LAX AREA TSM/CORRIDOR STUDY

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

LAX AREA TSM / CORRIDOR STUDY

FEBRUARY 1984

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

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I. INTRODUCTION

A. Setting

The LAX Area TSM/corridor study encompasses 34 square miles in the general South Bay area of Los Angeles County. The area includes such major traffic generators as Los Angeles International Airport (LAX), the third largest and second busiest airport in the U.S., and Marina Del Rey, the largest marina on the West Coast. It is also host to an intensive employment conglomerate of aerospace industries. LAX is expected to be expanded to accommodate 40 million annual passengers (MAP) by the year 2000, an increase of 7 MAP over current capacity of 33 MAP. The area around Los Angeles International Airport is one of the fastest growing in Los Angeles County. Employment and residential growth are expected to intensify as the last remaining areas of open space are developed. An addition of 41 million square feet of new office, commercial, industrial, and residential development has been proposed to take place within the study area in the next decade.

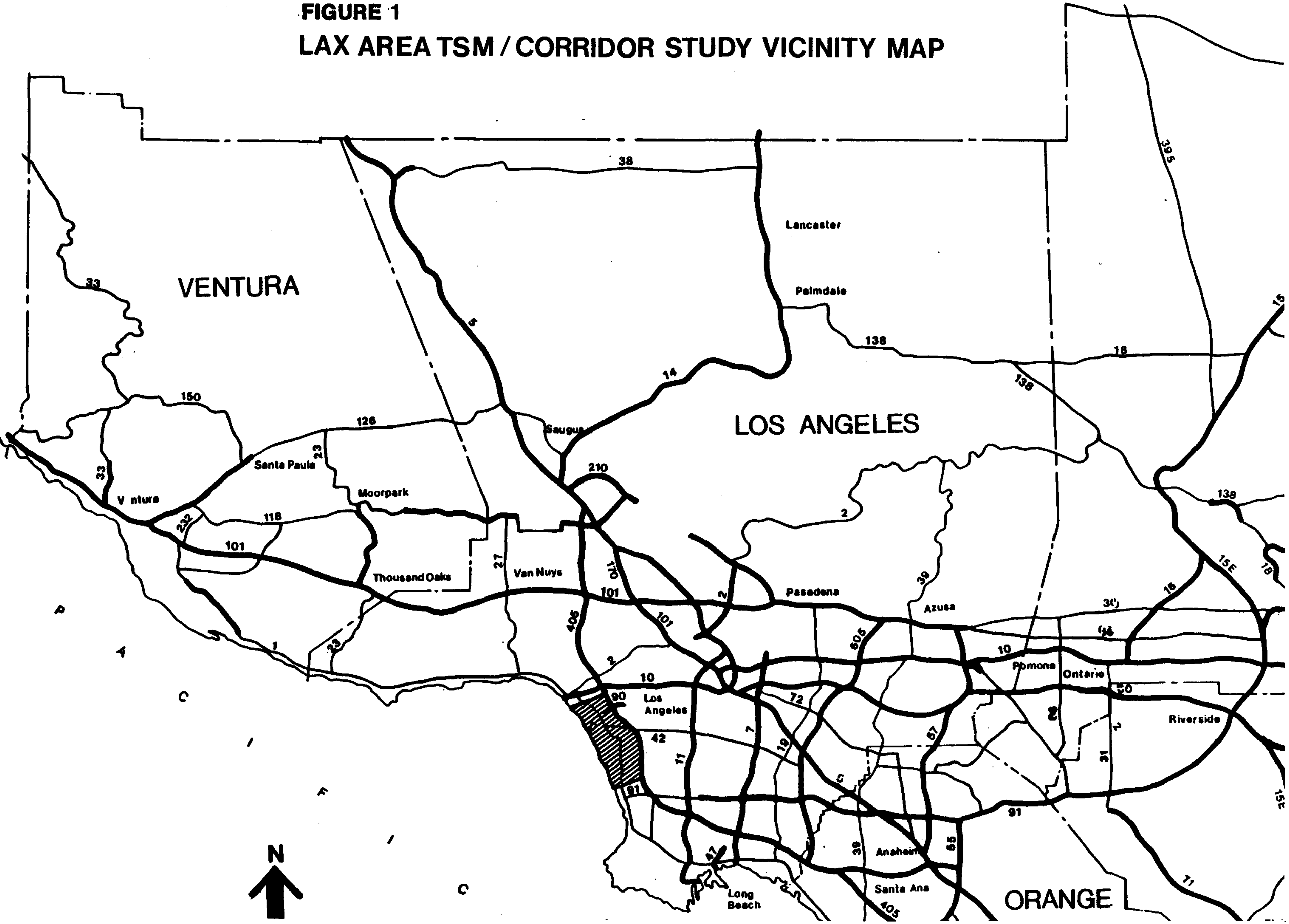
The Study area is served by a network of major arterials and freeways including I-405 in the eastern boundary. Traffic congestion already exists at most major intersections and peak hour congestions occur on major freeway and arterials outside the study area as well. The expected population and employment growth would lead to further deterioration in arterial services on the study area roadway network unless major capacity improvements are implemented.

The study area encompasses nine jurisdictions including the entire city of El Segundo, and parts of the cities of Los Angeles, Culver City, Manhattan Beach, Redondo Beach, Hawthorne, Inglewood, and Lawndale, as well as unincorporated areas of the County of Los Angeles (Figures 1 and 2). It is bounded on the north by Venice Boulevard, on the west by the Pacific Ocean, on the south by Manhattan Beach Boulevard and on the east by the San Diego Freeway (I-405). The above boundaries were chosen so as to enclose most of the proposed new development in the Westchester/South Bay Area.

B. Purpose of the Study

The LAX Area TSM/Corridor Study has a two-fold purpose. First, to identify and quantify traffic problems in the study area as a result of existing and projected growth and development. Second, to develop a multimodal set of transportation alternatives which would improve the mobility in the study area.

FIGURE 1
LAX AREA TSM / CORRIDOR STUDY VICINITY MAP



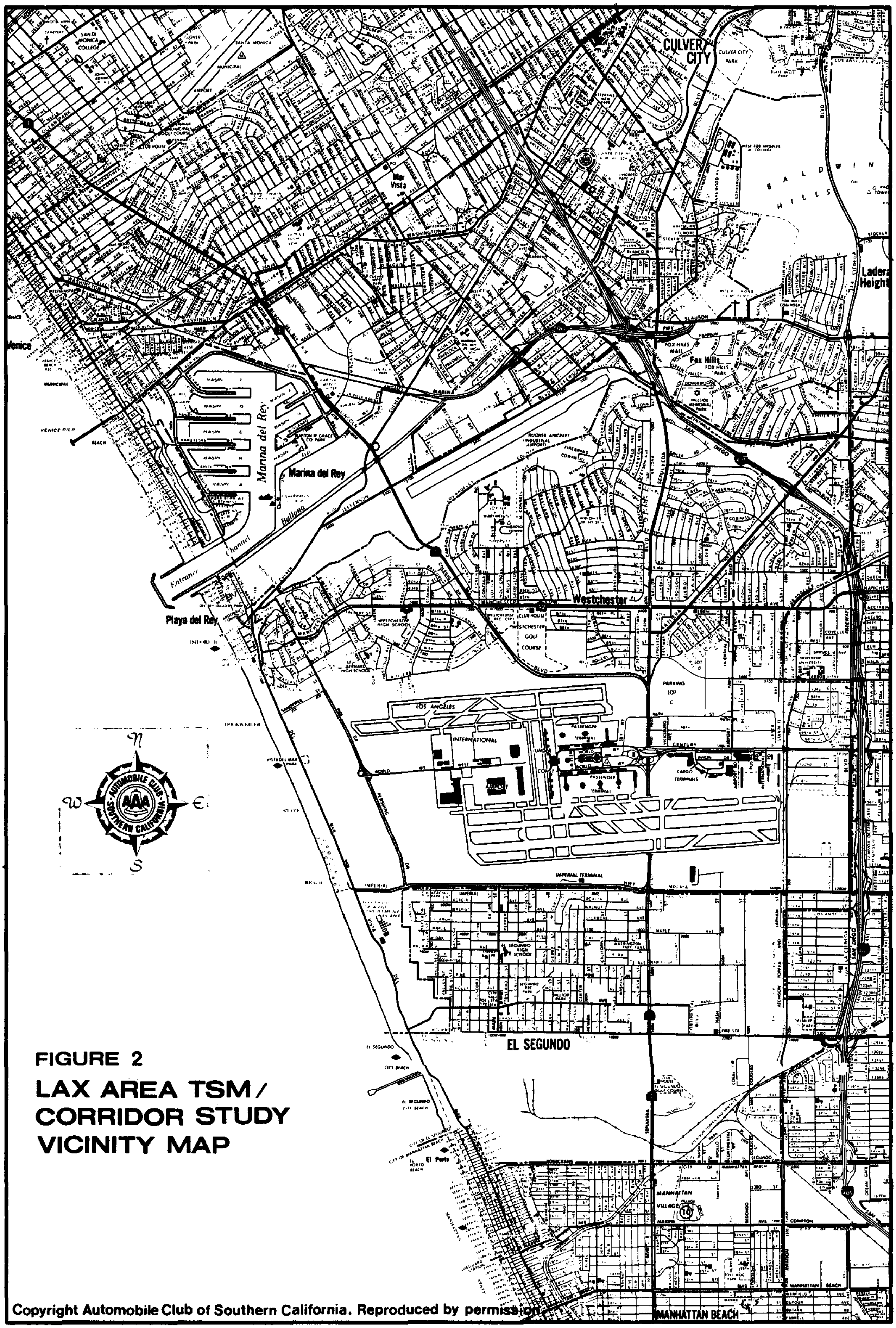


FIGURE 2

LAX AREA TSM / CORRIDOR STUDY VICINITY MAP

To alleviate congestion and to improve the mobility of persons in the corridors which serve the study area's activity centers, the following specific study objectives were established:

1. Develop multimodal sets of transportation improvements to increase the capacity of the current system while reducing the demand.

2. Develop a system of improvements which will preserve, or have the least negative impacts, on the physical environment of the study area.

3. Ensure that the selected transportation system will be cost-effective.

4. Develop a transportation system alternative for the study area that can be realistically attained under future available funding mechanisms.

5. Enhance the effectiveness of recommendations by assisting the local jurisdictions to develop an implementation program of supportive policies and actions.

6. Identify any new institutional arrangements necessary to implement the recommended transportation improvements.

To accomplish the above objectives, it is necessary to develop a set of multimodal transportation alternatives which will combine three distinct elements:

- Capital intensive improvements;
- Transportation Systems Management (TSM) strategies; and
- Planning and Administrative Policy-Making Strategies.

The capital intensive improvements could include solutions such as rail alternatives and highway improvements (roadway widening and/or additional lanes). TSM strategies include, but are not limited to, increased bus transit, reversible lane techniques, ridesharing, and staggered work hours. The planning element might involve reductions in land use density, phased development policies, and planning coordination with other local jurisdictions within the study area.

The LAX Area TSM/Corridor Study, therefore, is to propose alternatives which will result in mitigation measures for the projected traffic volume increases from planned developments within the study area. With this set of alternatives, the affected local jurisdictions can develop a rational implementation program to improve vehicular and pedestrian mobility.

C. Study Participants

The study area includes a variety of overlapping jurisdictions and private sector interests which will be affected by any planning activities. Given the complexity of the transportation problems in the study area and the goal to produce an implementable program, it was essential that all these interests participate together in this effort.

1. Lead Agency

   The Southern California Association of Governments (SCAG) had the overall responsibility for the performance of the work program. The City of Los Angeles, Department of Transportation assisted in the study by providing data and analysis for that portion of the study area within the City of Los Angeles.

2. Steering Committee

   SCAG established an advisory Steering Committee whose membership was broadly representative of the study area interests, including local elected officials, municipal and regional planning entities, employers, and developers. The Committee, chaired by Los Angeles City Councilwoman Pat Russell, met monthly during the course of the study to review the progress of the work and to provide a public forum for the exchange of ideas, information and opinions.

3. Technical Advisory Committee (TAC)

   A Technical Advisory Committee, composed primarily of municipal and regional planning and engineering staff, was established to coordinate all planning and technical efforts and to make recommendations on technical issues. The Technical Advisory Committee members worked very closely with SCAG staff throughout the conduct of this study, and met on an ad hoc basis.

4. General Public

   It was the Steering Committee's policy to encourage public awareness and involvement throughout the study. The monthly agendas were mailed to more than 100 people. The press and interested citizens frequently attended the monthly meetings. In addition, SCAG has informed citizens of the study progress, issues and problems by participating in local town hall and community meetings. Steering Committee and TAC meetings were frequently scheduled at locations throughout the study area for easier public access and participation.

D. Study Methodology

To develop a data base for the study, staff inventoried all surface transportation facilities, all public and private sector plans for future housing, population growth, employment growth, economic development, land use and traffic conditions in this 34 square-mile area including data on weekday traffic volumes, transit services, and facility characteristics. These data provided a basis for determining the state of the transportation system and for identifying existing and future deficiencies.

Population forecasts were based on the region's Development Guide adopted growth forecasts (SCAG-82). Employment forecasts were derived from estimates provided by consultants, developers, and/or cities for each major proposed development. The employment forecasts result, in the aggregate, in estimates greatly exceeding those in SCAG-82 for this subregion. The Committee agreed to use the higher projections for this phase of the study as a high growth scenario. Phase II of this study will provide an analysis of the SCAG-82 forecast as a low-level scenario as well as an intermediate employment scenario falling between the high (Phase I forecast) and low (SCAG-82 forecast) estimates.

Projections were made for the horizon years 1987 and 1992. The year 1987 was chosen as a reasonable short-term time frame for the analysis of transportation system management alternatives (which are short-term by nature), while 1992 is a medium-term horizon accounting for a sizable majority of the total projected growth in the area. The Phase II study will examine the year 2000 as a full build-out, long-term horizon.

In conjunction with demographic, travel and highway network characteristics projected for the years 1987 and 1992, two distinct but complementary sets of analyses were performed as part of the study. The first set involved evaluation of TSM alternatives on selected critical arterials in the study area employing the traffic simulation model TRANSYT 7-F. The second set of analyses involved the evaluation of the effects of TSM strategies such as traffic engineering and highway restriping on the entire study area transportation network. In addition, bus and rail alternatives were analyzed for arterials where such improvements were warranted. The SCAG Regional Transportation Modeling System (RTMS) which is a computer-based analytical forecasting technique, utilizing traditional trip generation, distribution, mode choice and assignment steps were used to project future traffic volumes on LAX area arterials.

Average morning peak hour volumes were projected for existing (1980) and future years (1987 and 1992) to evaluate existing and future transportation system deficiencies. The a.m. peak is two hours in the morning (6:30-8:30 a.m.) and the p.m. peak

(3:00-6:00 p.m.) is three hours in the afternoon. The p.m. peak is usually higher than the a.m. peak but it cannot be as accurately projected. Therefore most segments of arterials which experience traffic congestion in the morning peak period will experience the same level of traffic congestion or worse (although in the reverse direction) in the afternoon peak hours.

Analysis of existing and projected volumes disclosed existing and potential problem areas. A set of multimodal transportation solutions which would facilitate access to major activity centers and improve mobility within the study area was developed.

