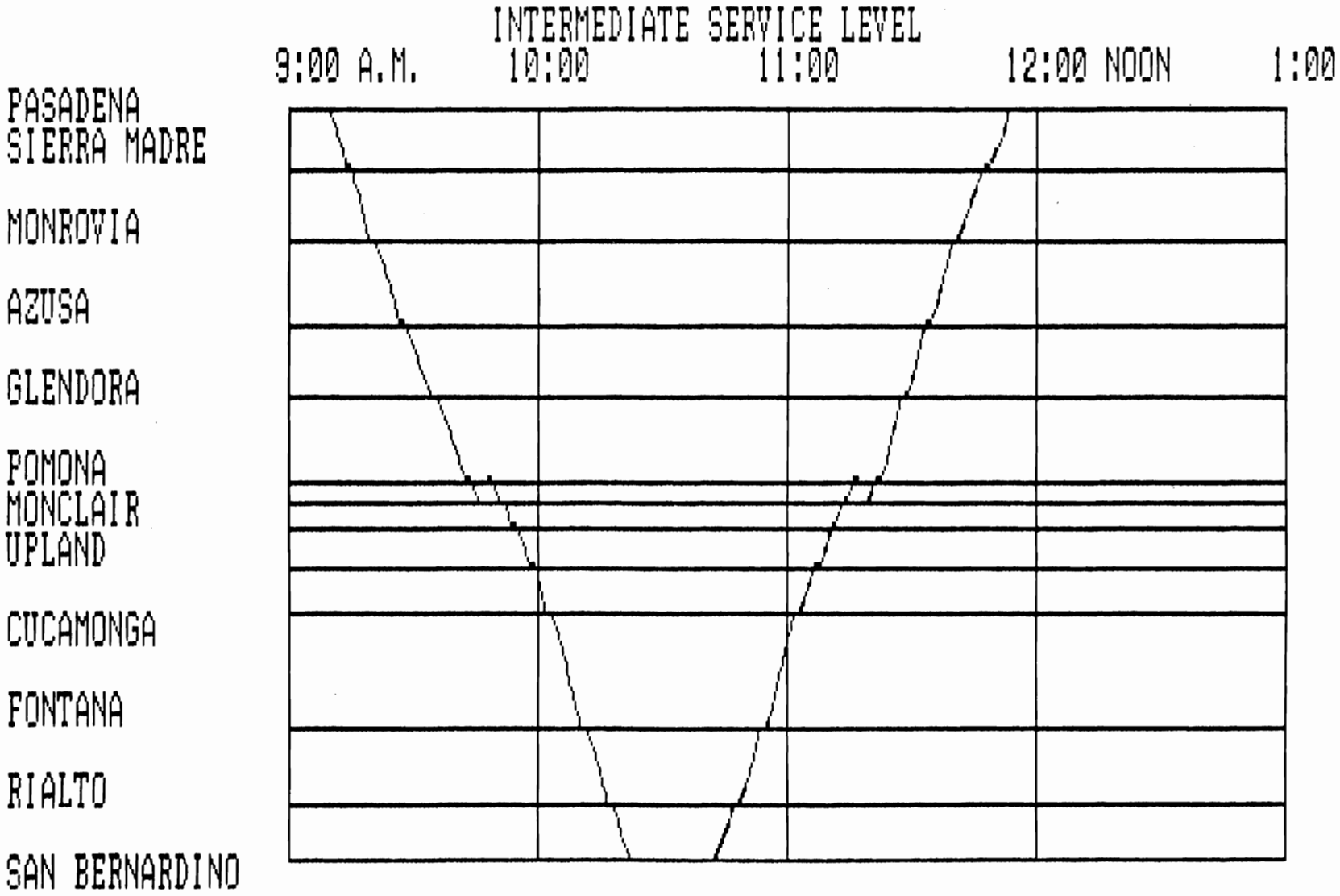

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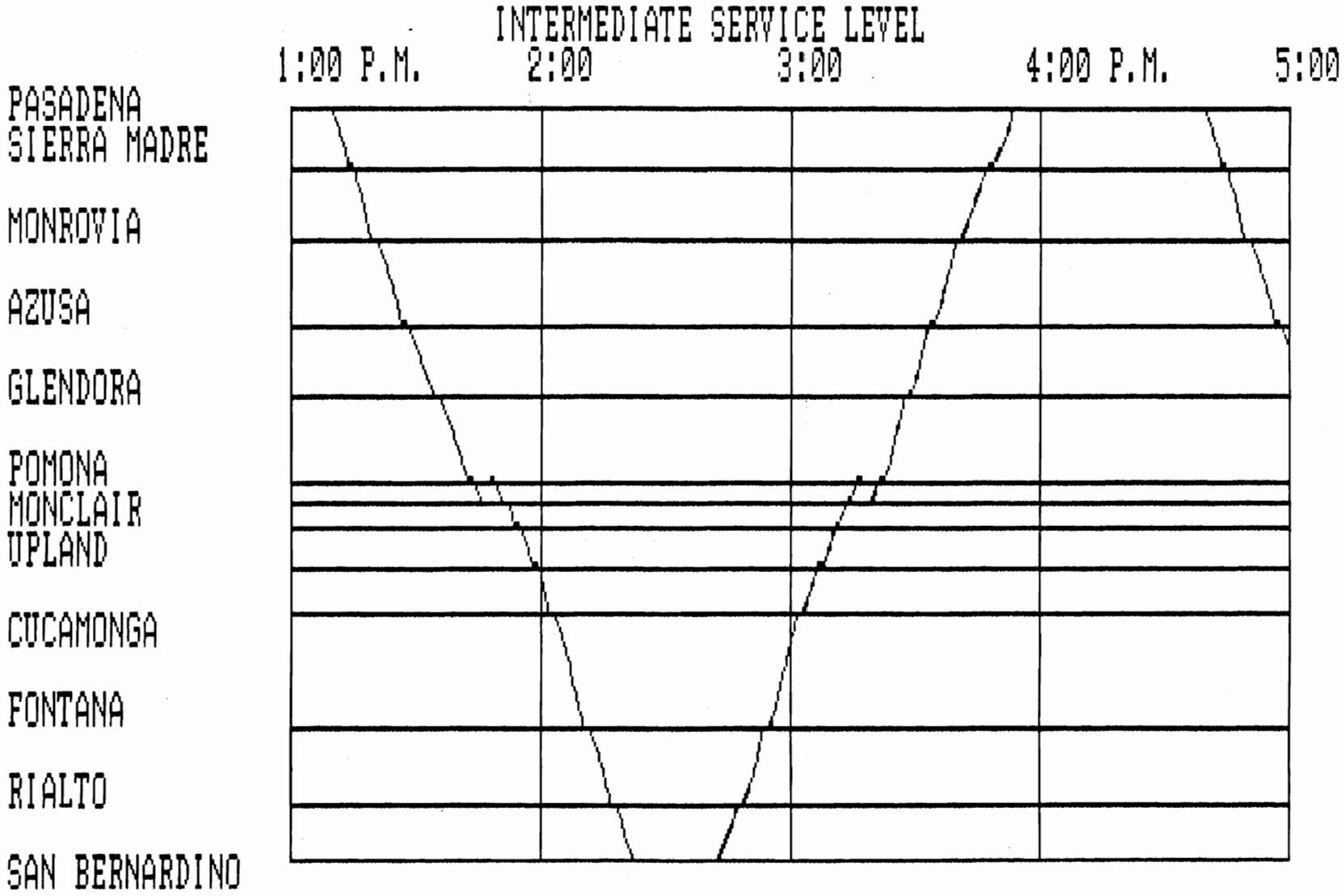