Four categories of improvements are considered as congestion relief measures. The first includes site-specific Transportation System Management (TSM) and highway improvement measures that appear to be feasible and can be readily implemented at relatively low cost. The second category includes high-priority transit programs which include network modifications, shorter headways, and better access to major activity centers. The third category, rail alternatives, includes rail passenger service on the proposed South Bay Trolley line, Marina/AT&SF/Hawthorne light rail transit line and the combination of both lines. The fourth and last category includes policy recommendations and other recommended improvements needed to accommodate the projected mobility deficiencies.

The data are not surprising; however, to assess the output accurately, the reader should be aware of several factors which have not been accounted for in the modelling. These factors, taken together, could mean that actual future conditions will be significantly better than the numerical results imply. For example, the model cannot accurately quantify the impacts of demand management strategies such as ridesharing incentives, bicycling promotion, parking management and flexible work hours, even though it can predict the number of the home-to-work trips in car and van pools. The model also does not reflect the impacts of proposed transportation engineering measures such as intersection improvements and traffic signal synchronization on the study area's network. Furthermore, public bus system improvements, which constitute an important component of transportation planning, were not studied due to perceived funding constraints; therefore, no increase in public transit service was added to the transit network of the modelling process.

II. EXISTING CONDITIONS

A. Population and Employment

Table 1 presents the 1980 land area, population and employment of the study area compared to Los Angeles County. Current population is about 194,000, an estimated 4% decrease from 1970, while employment stands at 187,000, approximately 25% greater than in 1970. In marked contrast to the overall county figure, the employment in the study area is nearly equal to its population. This reflects the "job-rich" character of the area.[1]

TABLE 1

1980 Land Area, Population, and Employment

	LAND AREA (SQ. MI.)	POPULATION	POPULATION DENSITY (PERSON/ SQ. MI.)	EMPLOYMENT	EMPLOYMENT DENSITY (PERSON/ SQ. MI.)
LAX Area	34	194,008	5,706	186,830	5,495
L. A. County	4,084	7,471,505	1,829	3,933,751	963

Further, the attractiveness of the area (for both population and employment) is demonstrated by the fact that its population density is more than three times that of L.A. County as a whole, while its employment density is 5.7 times greater.

Figures 3 and 4 portray the study area's 1980 population and employment, respectively, by zone. Relatively heavily populated areas include the Marina, the Fox Hills area of Culver City, Inglewood, the residential (northwest) quadrant of El Segundo, and the coastal portion of Manhattan Beach. Areas of high employment are primarily the airport and El Segundo. Note that 24 out of the 63 study area zones have less than 1,000 employment. Taken together, the population and employment maps indicate that much of the study area is residential in nature, with a few large employment centers.

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1 An area is defined to be "balanced" if the ratio of employment to population is between 0.38 and 0.55. An area is "housing-rich" if the above ratio is less than 0.38, and "job-rich" if the ratio is above 0.55. The ratio for the study area in 1980 is 0.96.

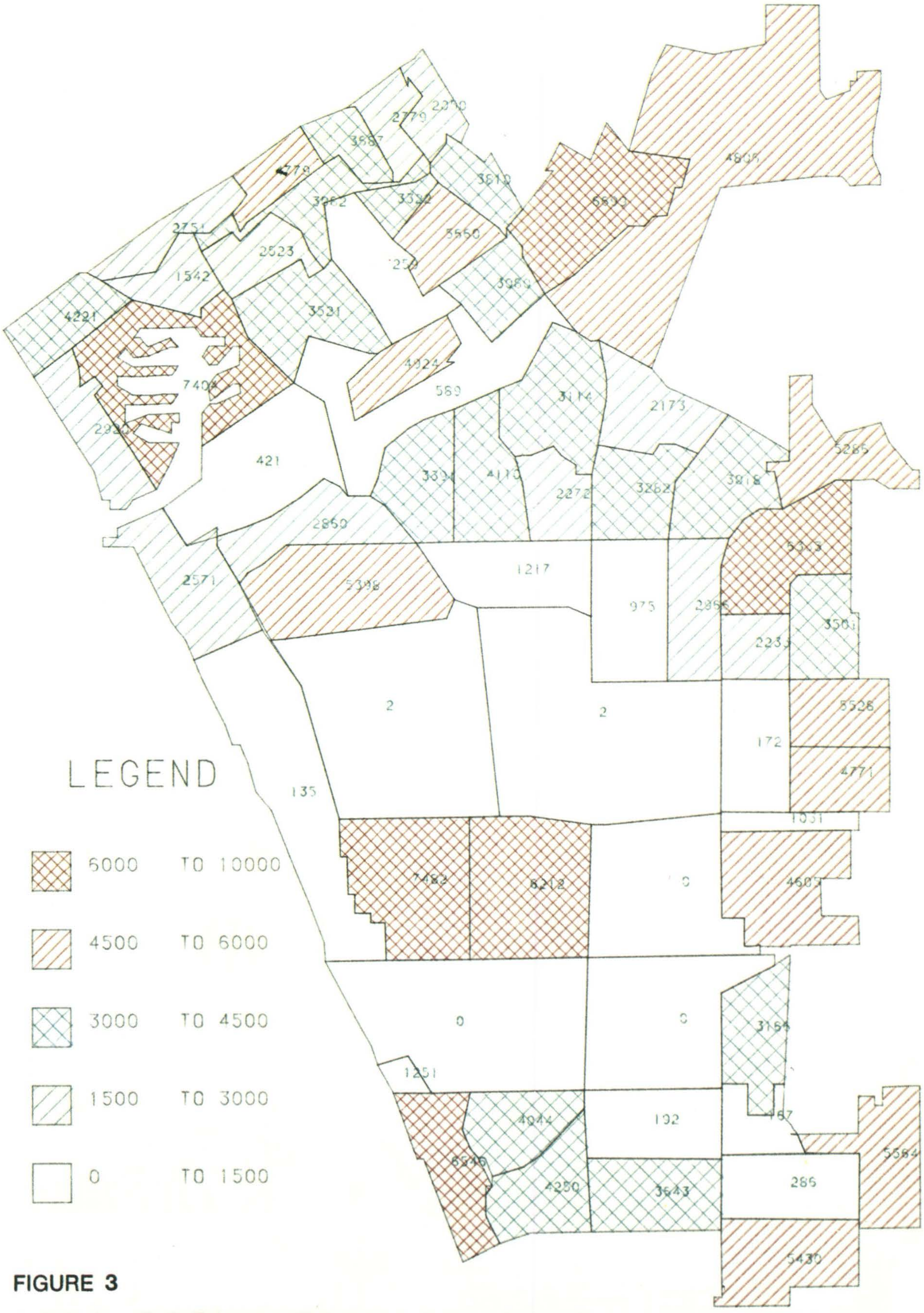


FIGURE 3

1980 POPULATION BY STUDY AREA ZONE

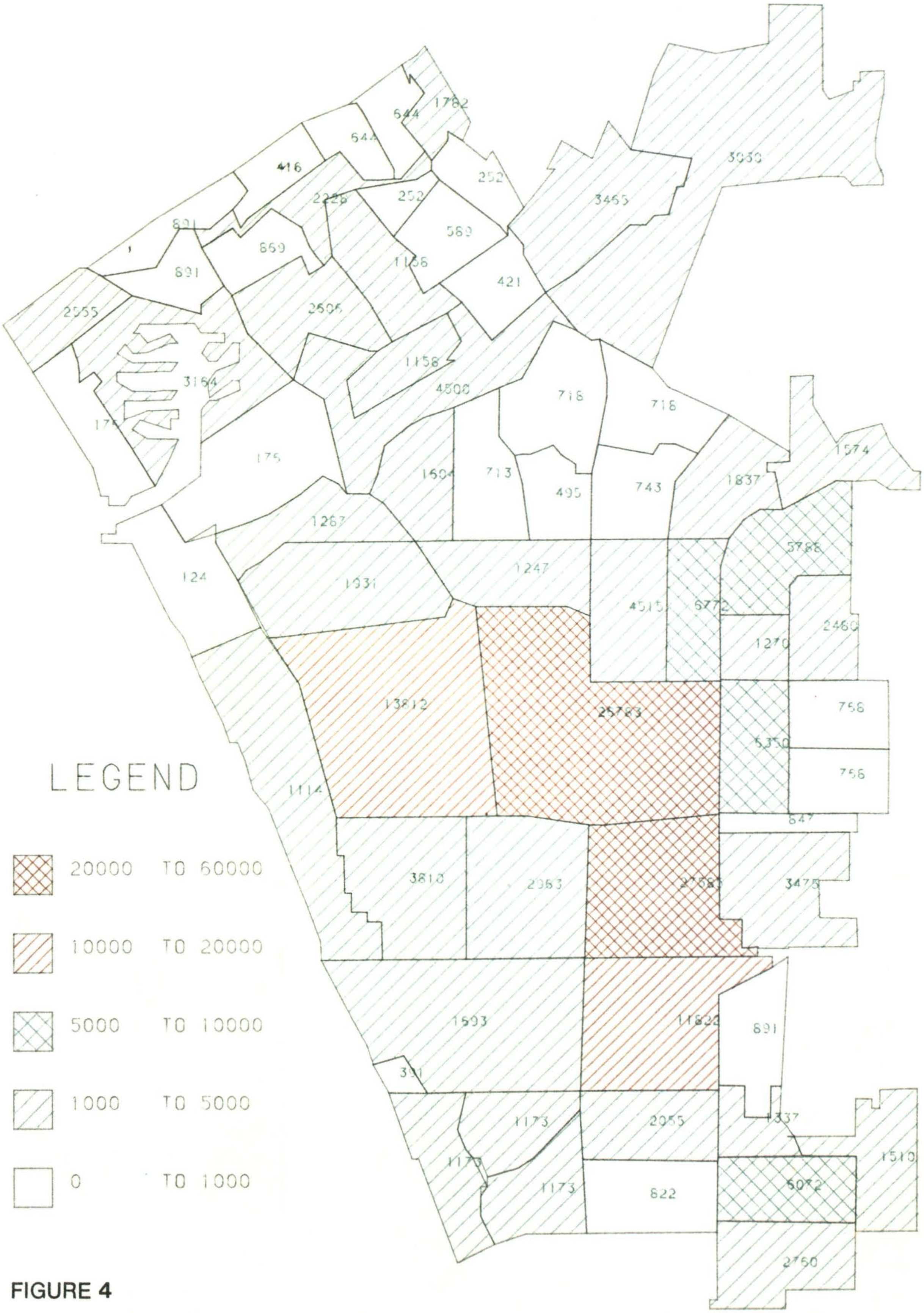


FIGURE 4

1980 EMPLOYMENT BY STUDY AREA ZONE

B. Study Area Activity Centers

The demand for transportation arises from urban activities. High activity centers and planned developments which attract or generate a substantial percentage of trips in the study area are shown in Figure 5, "Major Traffic Generators." They include the Los Angeles International Airport, the electronic/aerospace employment complex concentrated in the City of El Segundo, and the largest marina on the west coast (in the northern portion of the study area). The land uses shown were determined from zoning and land use maps furnished by Los Angeles City Planning Department, the Los Angeles County Department of Regional Planning, Los Angeles City Department of Airports, the cities of Culver City, El Segundo, Hawthorne, Redondo Beach, Manhattan Beach, and from major private developers such as Summa Corporation, and Hughes Aircraft Company.

In addition, many major commercial and industrial developments are either under construction or in the planning stages. These new developments will generate a substantial increase in movement of people and goods which will result in a severe worsening of an already close-to-capacity traffic situation. The proximity to the coast adds another dimension to trip-making since the transportation network must serve not only commuters and shoppers, but also persons using coastal recreation facilities.

C. Highway System

A number of facilities were included in the basic 1980 highway network for the LAX Area/TSM Corridor Study (Figure 6). All streets classified as "freeway" or "major arterial" were included in the network. In addition, certain streets classified as "secondary arterial" were included if they were currently or potentially important connectors or alternate routes. A description of these facilities is provided in Appendix A.

D. Transit Services

The study area is connected by transit service to most parts of the SCAG region. Public transit agencies connect the study area with direct local and express service to the South Bay, Westside, Los Angeles CBD, and South Central Los Angeles. Private carriers provide direct service to almost all of Los Angeles County and portions of Orange County. The study area is a focal point of private sector transit service, as may be seen from the fact that of the total daily number of people carried by private transit companies in the Los Angeles region, over 35% are transported into or out of the study area.

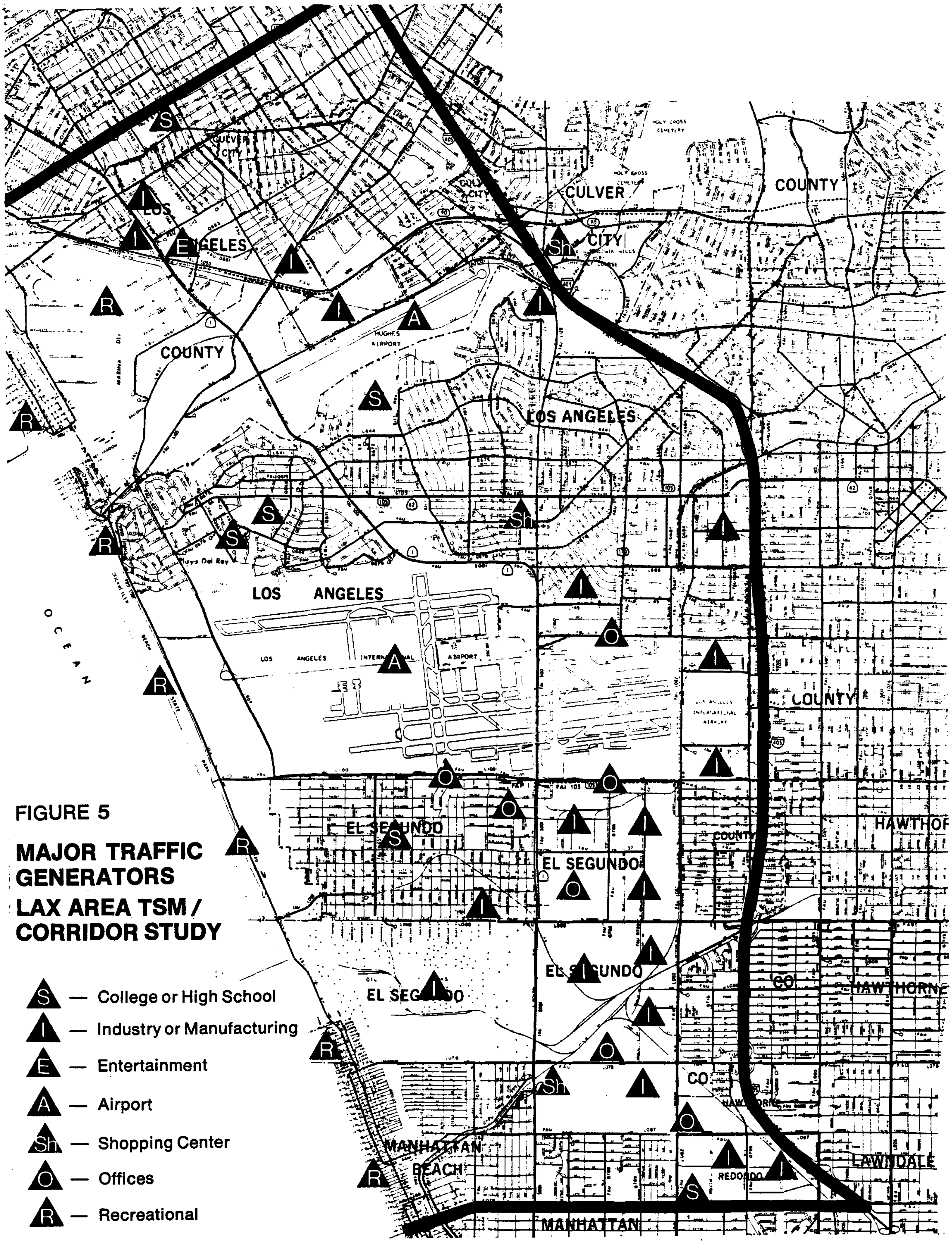


FIGURE 5

MAJOR TRAFFIC GENERATORS
LAX AREA TSM / CORRIDOR STUDY

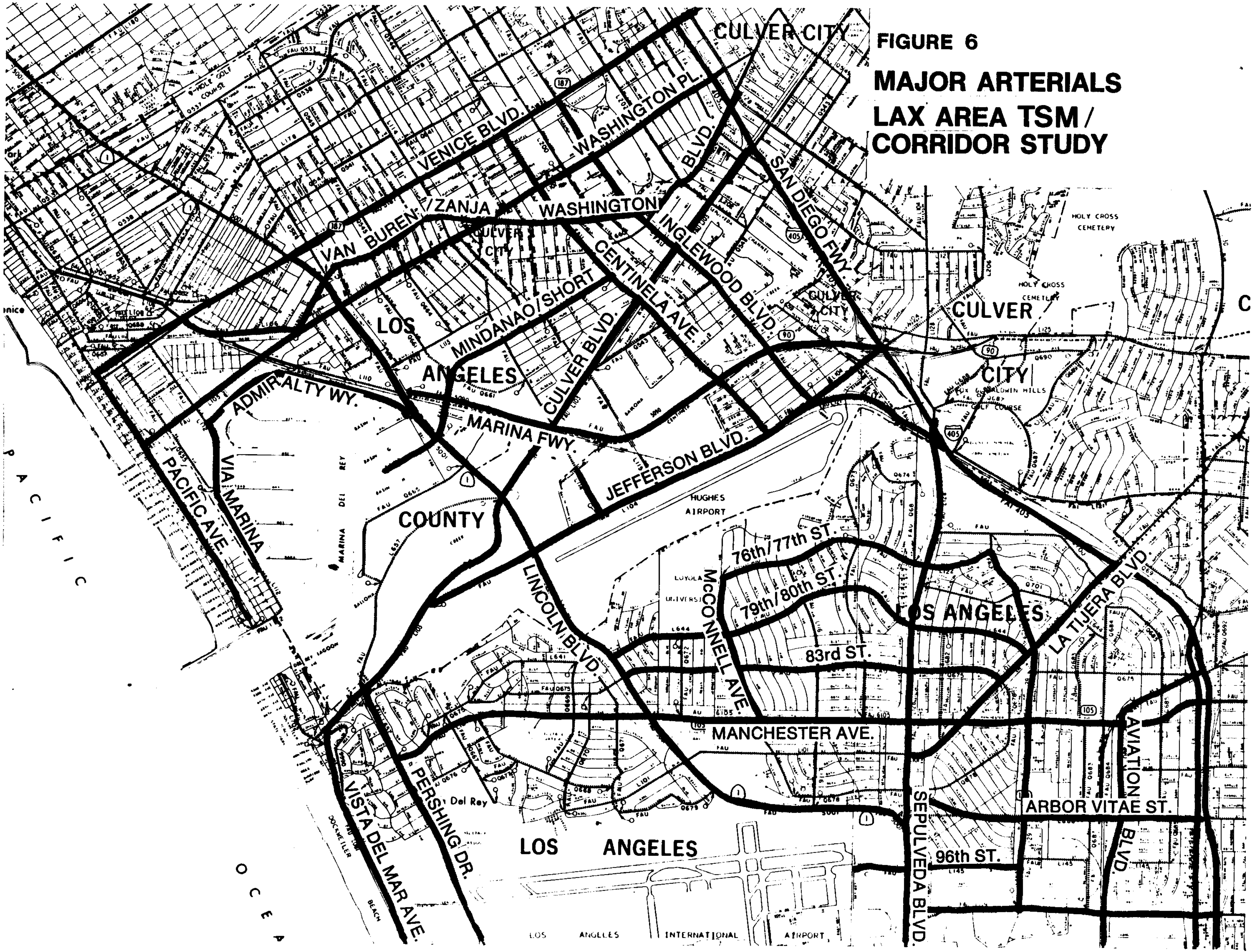


FIGURE 6
MAJOR ARTERIALS
LAX AREA TSM / CORRIDOR STUDY

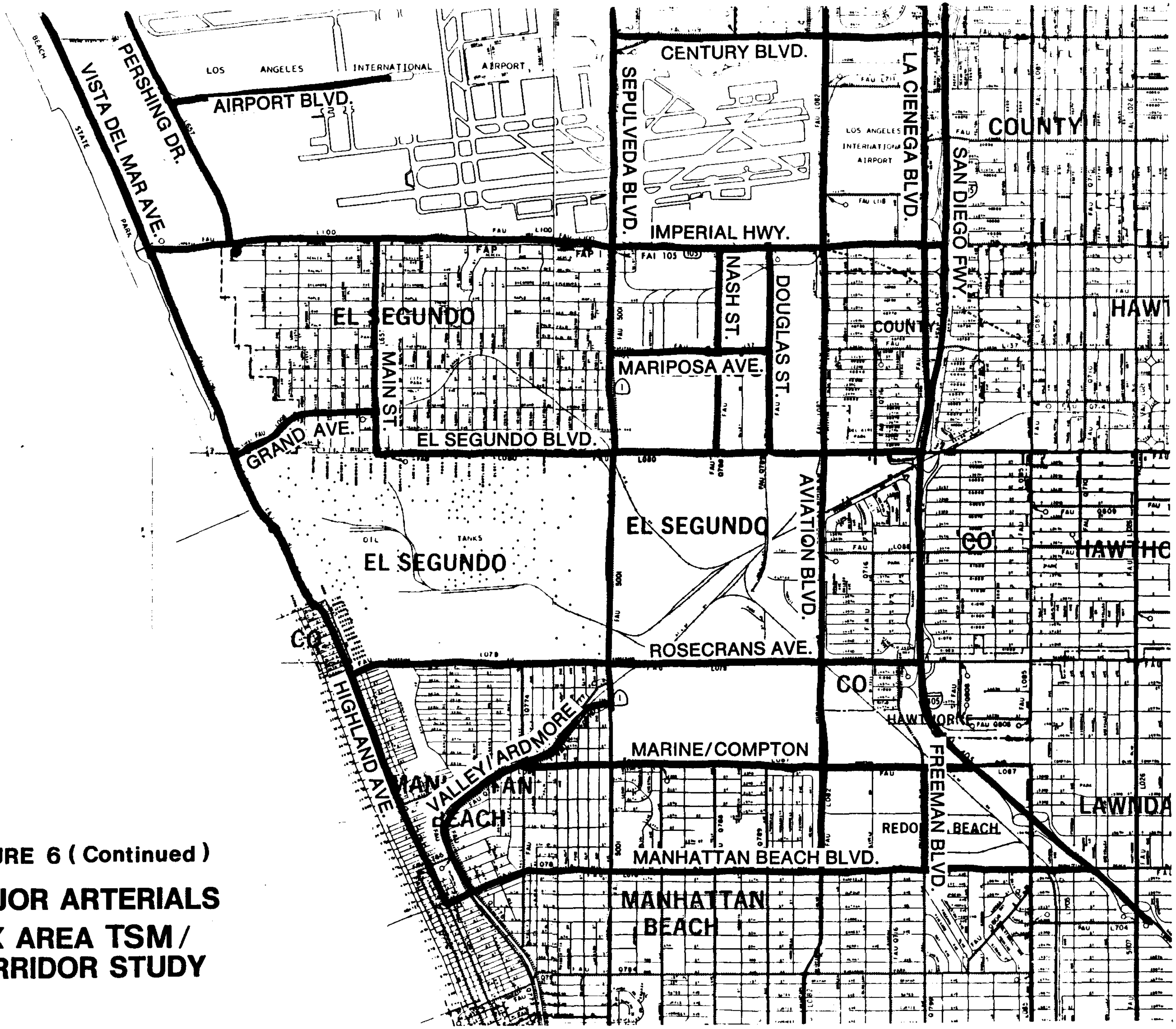


FIGURE 6 (Continued)

MAJOR ARTERIALS LAX AREA TSM / CORRIDOR STUDY

The frequency of study area line-haul public transit service varies from 12-1/2 to 60 minutes in the AM and PM peak travel periods and 15-60 minutes during the rest of the day. Transit service begins at about 5:20 a.m. and ends at 12:50 a.m.; a pan of 19-1/2 hours.

The intensity of transit service in the study area is 1,071 bus miles/week/square mile. This compares to 1,032 in the South Bay and 2,108 for the Westside. More than 23,000 boardings/day are registered. This is almost half of the daily boardings on the entire Long Beach and Santa Monica Bus systems. Private buses carry about 3,000 boardings/day. Interestingly, the private services do not compete with the public services, but complement them. The number of people carried by private bus services into the study area has been increased with the advent of service to the Hughes El Segundo facility.

Transit service (bus) utilization within the study area is higher than the SCRTD system average. For the study area, the average figure is 24.8 passenger miles/bus mile ranging from a high of 69 to a low of 2. The SCRTD system average is about 14 passenger miles/bus mile and the range is between 44 and about 2.

E. Ridesharing

Carpooling and vanpooling programs are implemented within the study area on an ongoing basis. Commuter Computer is implementing a number of programs in both the private and public sectors. They are working with developers and local governments to design rideshare programs where required as a condition of development approval. Furthermore, they are conducting training programs with public sector rideshare coordinators in the El Segundo area and providing assistance to employers who are relocating their facilities. In addition, the El Segundo Employers Association (ESEA) and its member companies are actively engaged in marketing and promoting ridesharing within the study area. ESEA provides matchlists to individuals and member companies, general information on ridesharing, and technical assistance to members who are interested in setting up their own ridesharing programs.

Rideshare participation within the study area is higher than Los Angeles County and SCAG region totals. For example, 23.7% of the work trips produced by the study area are carpool/vanpool trips, in comparison to 19% and 19.5% for Los Angeles County and the SCAG region, respectively (See table 4, Section III.B.).

Overall rideshare participation by ESEA and its member companies has increased by 23% in the last two years, while vanpooling has increased by 161%. Carpooling attracted the greatest number of commuters overall (11,934), along with the greatest group of new ridesharers (2,193) among the member companies.

F. Bicycle Facilities

Bikeway development in the study area has been strongly oriented toward recreational riders, and routing has been heavily influenced by opportunities to build bikepaths along beaches, railroads, and flood control channels. This reflects a continuation of existing conditions and past trends rather than a concentrated effort to promote ridership for the home-based work trips which has the greatest future potential to reduce traffic congestion.

G. Rail Facilities

The existing rail facilities within the study area are part of a whole regional system to provide services to the growing residential and industrial land uses. The later expansion of the highway system has led to the eventual abandonment of many of the passenger service facilities, leaving active only those alignments used for freight movements in the heavy industrial corridors. Figure 7 illustrates the active and inactive facilities within the study area vicinity.

Active Facilities

Atchison, Topeka, and Santa Fe Track

Formed by single track sections, this alignment services the industrial land uses along Aviation Boulevard, south of Manchester Avenue, and within the City of El Segundo. Inside the study area, the AT & SF track runs along the north side of Florence Avenue between the I-405 Freeway and Manchester Avenue. South of Manchester Avenue, it extends along the west side of Aviation Boulevard with side-tracks provided at both sides. South of El Segundo Boulevard the alignment swings west toward the El Segundo junction where it splits into two lines. The active part of the facility continues then southeast over the intersection of Aviation Boulevard and Rosecrans Avenue to service the Los Angeles Harbor area. The tracks throughout the facility are currently maintained to meet the demand for active freight services in the area. Additionally, the different street intersections along the route are equipped to provide the necessary control for both track and street operation.

Inactive Facilities

AT & SF (Redondo Section)

This single track 4.5 mile section of the AT & SF alignment has been abandoned by the railroad. It begins north of Rosecrans at the El Segundo Junction, running south over the center median that separates Valley Drive and Ardmore Avenue between Sepulveda Boulevard and the City of Redondo Beach.

Given its abandonment, the existing right-of-way along the route is in fairly good condition with the exception of some street crossings which need rehabilitation.

<u>Southern Pacific Railroad</u>

The SPRR right-of-way extends approximately seven miles from the Venice Beach to its end, 2 miles east of the I-405 Freeway. The alignment runs parallel to Washington Boulevard, Marina Freeway, Jefferson Boulevard, and Centinela Avenue, and intersects other major arterials such as Washington Street, Lincoln Boulevard and Culver Boulevard before leaving the study area.

Other sections of this alignment are located over the median along Venice Boulevard, west of Lincoln Boulevard, and along Culver Boulevard between the Marina Freeway and Venice Boulevard. The land uses along the SPRR Path are mainly commercial and residential.