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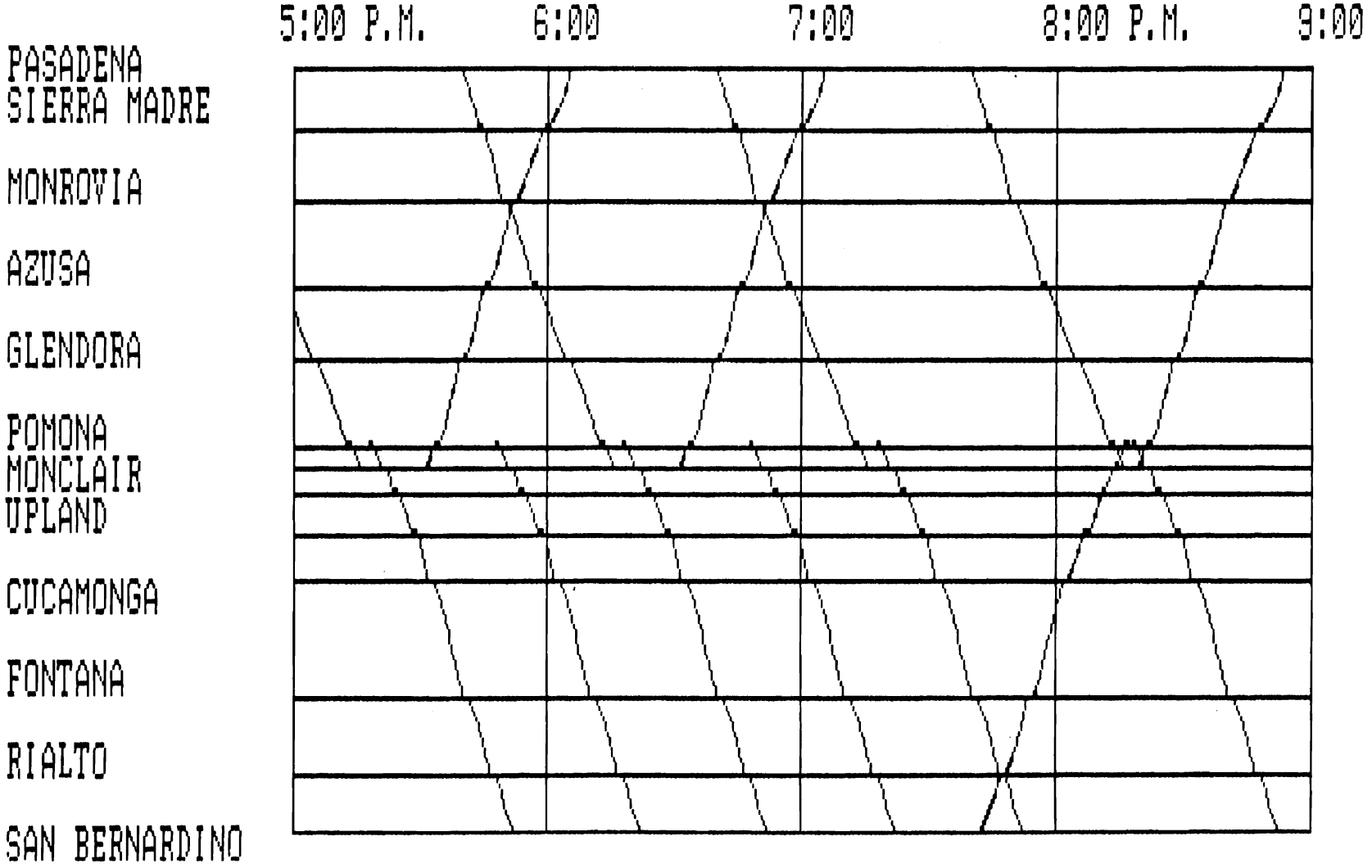