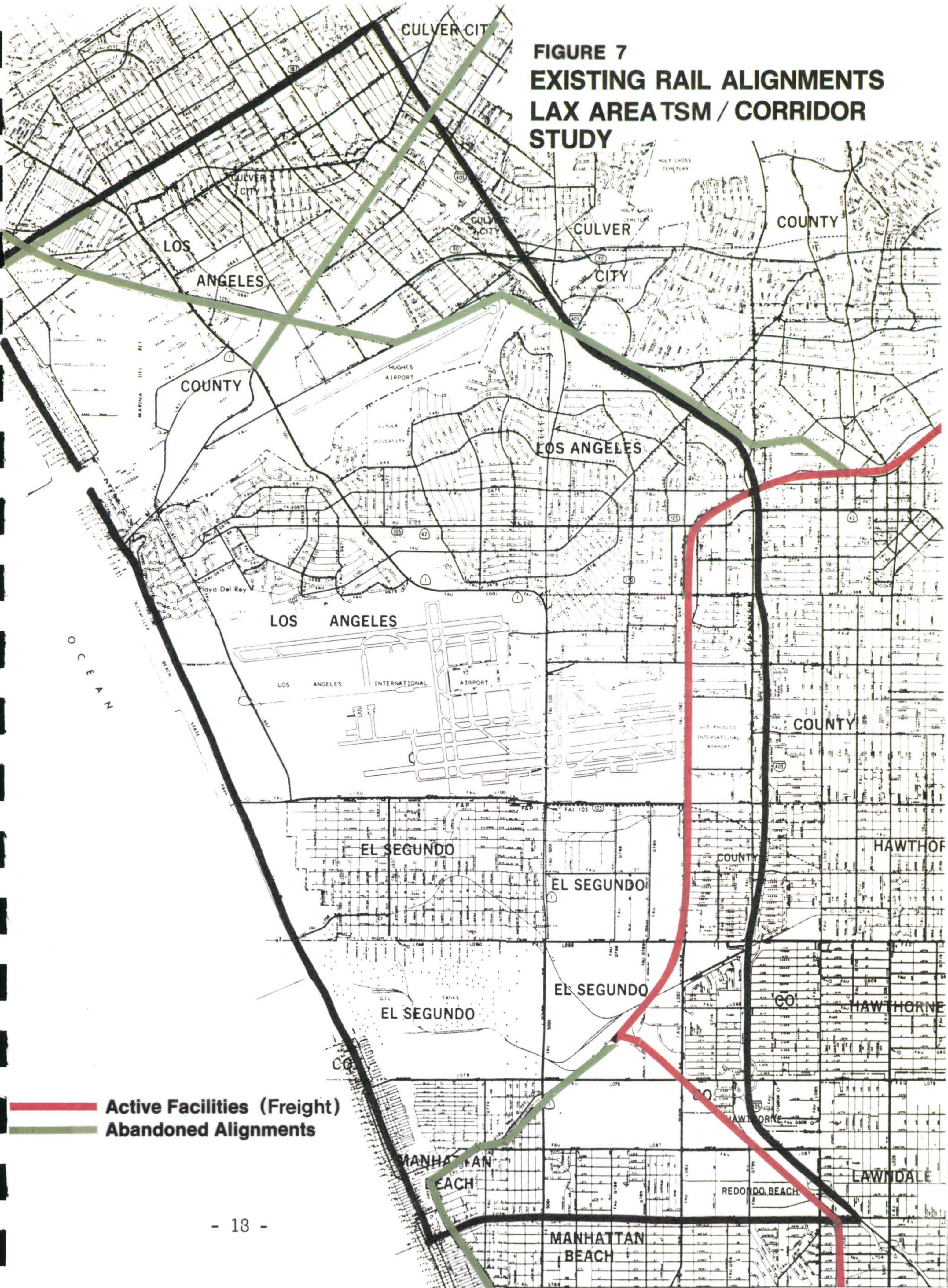


FIGURE 7
EXISTING RAIL ALIGNMENTS LAX AREA TSM / CORRIDOR STUDY

III. EXISTING TRAFFIC VOLUMES (1980) AND CAPACITY DEFICIENCY

A. Modeling Process

As indicated in Chapter I, the quantitative analysis of present and future traffic deficiencies in the study area has two separate parts: the detailed study of signal timing and other TSM impacts on each of selected major arterials in the study area, and the areawide analysis of various transportation alternatives using the UTPS/RTMS models. The arterial analysis using TRANSYT is described in a separate report and the UTPS/RTMS models are described in detail in Appendix B. This section briefly outlines the UTPS/RTMS models and how they are adapted in this context.

The Urban Transportation Planning Sequence (UTPS) is a set of models approximating aggregate transportation behavior. It is commonly used in the United States and elsewhere for travel demand forecasting and evaluation of alternatives. Specifically, the UTPS modeling sequence, as calibrated in the 1967 Los Angeles Regional Transportation Study (LARTS) performed by Caltrans, and updated in 1976, is used for the regionwide travel forecasting done by SCAG. Within the SCAG region, the UTPS package is known as the Regional Transportation Modelling System (RTMS).

Since it is clearly impossible to model on a regionwide level the traffic on every street and alley, the regional transportation system is abstracted somewhat for the purposes of modeling: only the freeways and major arterials are included in the regionwide network. Further, the region is divided into 1,285 analysis zones (AZs), which are assumed to be the trip-making units. Thus, traffic originates in one zone, is destined for another, and finds its destination over the regional transportation network.

The UTPS process has four major submodels:

1. Trip generation. This model estimates the number of trips (of each type) produced by and attracted to each zone, as a function of sociodemographic characteristics of the zone such as population, housing, employment, median income and auto ownership. Five different trip types are defined, based on the purposes of each end of the trip: home-to-other, other-to-other, other-to-work, home-to-work, and home-to-shop.

2. Trip distribution. This model estimates how many of the trips (of each type) produced in zone i are attracted to zone j, for all zone pairs i and j. The "attractiveness" of zone j is calculated based on its population, employment, and travel time from zone i.

3. Mode split. This model allocates the total number of trips (by each type) between each pair of zones to each of six transportation modes: drive alone, two-person carpool, 3+-person carpool/vanpool, local bus, express bus, and rail (when available). The split is based on the comparative travel times and costs of each mode.

4. Trip assignment. This model determines the route taken by trips from i to j, either on the transit or the highway network, depending on mode. The result when all routes between all zone pairs are determined is volume on each link of the two networks (vehicle volume for highway, passenger volume for transit). From this basic information, a number of quantities can be derived, such as volume-to-capacity (V/C) ratio (an indication of the level of congestion), average speed, vehicle miles traveled (VMT), and number of congested miles.

This sequence of models is followed for the areawide analysis in the LAX Area TSM/Corridor Study. One issue that must be resolved, however, is the level of detail at which the modelling will take place. While it is desirable to be able to put the study area in the regionwide context, it is most important to be able to focus primarily on the study area itself. Thus, while the modelling was performed at the regionwide level, a few refinements to the model inputs were made for the study area. For example, the zone structure and network are at a suitable scale for regionwide modeling, but are on too coarse a scale to allow detailed interpretation at the small-area level. Thus, for the study area itself, AZs were divided into smaller zones, and streets were added to the highway network.

Figures 8 and 9 compare the old and new zone structures and highway networks, respectively. The number of zones in the study area was increased from 32 to 63, and the density of the highway network was approximately doubled. In most cases, the original AZs were disaggregated to the census tract level, the smallest geographical unit for which most of the sociodemographic input variables were available.

Additional modifications to the standard modeling process must be made to account for the unusual attractor in the study area, namely, LAX. The regionwide models predict home-based-work trips very well, and other conventional travel reasonably well, but do not necessarily predict airport-related trips well at all (for example, population and employment of a zone would ordinarily be good indicators of the traffic generated by a zone, but would greatly under-estimate traffic generated by airport zones). While this is a relatively minor difficulty at the regionwide level, it is very important at the small-

FIGURE 8

ZONE MODIFICATIONS
LAX AREA TSM / CORRIDOR STUDY

Original Zones

New Additions

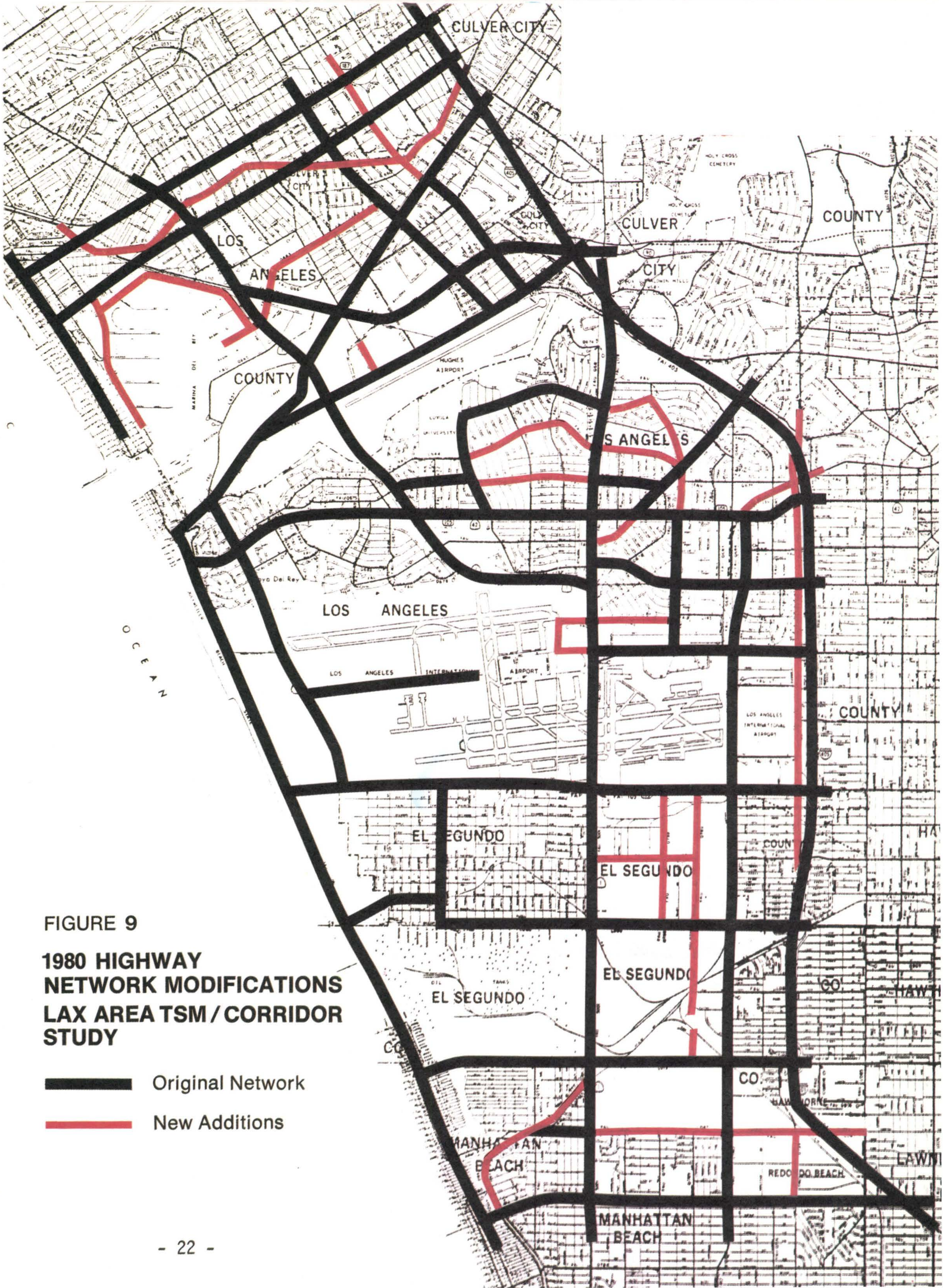


FIGURE 9

1980 HIGHWAY NETWORK MODIFICATIONS LAX AREA TSM / CORRIDOR STUDY

Original Network

New Additions

area level. Accordingly, manual adjustments were made at appropriate stages of the process to account for airport-related trips. The LAX Ground Access Study, Final Environmental Impact Report, 1978, prepared by the Los Angeles Department of Airports, was used to make these adjustments which were based on predictions of vehicular traffic in 1980 and at 40 MAP (million annual passengers).

B. Transportation Characteristics

In this section, existing transportation characteristics in the study area are portrayed by examining in turn the results of each of the four submodels in the UTPS process: generation, distribution, mode split, and (highway) route assignment. In Section III. C, specific major arterials in the highway network are highlighted for a discussion of the transportation deficiencies in the study area.

1. Trip Generation

The trip generation model estimates the number of trips produced and attracted by each zone. If, for example, someone leaves home in zone A, travels to work in zone B, and returns home, then two trips are said to be produced by zone A, and two trips attracted to zone B. Thus, a zone with a lot of productions will typically be a residential area, and a zone with a large number of attractions will contain high employment, and/or activity centers such as entertainment and recreational facilities, schools, airports, and shopping centers. Productions and attractions are estimated for the five trip types described in the previous section.

Table 2 compares 24-hour trip productions and attractions for the study area, Los Angeles County, and the SCAG region.

TABLE 2

1980 24-Hour Trip Productions and Trip Attractions--All Trip Types

	Productions	Attractions
Study area	784,692	928,003
Los Angeles County	25,809,422	26,407,806
SCAG Region	38,935,276	38,935,276

Trip productions in the study area total about 785,000, 3.0% of L. A. County trip productions and 2.0% of all trip productions in the region. There are over 928,000 trip attractions, forming 3.5% and 2.4% of L. A. County and regional attractions, respectively. Table 1 also indicates that, geographically, the study area covers about 0.8% of the county, so its trip-making activity in proportion to its size is much higher than for the county as a whole. The study area attracts about 18% more trips than it produces, as would be expected from its large number of employment and other activity centers.

Similar conclusions may be drawn for home-based work (HBW) trips alone, as shown in Table 3. Again, HBW trip productions from the study area (about 138,000 in all) are 3.0% of the trip productions for L. A. County and 2.0% of the trip productions for the region. The 235,000 study area HBW trip attractions comprise 4.7% of the county total and 3.3% of the regional total. The study area attracts 71.0% more HBW trips than it produces, again demonstrating the job-rich nature of the area.

TABLE 3

1980 24-hour Trip Productions and Trip Attractions--HBW Trips

	Productions	Attractions
Study area	137,600	235,259
Los Angeles County	4,601,148	5,006,950
SCAG region	7,041,469	7,041,469

2. Trip Distribution

The section above discussed the number of trips generated (i.e., produced and attracted) by the study area. It is of interest to know the distribution of those trips, i.e., where they are going to or coming from. For this purpose, the SCAG region was divided into eight subregions:

- Ventura County
- North Los Angeles County
- Northwest Los Angeles County
- Central Los Angeles County
- South Los Angeles County
- LAX Study Area
- Orange County
- Riverside/San Bernardino Counties

The proportion of trips with one end in the study area whose other end falls into each of those subregions is analyzed below.

Figures 10 and 11 portray the distribution of 1980 total trip productions and trip attractions, respectively. Looking first at Figure 10, it can be seen that over 99% of the trips produced by the study area are destined for Los Angeles County. The study area itself retains about 36% of the trips it produces, while central Los Angeles County attracts over 46% of the trips. Northwest and south Los Angeles County respectively attract about 13% and 4% of the trips; the remaining subregions draw fewer than half a percent each.

As for attractions, Figure 11 indicates that it is seen that central Los Angeles County produces 59% of the trips that are attracted to the study area, while the study area itself produces 23% of the trips it attracts. Taken together, Los Angeles County produces about 98% of the trips attracted to the study area, with 1.6% coming from Orange County and smaller fractions from Ventura, Riverside, and San Bernardino counties.

Figures 12 and 13 portray the distribution of home-based work (HBW) trip productions and trip attractions of the study area. HBW trip productions vary only slightly from total trip productions, the primary differences begin that a slightly higher proportion of HBW productions are attracted to central and south Los Angeles County, and a slightly lower proportion of HBW productions remain within the study area. HBW trip attractions, however, exhibit a somewhat different pattern from total trip attractions. The study area produces a much smaller proportion of its HBW trip attractions (14% versus 23%), while all the other subregions contribute a larger percentage than for total trip attractions. Los Angeles County as a whole produces nearly 96% of the HBW trips attracted to the study area, with Orange County again accounting for most of the rest at 3.5%.

3. Mode Split

All mode split calculations are done for home-based work trips only, as the RTMS focuses on peak period transit service. Table 4 compares the mode splits for the study area to those for Los Angeles County and the SCAG region. The numbers in the table represent the percentages of person trips made by driving alone, by shared ride (carpool and vanpool) and by transit.