INTERMEDIARE SERVICE LEVEL

9:00 P.M. 10:00 P.M. 11:00

PASADENA
SIERRA MADRE

MONROVIA

AZUSA

GLENDORA

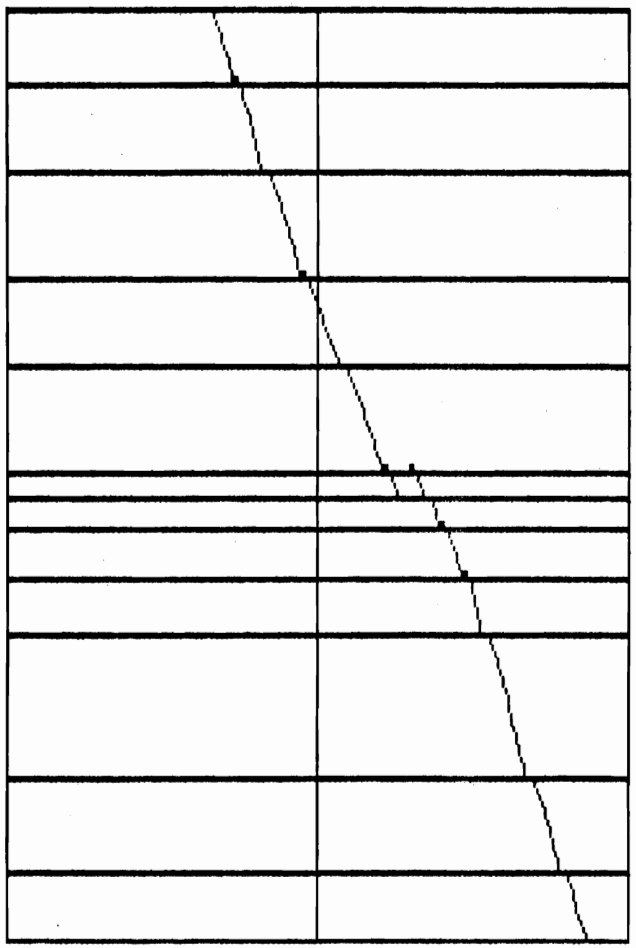
POMONA
MONCLAIR
UPLAND

CUCAMONGA

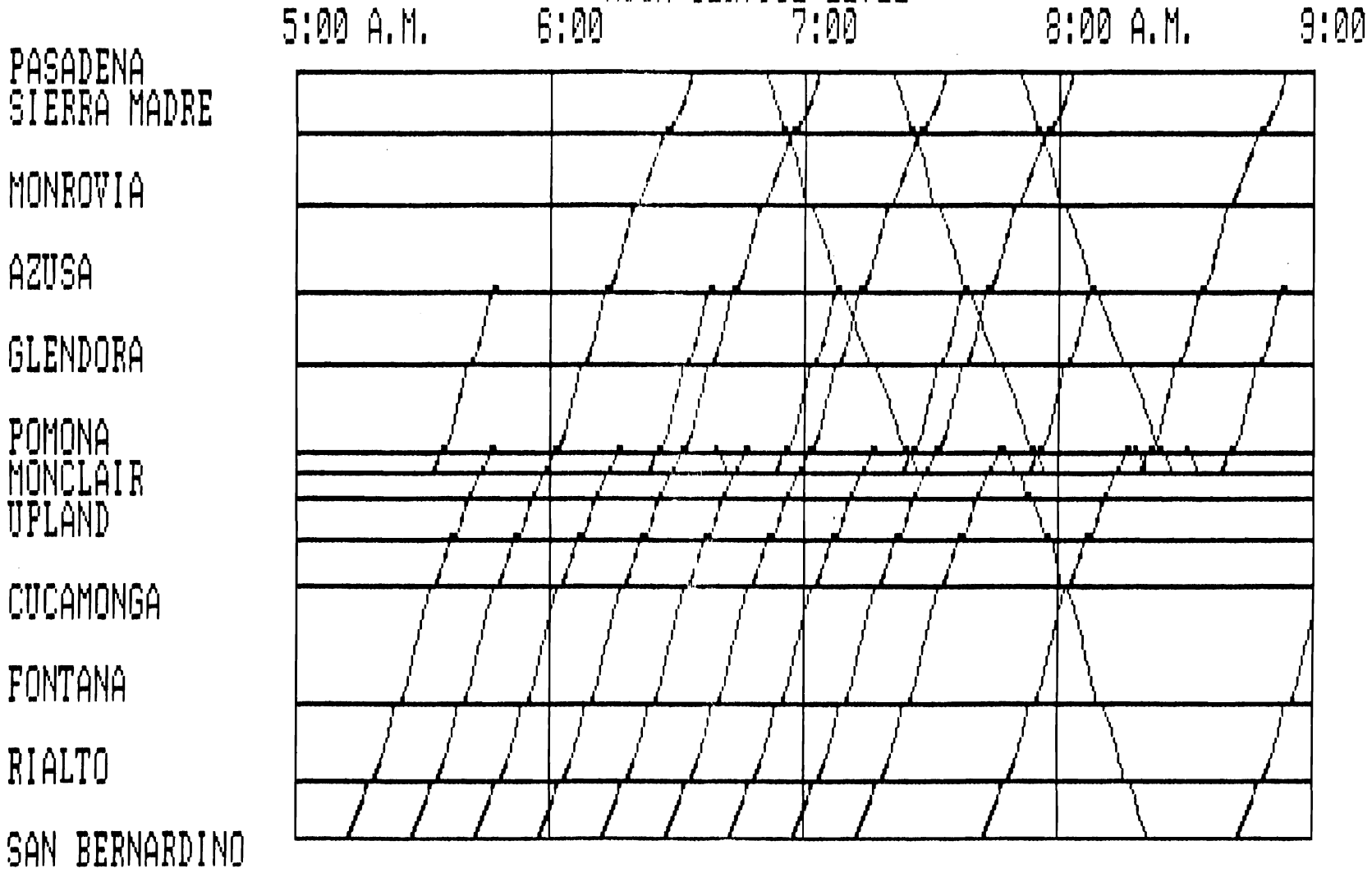
FONTANA

RIALTO

SAN BERNARDINO



HIGH SERVICE LEVEL



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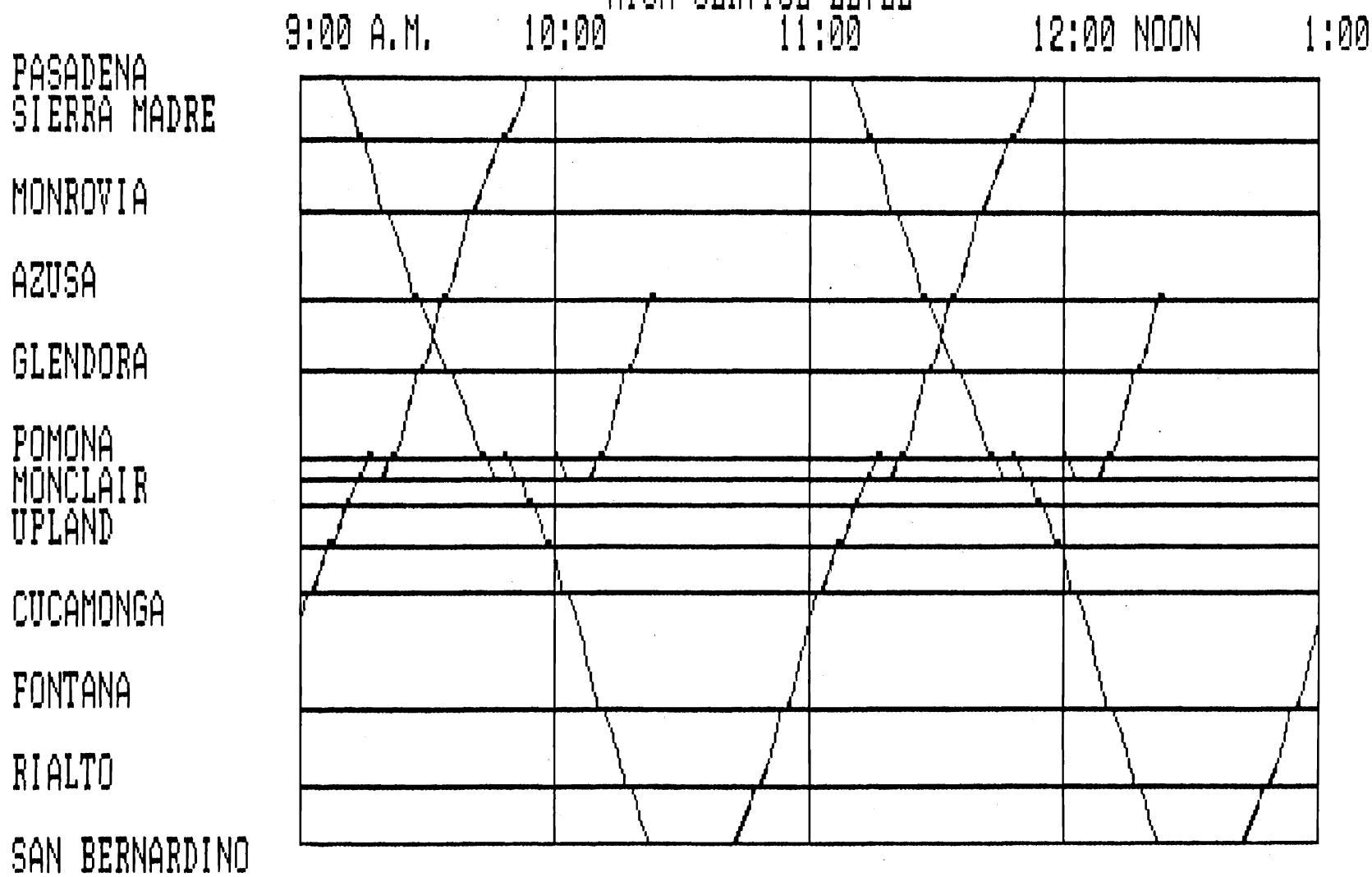

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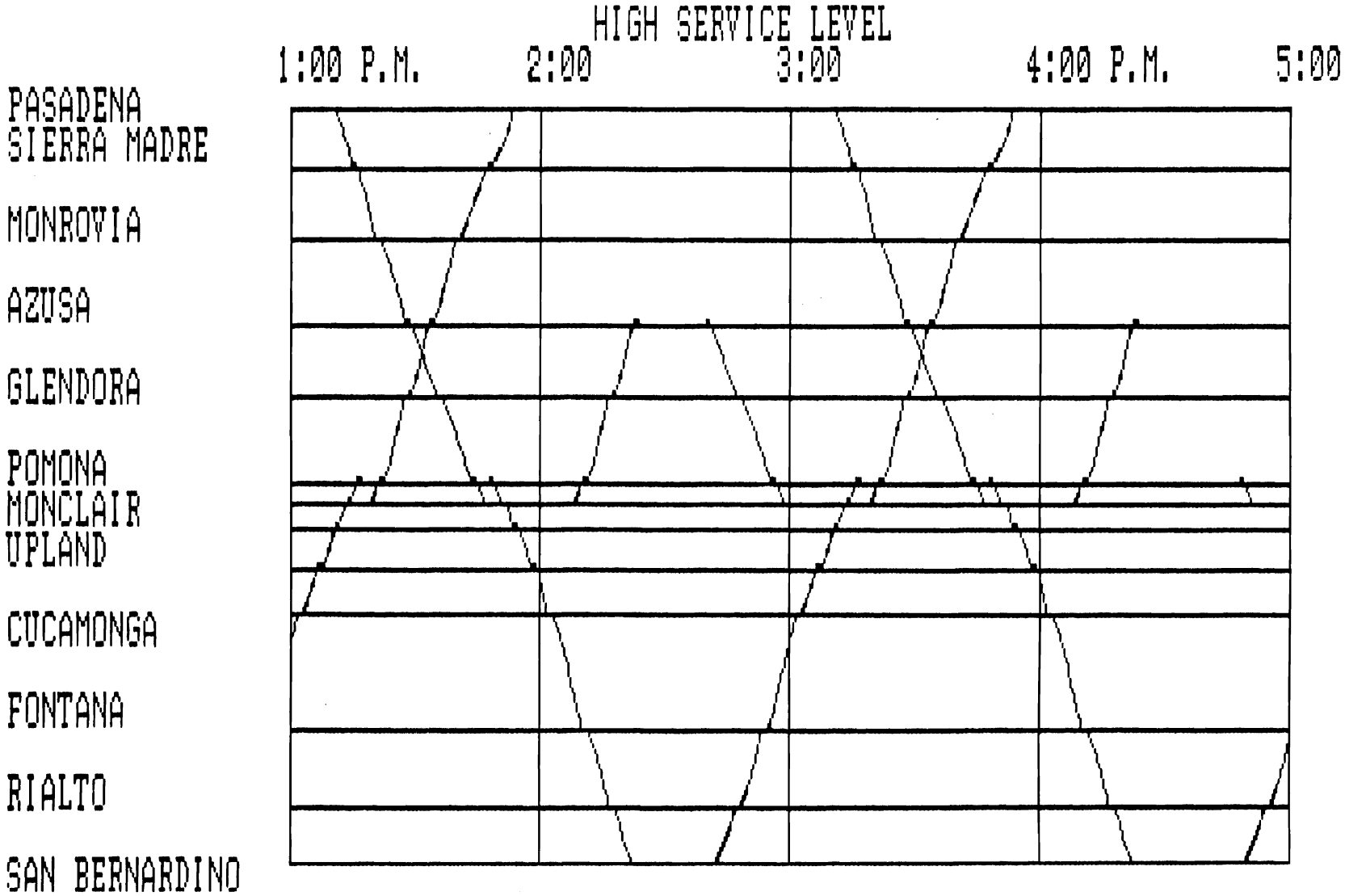
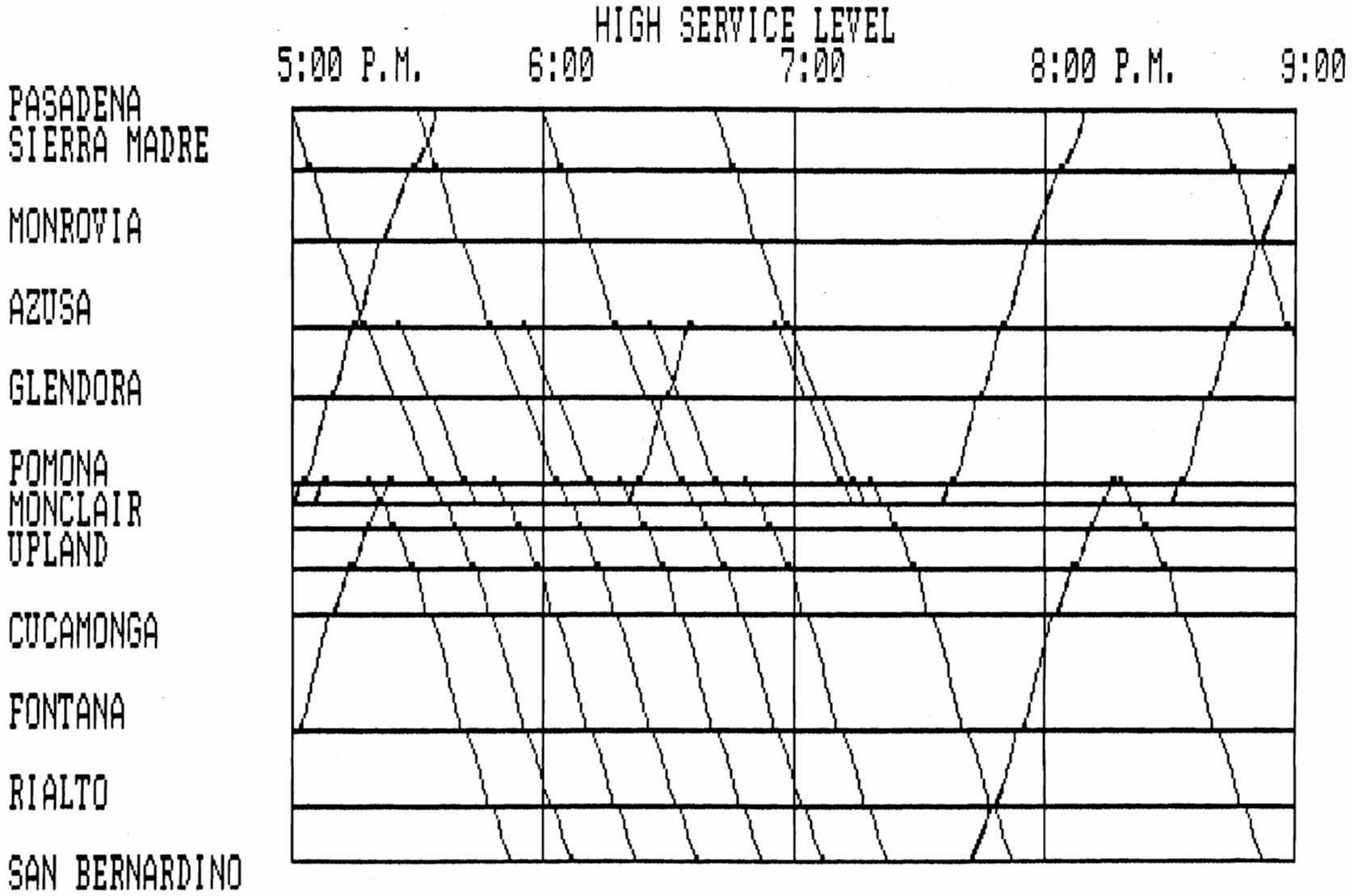