The general conclusion that can be drawn from Table 4 is that, for both trip productions and trip attractions, the study area shows a higher proportion of shared-ride trips and a lower proportion of transit trips than either Los Angeles County or the region. The high proportion of shared rides is confirmation of the effectiveness of the intensive ridesharing promotion (primarily employer-based) that has existed for several years in the study area. As for the low transit split, perhaps the most obvious explanations on inspection of

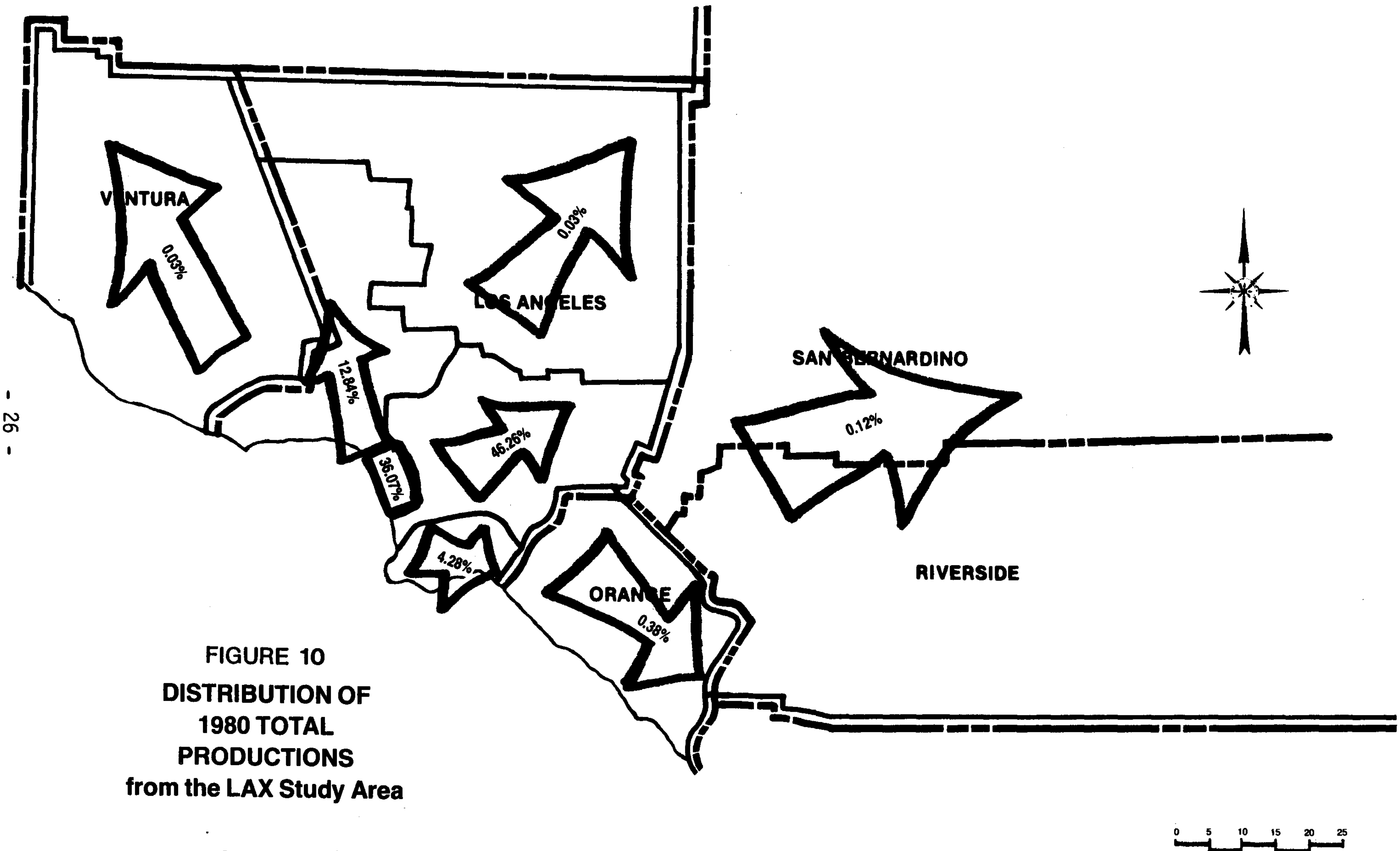


FIGURE 10
DISTRIBUTION OF 1980 TOTAL PRODUCTIONS from the LAX Study Area

County Boundary Line

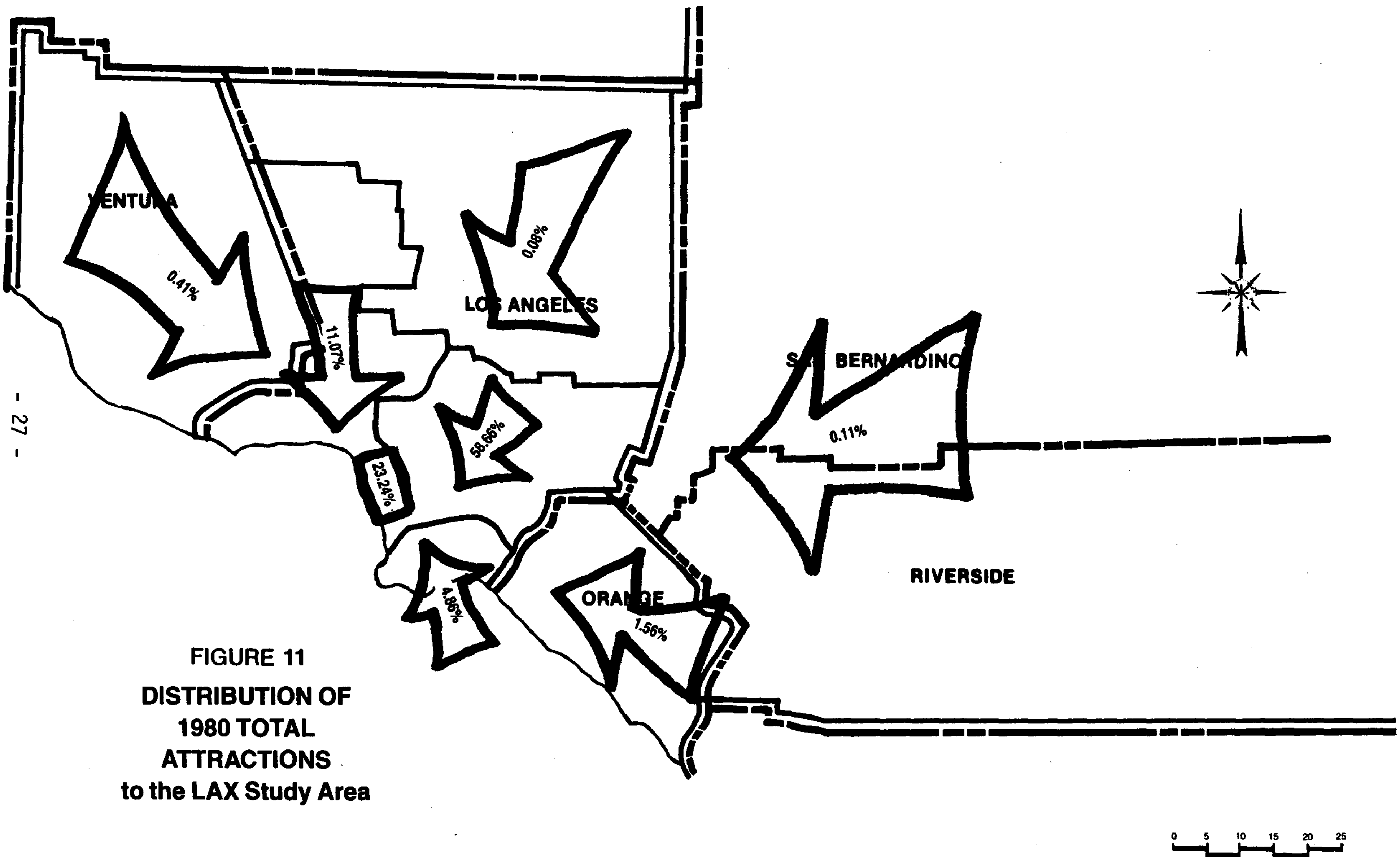


FIGURE 11

DISTRIBUTION OF 1980 TOTAL ATTRACTIONS to the LAX Study Area

County Boundary Line

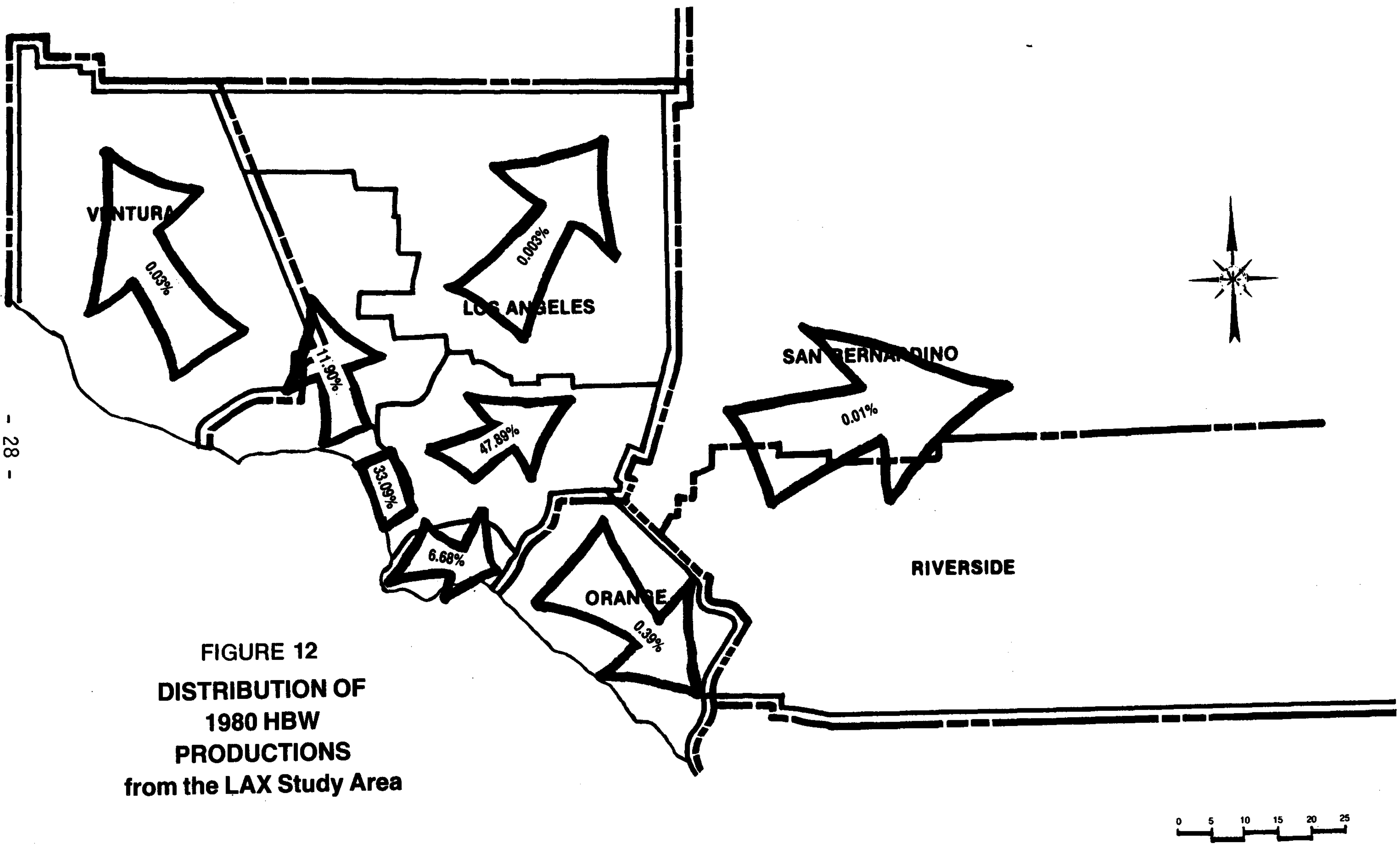
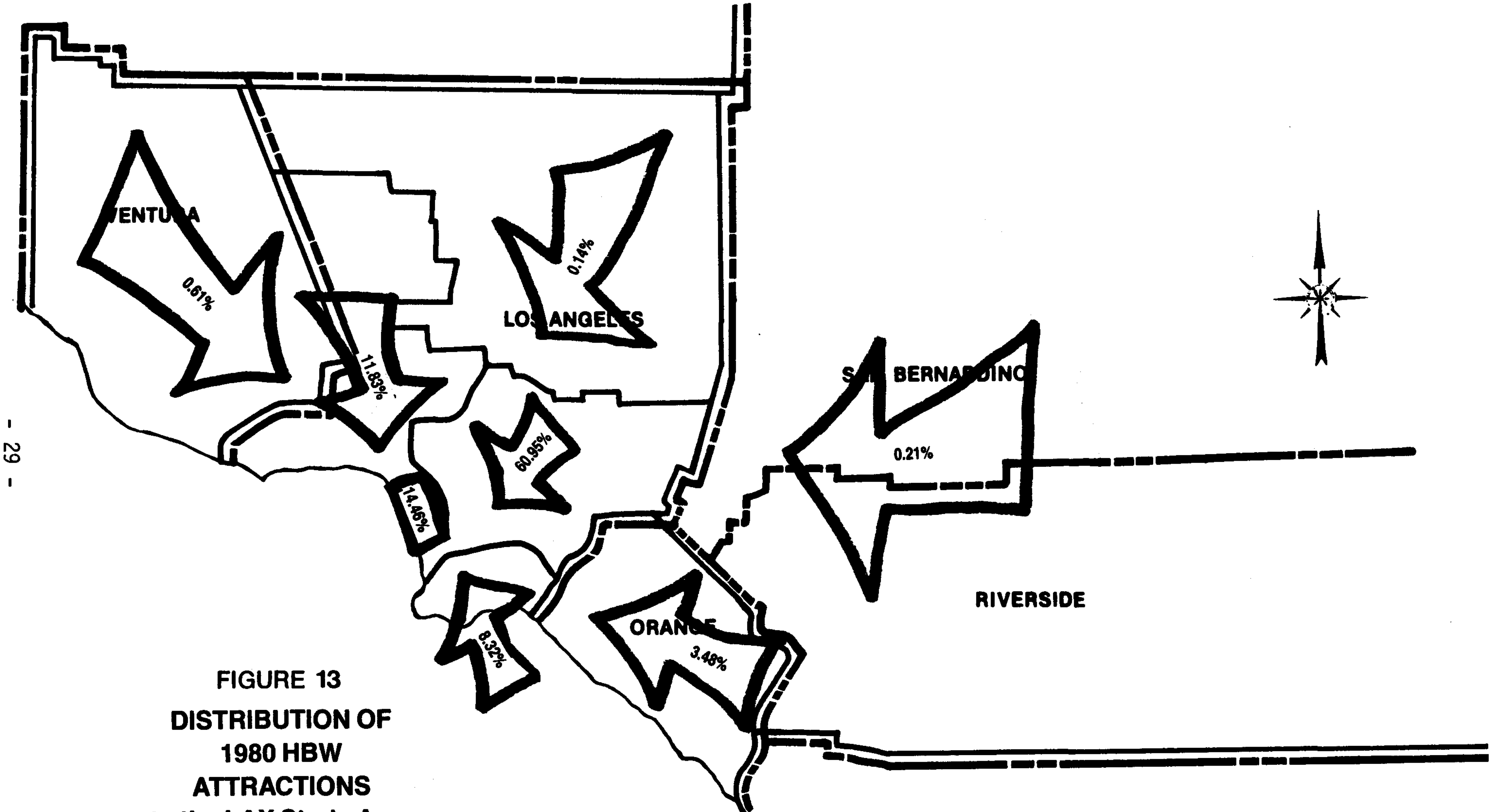


FIGURE 12

DISTRIBUTION OF 1980 HBW PRODUCTIONS from the LAX Study Area

County Boundary Line



0 5 10 15 20 25

FIGURE 13

DISTRIBUTION OF 1980 HBW ATTRACTIONS to the LAX Study Area

County Boundary Line

Table 4, is that most of the higher shared ride split has been drawn from transit rather than from the drive alone mode. Such a phenomenon (cannabalization of transit shares rather than reduction in drive-alone shares) has been observed before when ridesharing is promoted. However, an alternative (or additional) explanation that cannot be ruled out, is that overall transit service to the study area is not as attractive to begin with as in other parts of Los Angeles County and the region, making ridesharing relatively more attractive than it would be otherwise.