HIGH SERVICE LEVEL



HIGH SERVICE LEVEL

9:00 P.M. 10:00 P.M. 11:00

PASADENA
SIERRA MADRE

MONROVIA

AZUSA

GLENDORA

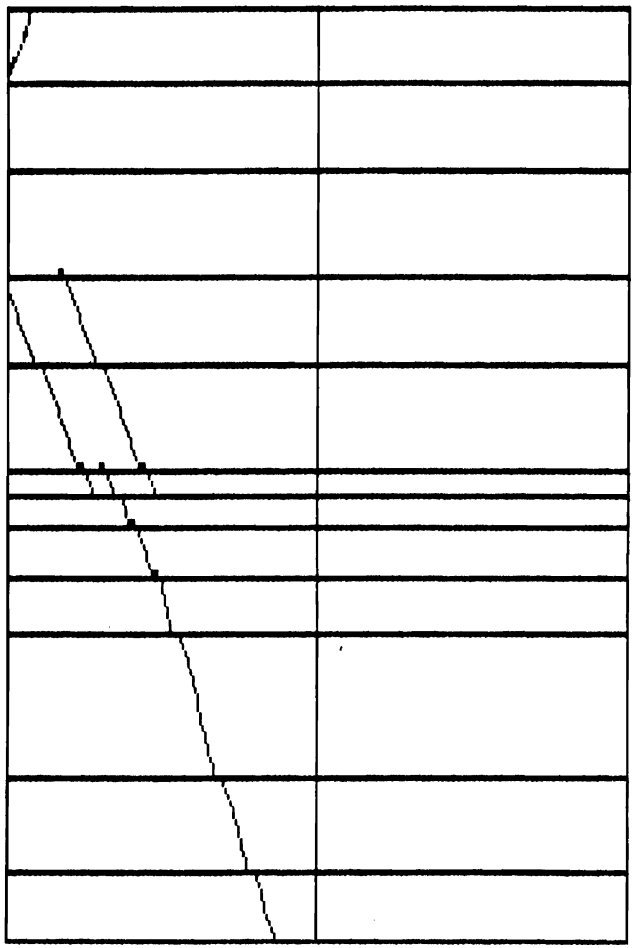
POMONA
MONCLAIR
UPLAND

CUCAMONGA

FONTANA

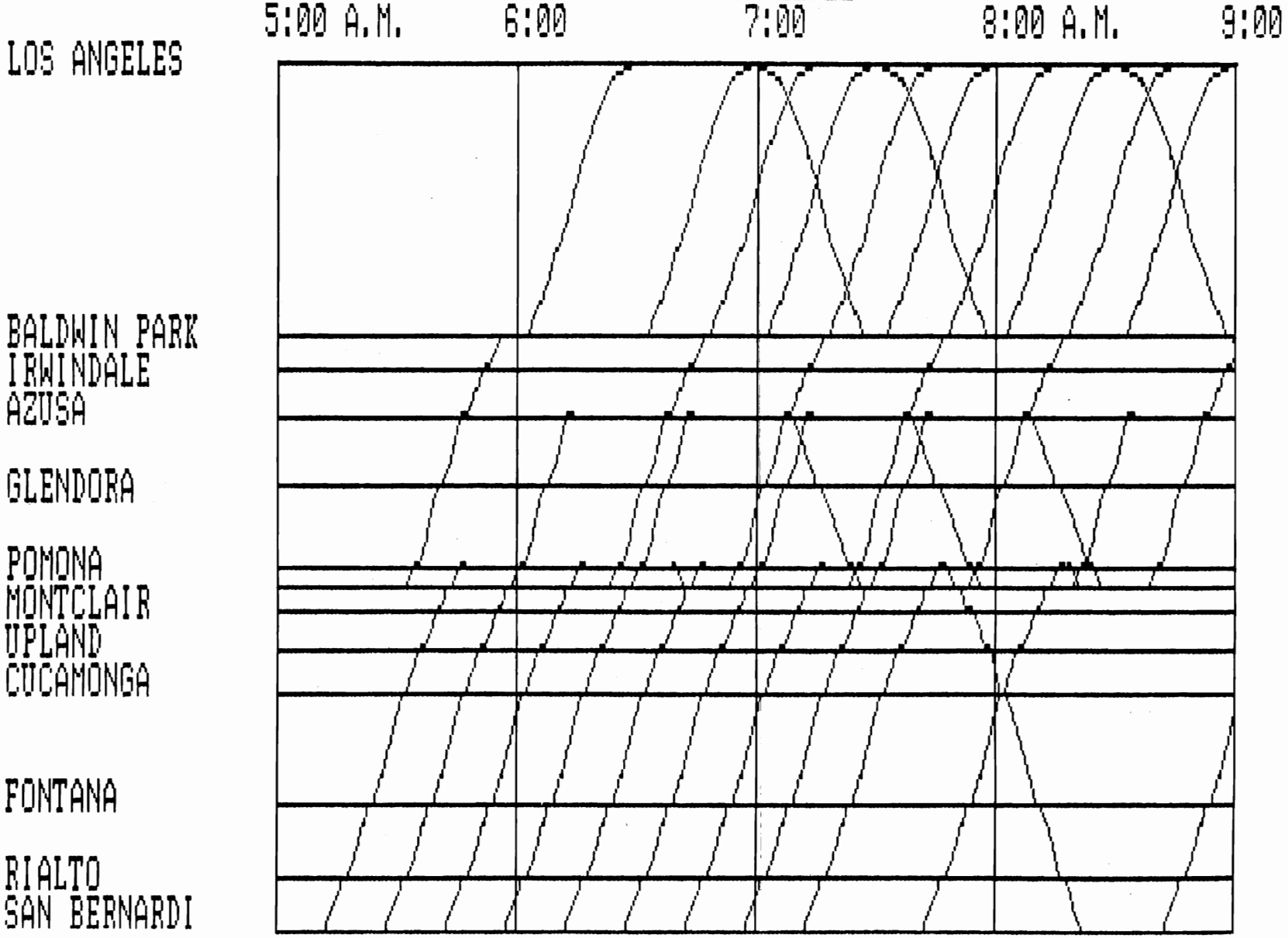
RIALTO

SAN BERNARDINO

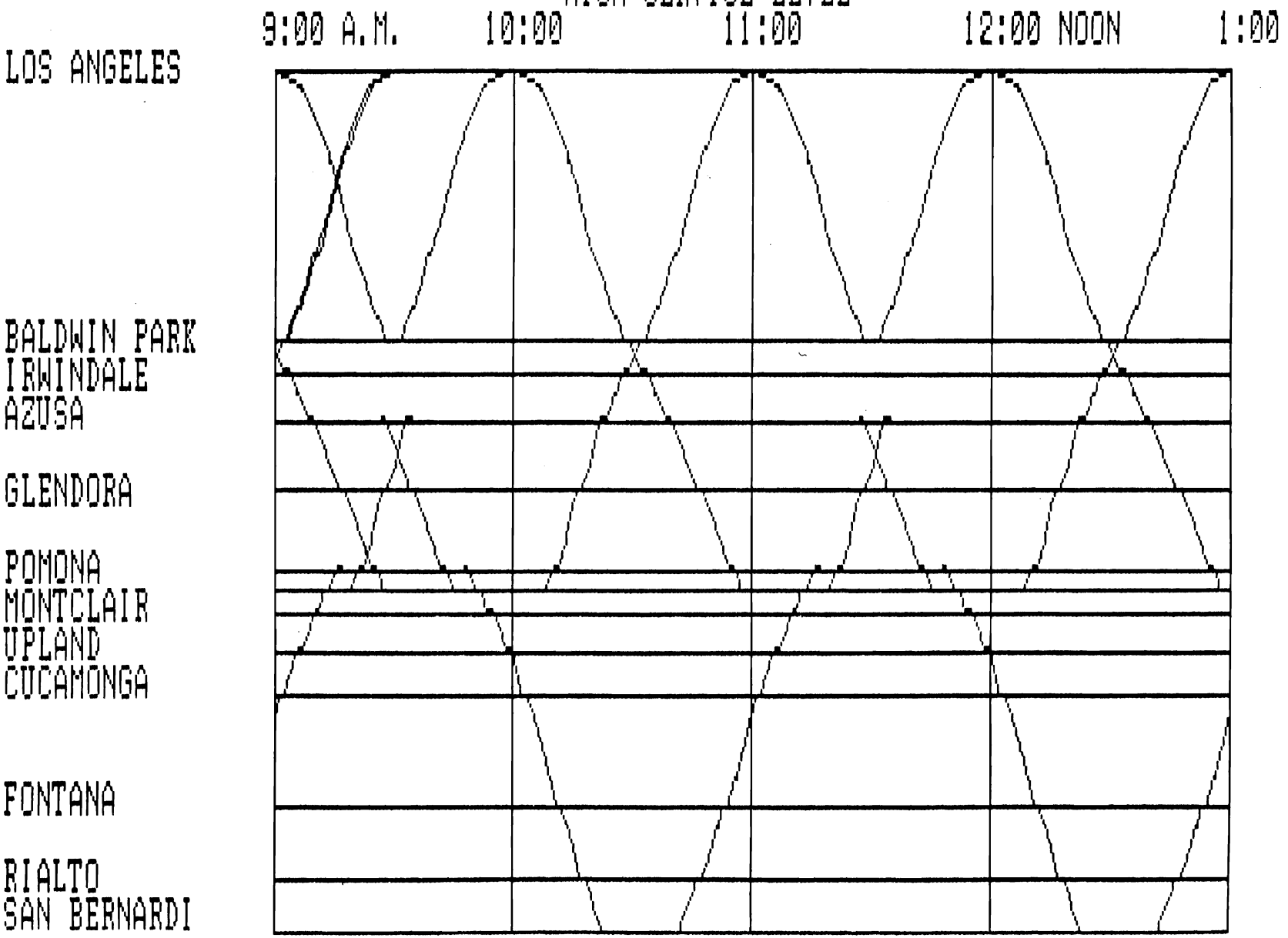


5. LOS ANGELES - SAN BERNARDINO VIA AZUSA

HIGH SERVICE LEVEL



HIGH SERVICE LEVEL