While both productions and attractions show a higher shared ride split and lower transit split for the study area than for Los Angeles County and the region, it is interesting to note that within the study area itself, the shared ride split is higher for productions than for attractions. Conversely, the drive alone share is lower for productions than for attractions. Thus, although trips into the study area display a relatively high amount of ridesharing, trips out of the study area display an even higher level.

This conclusion is further reinforced by the average auto occupancy (average number of persons per auto) shown in Table 4. For the study area, auto occupancy for HBW trip productions is 1.17 (higher than Los Angeles County and the region), while auto occupancy for HBW trip attractions is 1.14 (comparable to Los Angeles County and the region).

TABLE 4

1980 Mode Splits and Average Auto Occupancy: Home-Based Work Trips

	Study Area	Los Angeles County	SCAG Region
Productions			
Drive Alone (%)	72.6	72.6	74.1
Shared Ride (%)	23.7	19.0	19.5
Transit (%)	3.7	8.4	6.4
Auto Occupancy	1.17	1.14	1.14
Attractions			
Drive Alone (%)	74.9	72.3	74.1
Shared Ride (%)	20.7	19.6	19.5
Transit (%)	4.4	8.1	6.4
Auto Occupancy	1.14	1.14	1.14

4. Highway Assignment

The travel characteristics described in the preceding sections (generation, distribution, and mode split) are all computed for a 24-hour period. The highway assignment component of the UTPS/RTMS models, on the other hand, permits analysis of the 24-hour period, the a.m. peak period, or the p.m. peak period. It was decided to study one of the peak periods since they (by definition) represent the times of highest congestion for the transportation network. The a.m. peak (6:30-8:30 a.m.) was chosen because the model is most accurate for that period. The reason is that the a.m. peak is predominantly work trips, which the model predicts very well, while the p.m. peak contains shopping, entertainment, and many other kinds of trips which are much harder to predict. However, for the same reason (the p.m. peak contains not only work trips but many other trips), p.m. peak traffic levels are generally higher than a.m. levels. Thus, it should be kept in mind that the results presented here will typically be worse (with the predominant direction of travel being reversed) for the p.m. peak.

In summarizing the overall results of the highway assignment model, the V/C ratio, or ratio of volume on a given link in the highway network to the capacity of that link, is used to provide a quantitative measure of the congestion level on that link. Table 5 shows the number of arterial miles that fall into each of the following four volume/capacity categories:

- $V/C < .75$ (excellent operation)
- $0.75 \leq V/C < 1.00$ (good to fair operation)
- $1.00 \leq V/C < 1.25$ (poor operation)
- $V/C \geq 1.25$ (extremely poor operation)

TABLE 5

MILES OF MAJOR ARTERIAL
BY V/C CATEGORY (1980)

$V/C < 0.75$	$0.75 \leq V/C < 1.00$	$1.00 \leq V/C < 1.25$	$V/C \geq 1.25$
95.75 (53%)	39.53 (22%)	27.93 (16%)	16.85 (9%)

This table indicates that 25% of the miles in the major arterial network may be classified as congested, i.e., for which the V/C ratio exceeds 1. This means that for 25% of the miles of major arterial in the study area, the volume exceeds the theoretical capacity of the street.

C. Deficiency Analysis

This section deals with an analysis of a number of arterials within the study area which experience congestion today. The limitations of this study did not permit a comprehensive analysis of all the intersections; therefore, a detailed capacity analysis of the entire study area network on an arterial by arterial basis was performed to provide both recommendations and a methodology which could be applied to similar locations throughout the study area for future years.

Analysis of traffic flows are useful in attaining an understanding of the general nature of traffic in an area, but by themselves do not indicate the ability of the street network to carry additional traffic nor the quality of service afforded by the street facilities. For this, the concept of "level of service" has been developed to correlate numerical traffic volume and capacity data to average travel speeds and subjective descriptions of traffic performance. Table 6 presents the level of service categories (A through F) considered in this analysis of arterials and indicates the corresponding volume/capacity ranges, average travel speed conditions, and qualitative definition of each category.

Level of Service "D" will be considered the acceptable standard level of service for this and later arterial analyses. Level of Service "D" is the planning standard accepted by both the City of Los Angeles and Los Angeles County as well as other jurisdictions and is the level of service recommended for planning purposes by the 1965 Highway Capacity Manual. V/C ratios of 1.00 correspond to Level of Service "E" operation. V/C ratios greater than one imply forced flow ("F") traffic operation. V/C ratios less than one imply poor ("E"), fair ("D"), good ("C"), very good ("B"), or excellent ("A") traffic operation.

Volume to capacity ratios were developed for both existing (1980) and future (1987 and 1992) traffic volumes. The existing and future traffic volumes across arterials were obtained from a SCAG Regional Transportation Modeling System (RTMS) model run, as described in Appendix B. Next, the existing travel volumes based on the 1980 24-hour traffic volume flow map developed by the City of Los Angeles, Department of Transportation and other jurisdictions within the study area were used to validate the results obtained from the model runs. These volumes, with some unavoidable random variations, represent existing traffic conditions. Capacities for each arterial were based on existing roadway configurations provided by jurisdictions within the study area. Morning peak period volumes (2 hours) were used to develop volume-to-capacity ratios for both existing and future deficiency analyses.

The study area was divided into north/south and east/west alignments to enable analysis of parallel arterials on a subarea basis. Screenlines were drawn across each of the arterials to further enhance the analysis of traffic congestion across segments of arterials traversing through different land use patterns (residential, commercial, industrial, and recreational). Next, volume/capacity (V/C) ratios were determined for each of the arterials. Individual link volumes (a.m. peak), link volume/capacity ratios, and linkspeeds were aggregated by segments of arterials under consideration. This procedure was followed to develop a measure of relative as well as absolute arterial capacity deficiency.

Average V/C ratios for all the arterials with V/C ratios greater than one, have been summarized in Table 7 and shown in Figure 14. This table also presents level of service (in brackets) for each V/C ratio as well as average speeds and corresponding morning peak period volumes (2 hours). Segments of arterials have been ranked from most deficient (higher V/C ratio) to least deficient (lower V/C ratio) for existing traffic volume conditions. These segments are further divided into three levels to allow a more detailed analysis of the existing and future deficiencies. (a) F, indicating those with a V/C ratio greater than 1.00 and less than 1.25, (b) F^1, indicating those with a V/C ratios greater than or equal to 1.25 and less than 1.50 and (c) F^2, indicating those with a V/C ratio greater than or equal to 1.50.

Table 7 indicates that under existing traffic demand volumes, segment of Lincoln Boulevard (Venice to Marina Freeway in both directions), El Segundo Boulevard (I-405 to Douglas, westbound), and Aviation Boulevard (Manhattan Beach Boulevard to El Segundo, northbound) have the highest existing deficiency ranking of the arterials in the study area with a level of service "F^1". In addition, twelve segments of other arterials presently operate a seriously deficient Level of Service "F" and five others are now operating at Level of Service "E". The rest of the arterials are presently operating at recommended Level of Service "D" or better with the exception of I-405 (Venice to Manhattan Beach Boulevard both directions) and Sepulveda Boulevard (Southbound) which are the only freeway and arterial experiencing severe congestion through their entire length within the study area (Level of Service F^1).

The results of the analysis also indicate that there is little available capacity today in the north-south arterials while east-west corridors experience a somewhat lesser degree of congestion and provide better access to the study area. Problems in the north-south arterials are compounded by the fact that there is only one continuous arterial traversing through the entire study area, Sepulveda Boulevard/Pacific Coast Highway. Furthermore, most of the arterials which experience traffic congestion in the morning peak hours (6:30-

8:30 a.m.) in one direction will experience the same level of traffic congestion or worse in the evening peak hours (3:00-6:00 p.m.) in the opposite direction.

TABLE 6

Interpretation of Levels of Service for Arterial Streets

Level of Service*	V/C	Interpretation (During Peak Periods)
"A"	less than 0.60	Excellent operation, relatively free flow, average speeds 30 mph (constrained only by roadway alignment and/or speed limits).
"B"	0.60-0.70	Very good operation, stable flow, slight delay at key intersections, average travel speed 25+ mph.
"C"	0.70-0.80	Good operation, stable flow, occasional delay and intervehicular conflicts at many intersections, average speed reduced to 20+ mph.
"D"	0.80-0.90	Fair operation, approaching unstable flow, delays at critical intersections as long as two or more signal cycles, average speed as low as 15 mph.
"E"	0.90-1.00	Poor operation, unstable flow, continuous backups occur on the approaches to critical intersections, traffic from minor cross streets has difficulty entering or crossing main traffic stream, average speed likely to be at or below 15 mph.
"F"	greater than 1.00	Forced flow, vehicles back up from critical downstream signal through upstream signalized intersections. Stop and go conditions. Average speed less than 10 mph.

* As defined in the National Academy of Sciences Highway Capacity Manual, 1965.

TABLE 7

Existing (1980) Arterials Deficiency Analyses

	V/C Ratio (Level of Service)	Average Speed MPH	Average Volume Morning Peak Period (2-hours)
1. **Lincoln Boulevard**			
Venice to Marina Fwy (SB)	1.33 (F[1])	7-12	3,764
Marina Fwy to Venice (NB)	1.23 (F)	10-15	3,471
2. **El Segundo Boulevard**			
I-405 to Douglas (WB)	1.33 (F[1])	7-12	4,766
3. **Aviation Boulevard**			
Manhattan Beach Blvd to El Segundo (NB)	1.24 (F)	10-15	2,977
Manhattan Beach Blvd. to Imperial (NB)	1.10 (F)	12-17	2,940
4. **Rosecrans Boulevard**			
I-405 to Aviation (WB)	1.23 (F)	10-15	4,417
5. **I-405**			
Venice to Manhattan Beach Blvd (SB)	1.24 (F)	20-25	16,220
Manhattan Beach Blvd to Venice (NB)	1.23 (F)	20-25	16,164
6. **Sepulveda Boulevard**			
Venice to Manhattan Beach Blvd (SB)	1.17 (F)	10-15	4,412

---

1 Volume/Capacity ratios equal to or greater than 1.25 and less than 1.50.

TABLE 7 (continued)

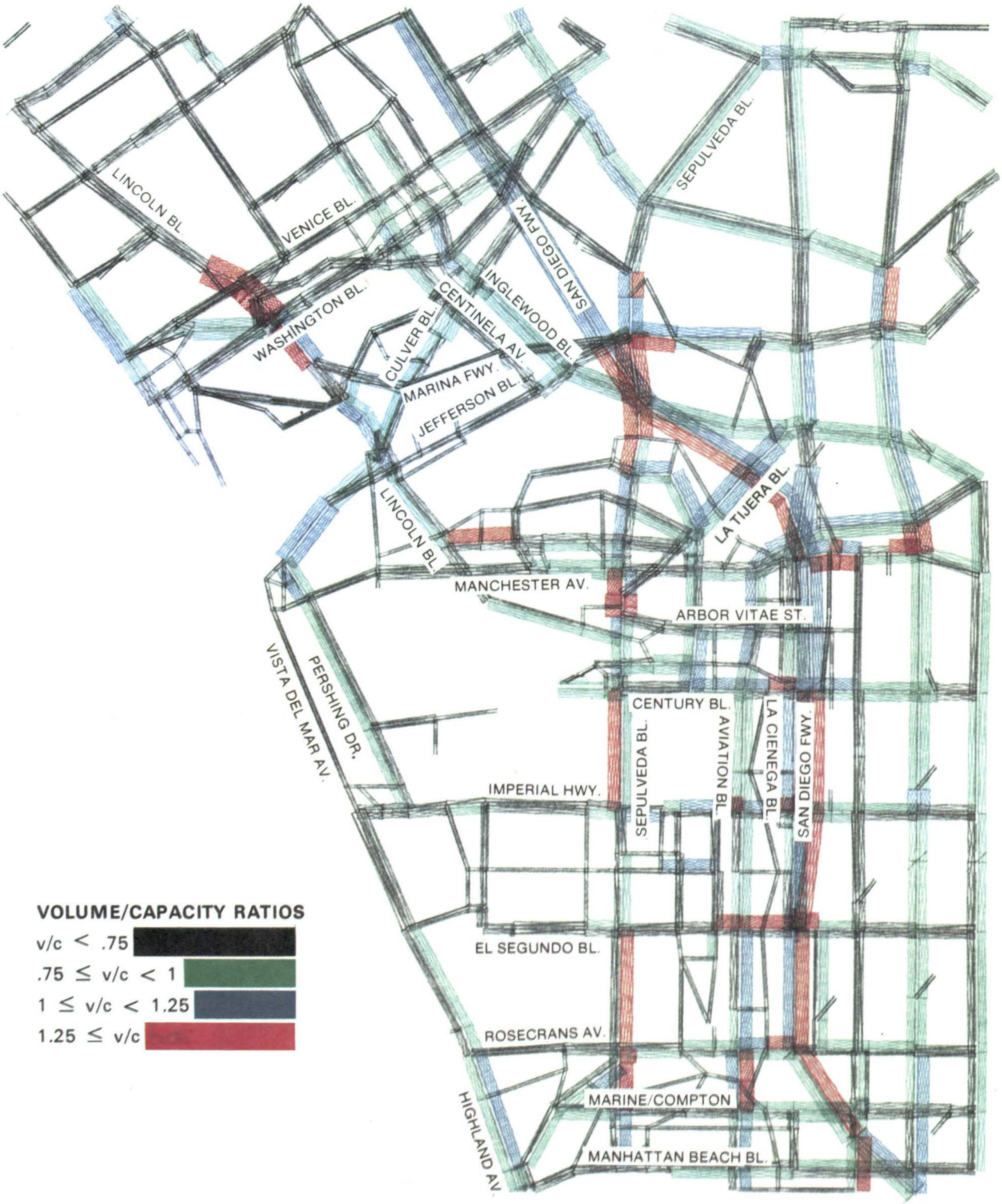
Existing (1980) Arterials Deficiency Analyses

	V/C Ratio (Level of Service)	Average Speed MPH	Average Volume Morning Peak Period (2-hours)
7. La Cienega Boulevard			
Century to El Segundo (SB)	1.17 (F)	10-15	2,793
I-405 to Imperial (SB)	1.11 (F)	12-17	2,641
8. Culver Boulevard			
Vista Del Mar to Jefferson (EB)	1.16 (F)	10-15	2,772
9. Century Boulevard			
I-405 to Airport Blvd (WB)	1.15 (F)	10-15	5,534
10. La Tijera Boulevard			
I-405 to Airport Blvd (WB)	1.12 (F)	12-17	2,692
Airport Blvd to I-405 (EB)	1.04 (F)	12-17	2,495
11. Imperial Highway			
I-405 to Sepulveda (WB)	1.08 (F)	12-17	3,936

[1] Volume/Capacity ratios equal to or greater than 1.25 and less than 1.50.