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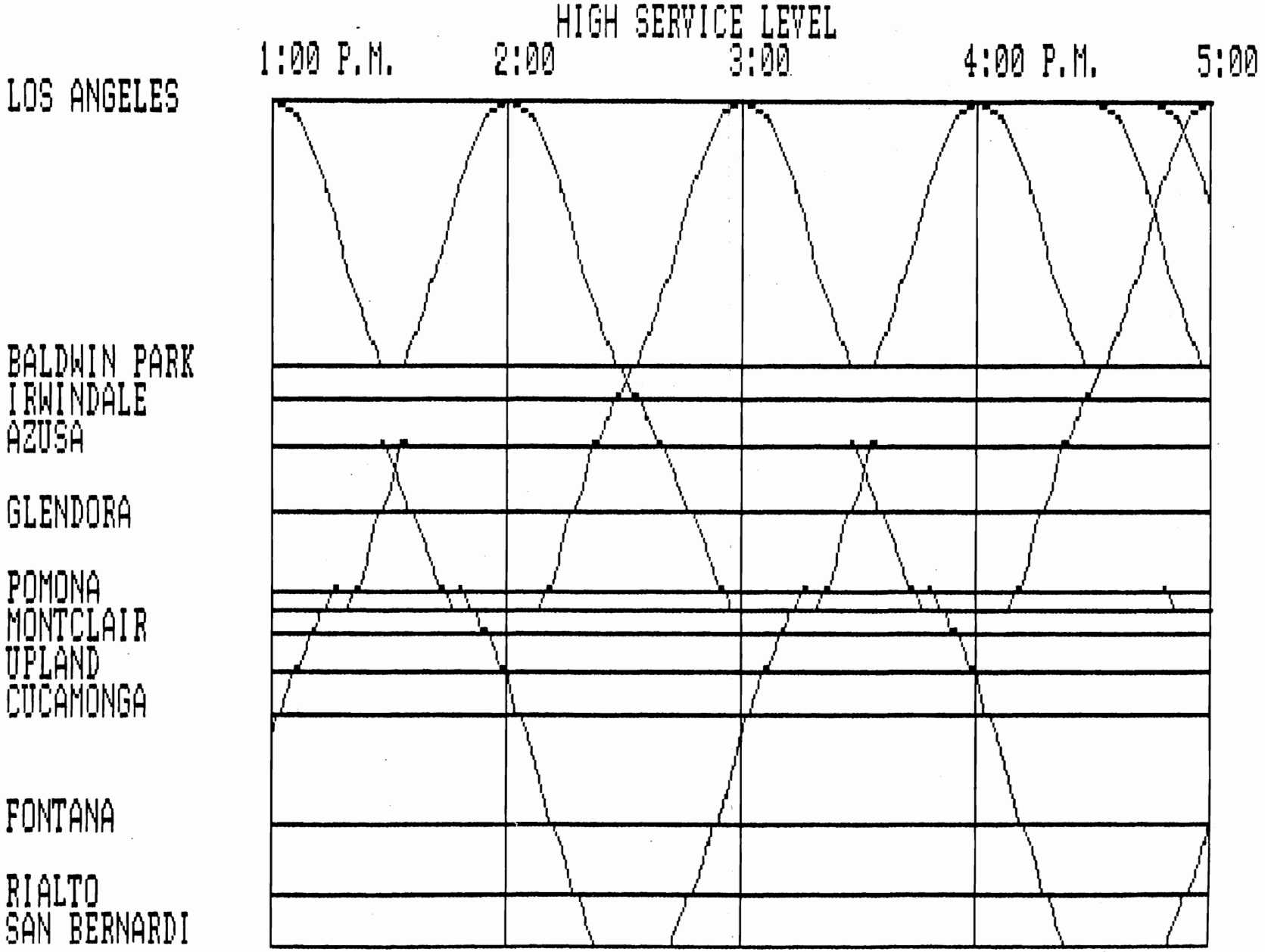

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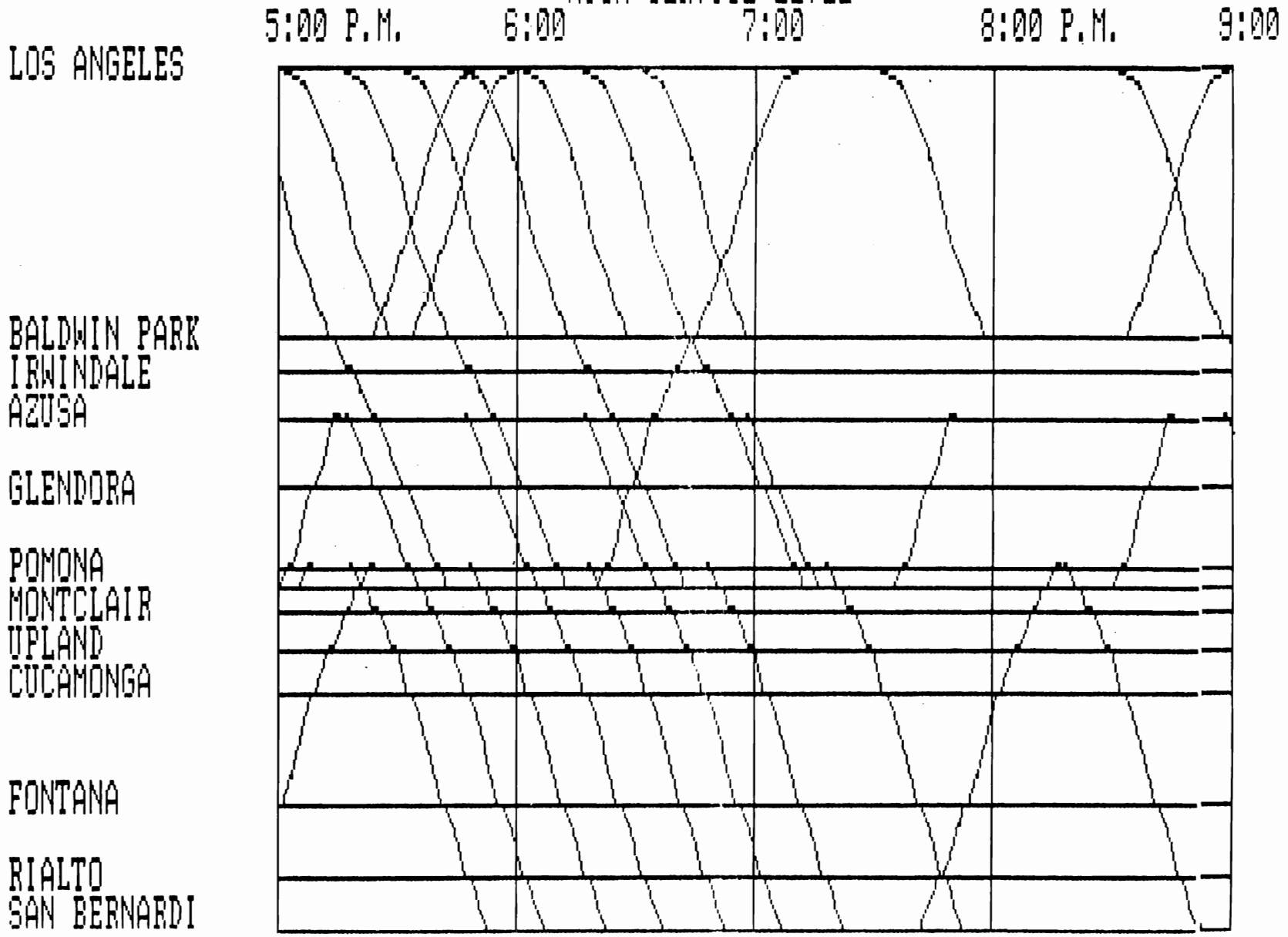