FIGURE 14

LAX AREA TSM/CORRIDOR STUDY



YEAR 1980 ALTERNATIVE 1

IV. FUTURE CONDITIONS

A. Forecasting Process and Future Developments

Previous chapters described existing (1980) socioeconomic and transportation conditions in the study area. While existing transportation deficiencies are certainly serious enough to warrant attention, of greater concern is the expected employment growth in the area in the near-term future, leading to even more serious deficiencies. In order to analyze future transportation conditions, it is necessary to forecast future socioeconomic conditions. The methodology for doing this is briefly described below.

The UTPS/RTMS modeling process used in this study requires several socioeconomic variables as input: population, housing, employment, income, auto ownership, and so on. For 1980, these variables are available by zone based on census data or other information. Future year projections are made by the Development Guide staff of SCAG. In particular, the "SCAG-82 forecast" is the year 2000 socioeconomic projections by zone (adopted in 1982) for the entire SCAG region.

The SCAG-82 forecast formed the basis for the 1987 and 1992 projections for the LAX Area TSM/Corridor Study. For all input variables except employment, linear interpolation between 1980 and 2000 values was used to estimate 1987 and 1992 levels. For example, the population of zone x for 1987 is estimated to fall 7/20 of the distance between the populations for 1980 and for 2000; the 1992 population is estimated at 12/20 of the distance. While this is only an approximation (for example, zone x may grow very rapidly in the first few years, decline a little for a few years, and grow very slowly for a number of years), there is no solid basis for refining each estimate on a zone-by-zone basis. A linear interpolation represents the best available forecast for all variables except employment.

For employment, however, two ways of arriving at 1987 and 1992 forecasts were possible. One way was simply to interpolate between 1980 and the SCAG-82 year 2000 estimate as was done for the other socioeconomic variables. The second way took advantage of the detailed information available on the location, extent, nature, and timing of the major proposed developments in the study area. By estimating the amount and timing of the employment generated by each development, the increase in employment by zone could be projected for 1987, 1992, and 2000 (using the SCAG-82 forecast for zones with no proposed major developments).

Comparison of the two prediction methods indicated that the development-based forecasts were substantially higher than the SCAG-82 based forecast (e.g., the predicted increase in employment for the study area between 1980 and 2000 was approximately 52,225 for SCAG-82 and 175,288 for the development-based forecast). The advisory Steering Committee members elected to analyze the higher forecast, to provide an upper-bound indication of the future deficiencies in the study area. As mentioned, it is intended that Phase II of this study will provide an analysis of the SCAG-82 forecast as a low-level scenario, as well as an intermediate employment scenario falling between the high and low estimates.

Table 8 lists each known proposed development in the study area, and estimates the number of trips and employees generated by each. Figures 15 and 16 show the location and approximate timing of each of the developments shown in Table 8. A number of assumptions were required to calculate these figures; those assumptions are documented in the footnotes and in technical memoranda of the study. The conclusion one draws from the table is that <u>if</u> each of the developments listed is realized in its entirety, they alone will increase employment in the study area by 172,206 by the year 2000, 92% more than in 1980. It is not realistic to expect every development to be 100% occupied, however, so an adjustment was made to reflect a vacancy rate based on how long the development had been completed and assuming an equilibrium vacancy rate of 5%.

The final 1987, 1992, and 2000 estimates for population and employment in the study area (compared to L. A. County and the rest of the SCAG region) are shown in Table 9. Study area population increases a total of 17.1% by 2000, while employment increases 93.8%. Note that from 1987 on, employment in the study area exceeds population. Of the total employment increase of 175,288, 51.3% is achieved by 1987, and 83.4% by 1992.

Figures 17 through 20 portray 1987 and 1992 population and employment by zone in the study area. Comparing population for 1980, and 1987, and 1992 (Figures 3, 17, and 19), it is evident that while population of most zones is projected to increase at least slightly, the only really major changes are in the Marina del Rey/Playa Vista area. This is to be expected, since that area will be the primary site of new dwelling unit construction.

Comparing employment for 1980, 1987, and 1992 (Figures 4, 18, and 20), reveals that major changes occur in many areas. For example, while in 1980 only four zones (LAX and El Segundo) have an employment greater than 10,000, this becomes eight zones in 1987 and eleven in 1992. The new zones include the eastern portion of Playa Vista, part of Culver City, the area of the proposed Spicer property development, the western section of LAX Northside development, some areas along Century Boulevard, and the Chevron Oil property development in Manhattan Beach.

TABLE 8

Estimated New Trip Generation and Employment In LAX TSM/Corridor Study Area (Year 2000)

Name of Development	Estimated Generation Rate	Estimated New Vehicle Trip Ends (Average Daily Weekday)	Estimated Employment Rate	Estimated New Employment
1. Culver City Redev. since 1980				
290 K sq. ft. office	12.3/Ksf	3,567	4.5 /Ksf	1,305
113 K sq. ft. industrial	6 /Ksf	678	3 /Ksf	339
		4,245		1,644
2. Corporate Pointe				
1.5 M sq. ft. office	12.3/Ksf	18,450	4.5 /Ksf	6,750
3. Future Culver City Redev.				
500 K sq. ft. office	12.3/Ksf	6,150	4.5 /Ksf	2,250
589 hotel rooms	10.5/room	6,185	.929/room	547
		12,335		2,797
4. Marina del Rey Intensification[1]				
1,500 D.U.	5.3/D.U.	7,950	--	--
1,800 hotel rooms	10.5/room	18,900	.929/room	1,672
450 boat slips	3.8/slip	1,710	.015/slip	7
200 K sq. ft. office	12.3/Ksf	2,460	4.5 /Ksf	900
54 K sq. ft. marine commercial[2]	12.3/Ksf	664	2.25 /Ksf	122
462 seat restaurant	1.2/seat[3]	554	.083/seat[4]	38
		32,238		2,739
5. Lincoln Blvd. Development				
600 K sq. ft. office/hotel/commercial	25 /Ksf[5]	15,000	3.439/Ksf[6]	2,100
6. Playa Vista				
4 M sq. ft. office/industrial	10 /Ksf[7]	40,000	3.75 /Ksf[8]	15,000
8,837 D.U.	5.3/D.U.	46,836	--	--
2,400 hotel rooms	10.5/room	25,200	.929/room	2,229
750 boat slips	3.8/slip	2,850	.015/slip	11
670 K sq. ft. retail	56.1/Ksf[9]	37,592	2.25 /Ksf[10]	1,508
80 K sq. ft. sports center	35 /Ksf[11]	2,800	1.538/Ksf	123
		155,278[12]		18,871[13]

TABLE 8 (continued)

Estimated New Trip Generation and Employment
In LAX TSM/Corridor Study Area (Year 2000)

	Name of Development	Estimated Generation Rate	Estimated New Vehicle Trip Ends (Average Daily Weekday)	Estimated Employment Rate	Estimated New Employment
7.	Spicer Property				
	2.7 M. sq. ft. office	12.3/Ksf	33,210	4.61 /Ksf[14]	12,442
	600 room hotel	10.5/room	6,300	.929/room	558
			39,510		13,000
8.	9025 Lincoln Blvd.				
	181 K sq. ft. office	12.3/Ksf	2,226	4.5 /Ksf	815
9.	LAX Northside[15]				
	392 K sq. ft. office	14 /Ksf	5,488	5.263/Ksf	2,063
	913 K sq. ft. office park	12 /Ksf	10,956	3.510/Ksf	3,204
	1,595 K sq. ft. office-ind. park	8.2/Ksf	13,079	2.925/Ksf	3,030
	1,036 K sq. ft. airport-related ind.	10.3/Ksf	10,671	3.217/Ksf	5,131
	525 K sq. ft. hotels	20 /Ksf	10,500	2.478/Ksf	1,301
	55 K sq. ft. restaurant	105 /Ksf	5,775	2.273/Ksf	125
	65 K sq. ft. retail	50 /Ksf	3,250	2.25 /Ksf	146
			59,719		15,000
10.	Hughes Corporate Office				
	475 K sq. ft. office	12.3/Ksf	5,843	4.5 /Ksf	2,138
11.	Century Park				
	2,060 K sq. ft. office	12.3/Ksf	25,338	4.5 /Ksf	9,270
	1,300 hotel rooms	10.5/room	13,650	.929/room	1,208
			38,988		10,478
12.	Plaza La Reina				
	205 K sq. ft. office	12.3/Ksf	2,522	4.5 /Ksf	923
13.	Union Bank				
	325 K sq. ft. office	12.3/Ksf	3,998	4.5 /Ksf	1,463
14.	Continental City				
	1.9 M sq. ft. office	12.3/Ksf	23,370	4.5 /Ksf	8,550
	100 K sq. ft. retail	60.4/Ksf	6,040	2.25 /Ksf	225
	1,000 hotel rooms	10.5/room	10,500	.929/room	929
			39,910		9,704

TABLE 8 (continued)

Estimated New Trip Generation and Employment In LAX TSM/Corridor Study Area (Year 2000)

Name of Development	Estimated Generation Rate	Estimated New Vehicle Trip Ends (Average Daily Weekday)	Estimated Employment Rate	Estimated New Employment
15. Hotel-Century E of Aviation				
750 hotel rooms	10.5/room	7,875	.929/room	697
16. Dev. @ La Cienega and Imperial[16]				
off./lt. ind. on 50 acres	3 /emp	3,000	--	1,000
17. Hotel-Pacific Ave.				
144 "hometel" rooms	8 /room[17]	1,152	.929/room	134
41 condominium units	5.6/D.U.	230	--	--
		1,382		134
18. LAX	--	59,446[18]	--	4,000[19]
19. Hotel-Airport and Century				
1,300 hotel rooms	10.5/room	13,650	.929/room	1,208
20. El Segundo[20]	3.3/employee	211,289	--	64,027
21. Chevron Oil Property				
115 single family D.U.	10 /D.U.	1,150	--	--
400 town homes	6 /D.U.	2,400	--	--
4.4 acres affordable housing	unknown	unknown	--	--
21.3 acre (9-hole) golf course	9.1/acre	194	.282/acre	6
425 hotel rooms	10.5/room	4,463	.929/room	395
20 K sq. ft. medical office	75 /Ksf	1,500	6.250/Ksf	125
1,075 K sq. ft. office	12.3/Ksf	13,223	4.5 /Ksf	4,838
		22,930		5,364
22. TRW				
1,110 K sq. ft. office/lab/lt. manuf.	7 /Ksf[21]	7,770	3.333/Ksf	3,706
23. Aviation Office Bldg.				
175 K sq. ft. office	12.3/Ksf	2,153	4.5 /Ksf	788

TABLE 8 (continued)

Estimated New Trip Generation and Employment
In LAX TSM/Corridor Study Area (Year 2000)

	Name of Development	Estimated Generation Rate	Estimated New Vehicle Trip Ends (Average Daily Weekday)	Estimated Employment Rate	Estimated New Employment
24.	Prudential Office Development[22] 1.6 M sq. ft. office	12.3/Ksf	6,660 (net)	4.5 /Ksf	2,860 (net)
	TOTAL		766,417		172,206

Notes on "Estimated New Trip Generation and Employment . . ."

(1) The development shown represents a "most likely" scenario, based on the Land Use Plan of the L. A. County Local Coastal Program. However, trade-offs among land uses may occur as long as the total peak hour trips generated are kept below a fixed ceiling. The Local Implementation Program of the LCP mentions a horizon as long as 40 years for this development; however, indications are that it will take place much sooner. We assume that all the development shown occurs by 1992.

(2) According to the Local Implementation Program, the trip-making rate for "marine commercial" should be the same as for office. The employment rate was judgmentally calculated to be the same as for retail.

(3) Assuming a "quality restaurant" as opposed to a "high-turnover, sit down restaurant."

(4) Judgmental estimate.

(5) According to the LAX Northside Study.

(6) Judgmental estimate.

(7) A composite of trip generation rates for office (12.3/Ksf) and industrial (4-8/Ksf) uses.

(8) Judgmental estimate.

Notes on "Estimated New Trip Generation and Employment . . ."

(continued)

(9) Retail trip generation rates vary with the size of the shopping center (the larger the center the lower the rate). The Playa Vista development has four shopping centers of different sizes; the rate shown represents the average when each center is calculated separately.

(10) Judgmental estimate, based on a small phone survey of area shopping centers.

(11) According to the LAX Northside Study.

(12) This is evidently a conservative estimate. The LAX Northside Study gave the figure of 183,400, while the Airport Noise Control and Land Use Compatibility Study (ANCLUC) went as high as 200,000.

(13) The Summa Corporation estimates an employment of 20-25,000. The difference lies primarily in that they assumed a somewhat higher employment rate for office uses (5/Ksf) than we have (4.5/Ksf).

(14) Derived from the 13,000 total employment figure provided by the developer.

(15) A total employment figure of 15,000 was given by the development proposal. Judgment on the part of SCAG was required to allocate the total employment among the various land uses.

(16) According to the Economic Development Corporation of L. A. County, this tentative development will add about 1,000 employees. The trip-making rate is a judgmental estimate based on office and industrial rates per employee.

(17) A judgmental reduction of the normal hotel trip-making rate due to the specific nature of the development.

(18) Based on a figure of 237,000 total trips generated at 40 MAP found in the LAX Ground Access EIR.

(19) Based on a Department of Airports estimate of 10% additional employment at 40 MAP.

(20) Total new employment by the year 2000 was estimated by El Segundo City Planning and the El Segundo Employers Association. The trips generated by this employment were judgmentally estimated by SCAG.

(21) A composite of trip generation rates for these uses.

(22) Based on the consultant's report ("Traffic Impact Study: Prudential/Embassy Marina Center;" Linscott, Law, and Greenspan, Inc.; June, 1982), existing use of the site involves about 4,340 employees and about 13,000 daily trip ends. The trips and employment given in the chart, then, are <u>net</u> figures, accounting for existing use.