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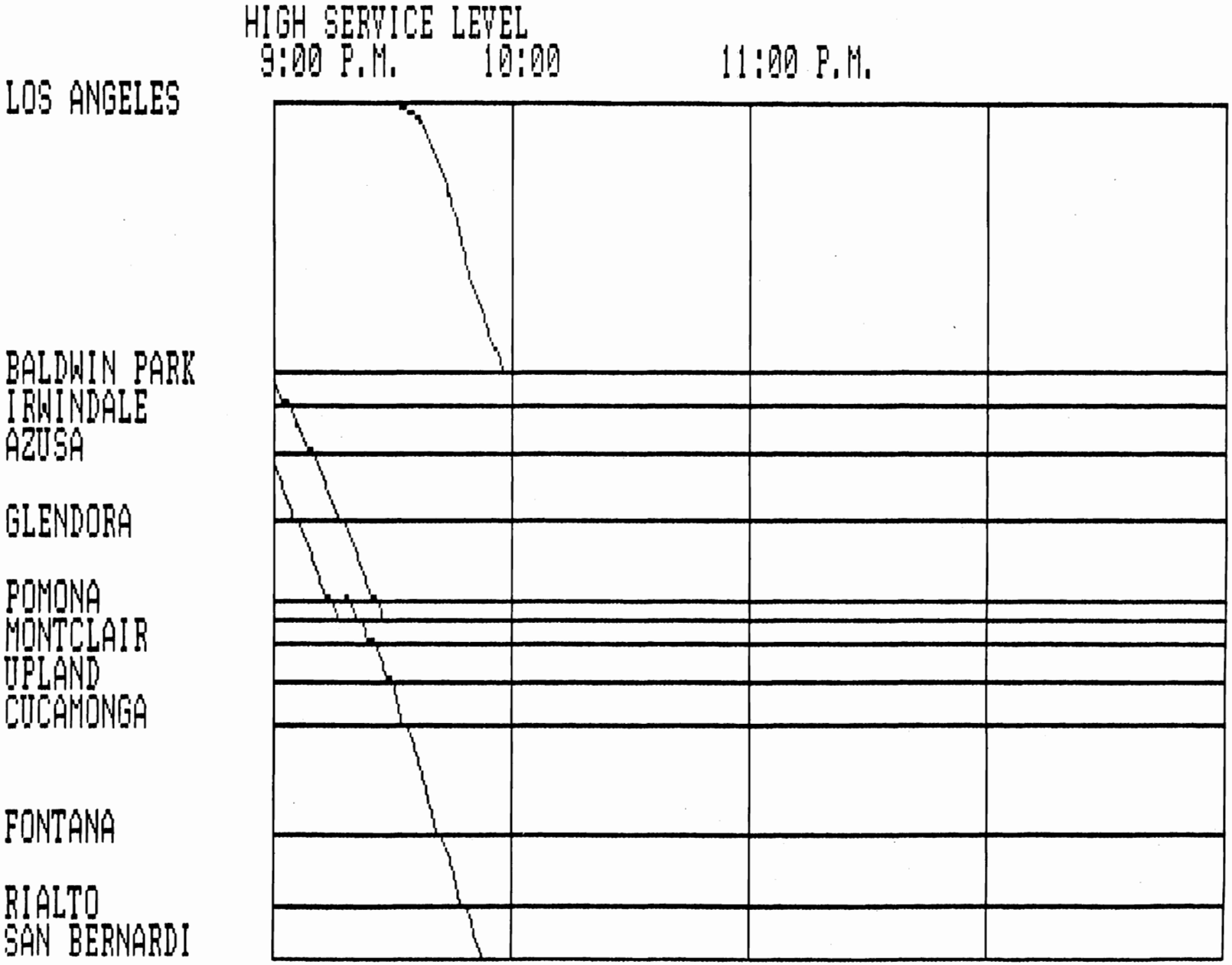

APPENDIX F TECHNICAL ADVISORY COMMITTEE

Project Manager: John Rinard, LACTC

James Adams	Amtrak
Lee Bullock	Amtrak
Lee Fox	ATSF
Royce Green	Southern Pacific
Sharon Greene	LOSSAN
Gil Hicks	Port of Long Beach
Leo Hoyt	Caltrans
Louis Maxberry	Amtrak
Roy Smith	ATSF
David Solow	LACTC
Ted Tanner	Catellus Development Corp.

Consultant Advisors

Michael McGinley	Daniel, Mann, Johnson & Mendenhall
Carl Schiermeyer	Schiermeyer Consulting Services
Willard Weiss	Morrison-Knudsen Engineers

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Wilbur Smith Associates, Morrison-Knudsen Engineers, Arthur Bauer & Associates, *Los Angeles-San Diego (LOSSAN) State Rail Corridor Study.* Prepared for the State Rail Corridor Study Group, June 1987.

Wilbur Smith Associates, Morrison-Knudsen Engineers, Arthur Bauer & Associates, *Los Angeles-Santa Barbara Rail Corridor Study, Phase I Commuter Rail Feasibility Study.* Prepared for the Southern California Regional Intercity State Rail Corridor Study Group, August 15, 1989.

Wilbur Smith Associates, Morrison-Knudsen Engineers, Arthur Bauer & Associates, *Los Angeles-Santa Barbara Rail Corridor Study, Phase II Intercity Upgrade Study.* Prepared for the Southern California Regional Intercity State Rail Corridor Study Group, June 1989.