TABLE 9

Population and Employment Projections

POPULATION	1980	1987	1992	2000
LAX Area	194,008	205,590	213,867	227,103
LA County	7,471,505	7,799,679	8,124,000	8,394,860
SCAG Region	11,173,147	12,178,789	13,180,579	14,032,089
EMPLOYMENT				
LAX Area	186,830	276,712	333,076	362,118
LA County	3,933,751	4,285,393	4,602,996	4,747,149
SCAG Region	5,449,043	6,191,284	6,899,481	7,378,395

FIGURE 15
1987 MAJOR DEVELOPMENTS LAX AREA TSM / CORRIDOR STUDY

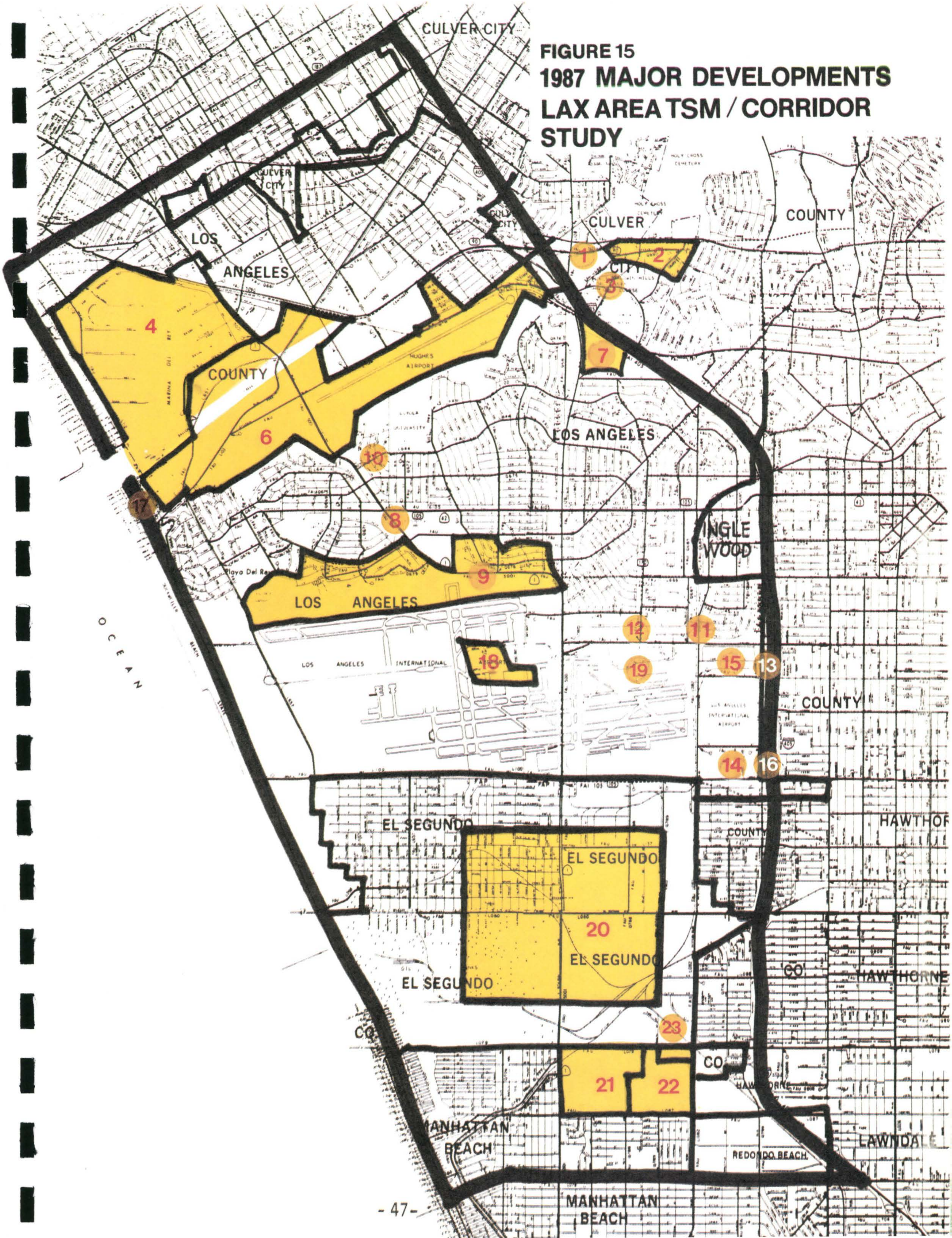
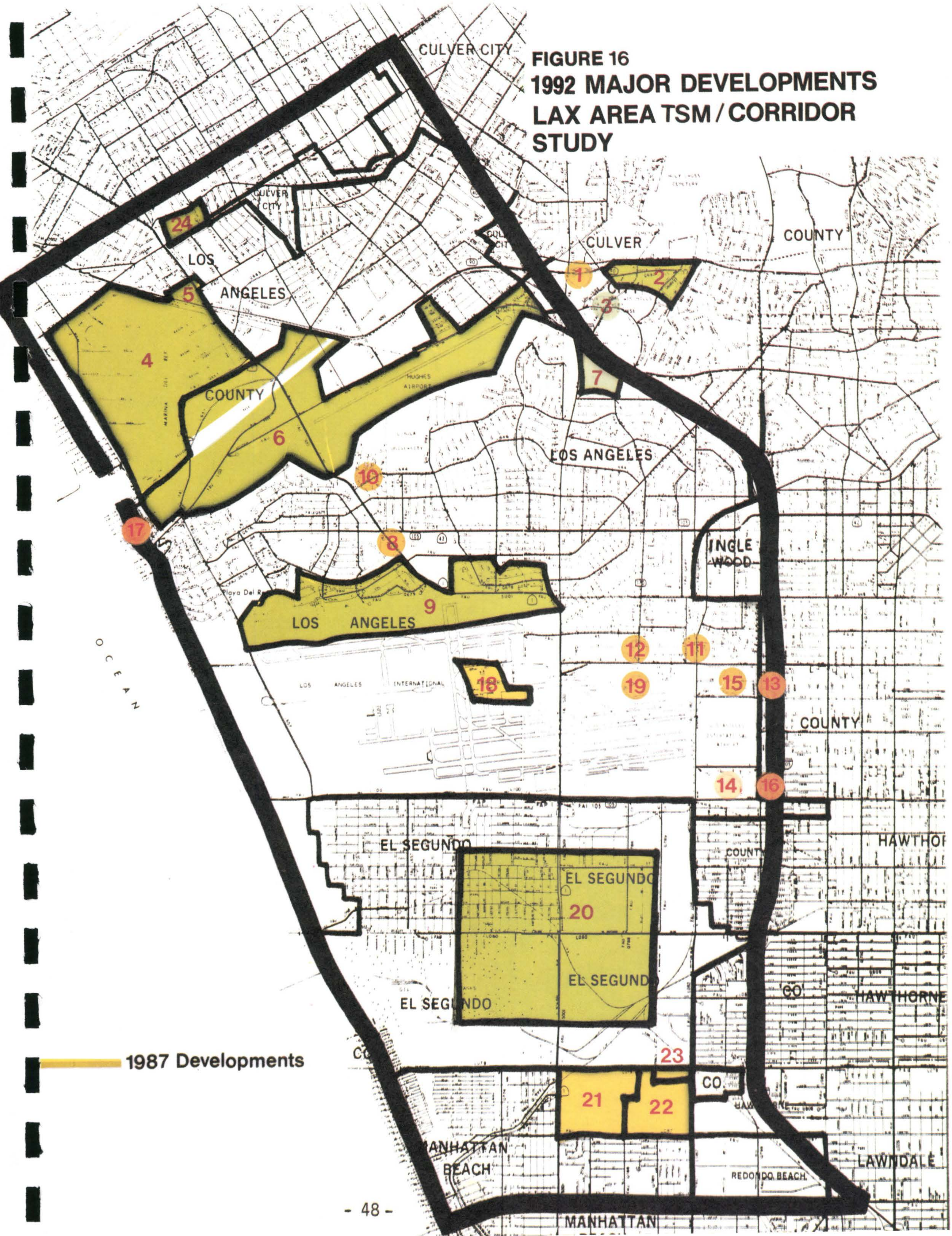


FIGURE 16
1992 MAJOR DEVELOPMENTS LAX AREA TSM / CORRIDOR STUDY



1987 Developments

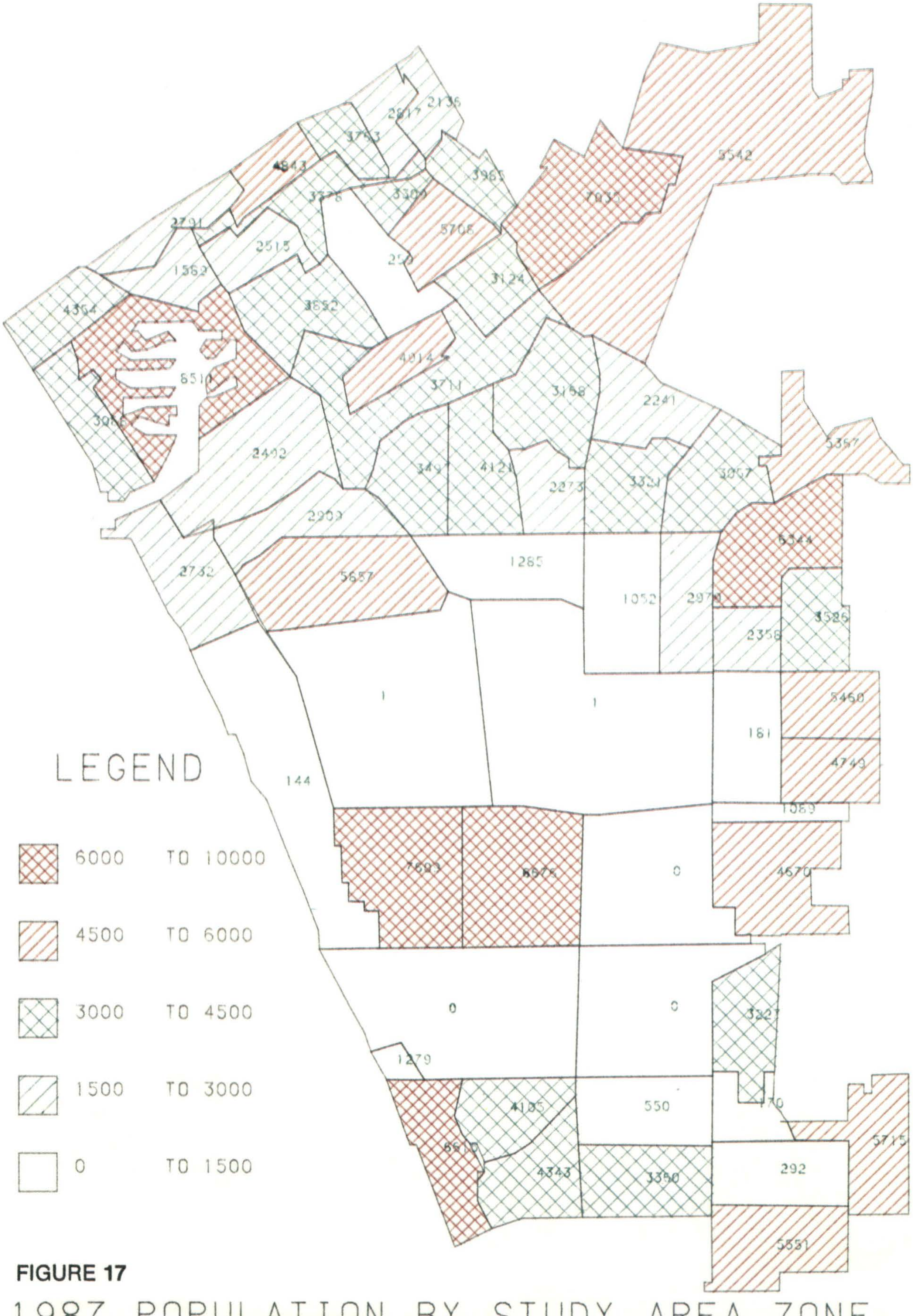


FIGURE 17

1987 POPULATION BY STUDY AREA ZONE

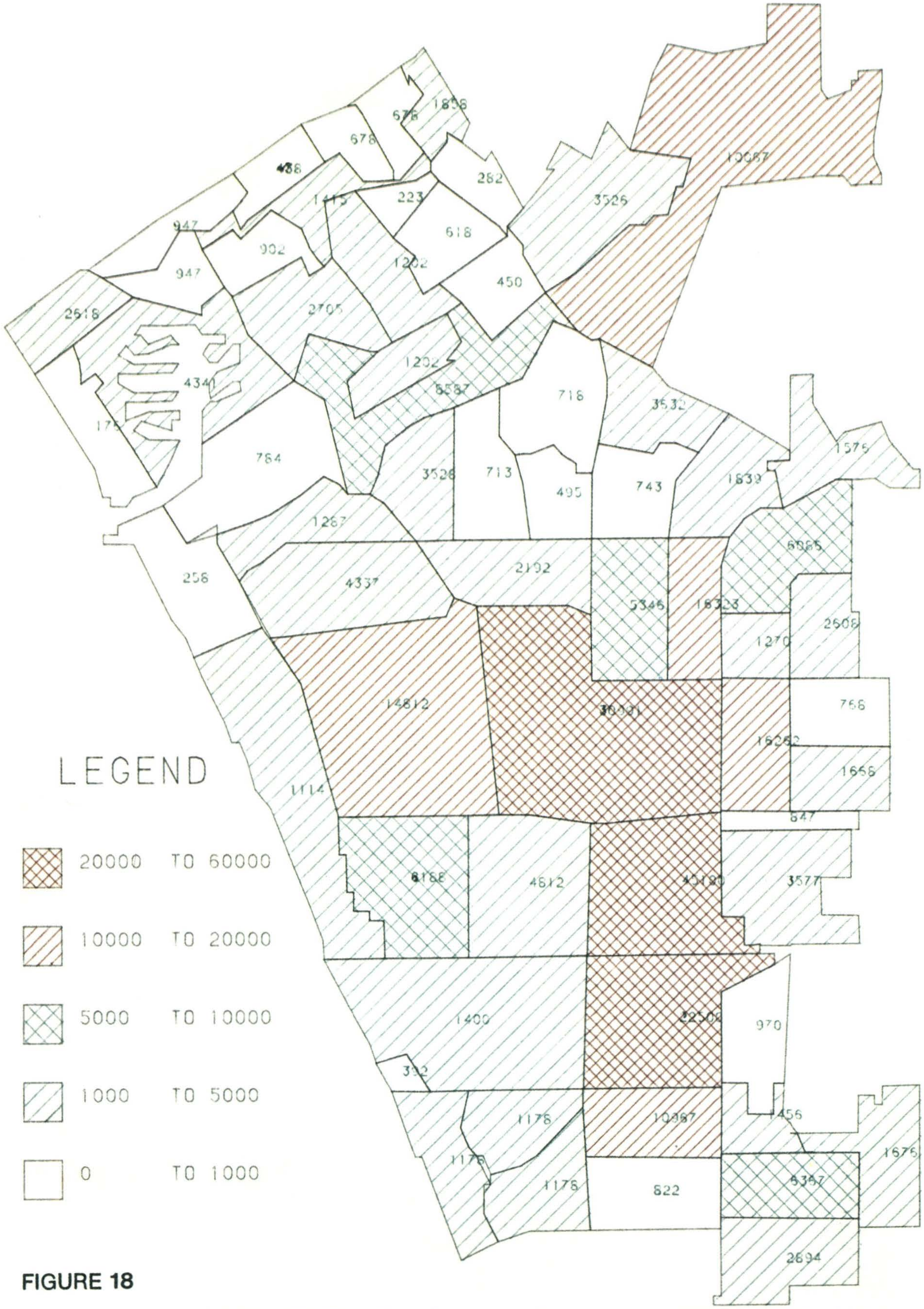


FIGURE 18

1987 EMPLOYMENT BY STUDY AREA ZONE

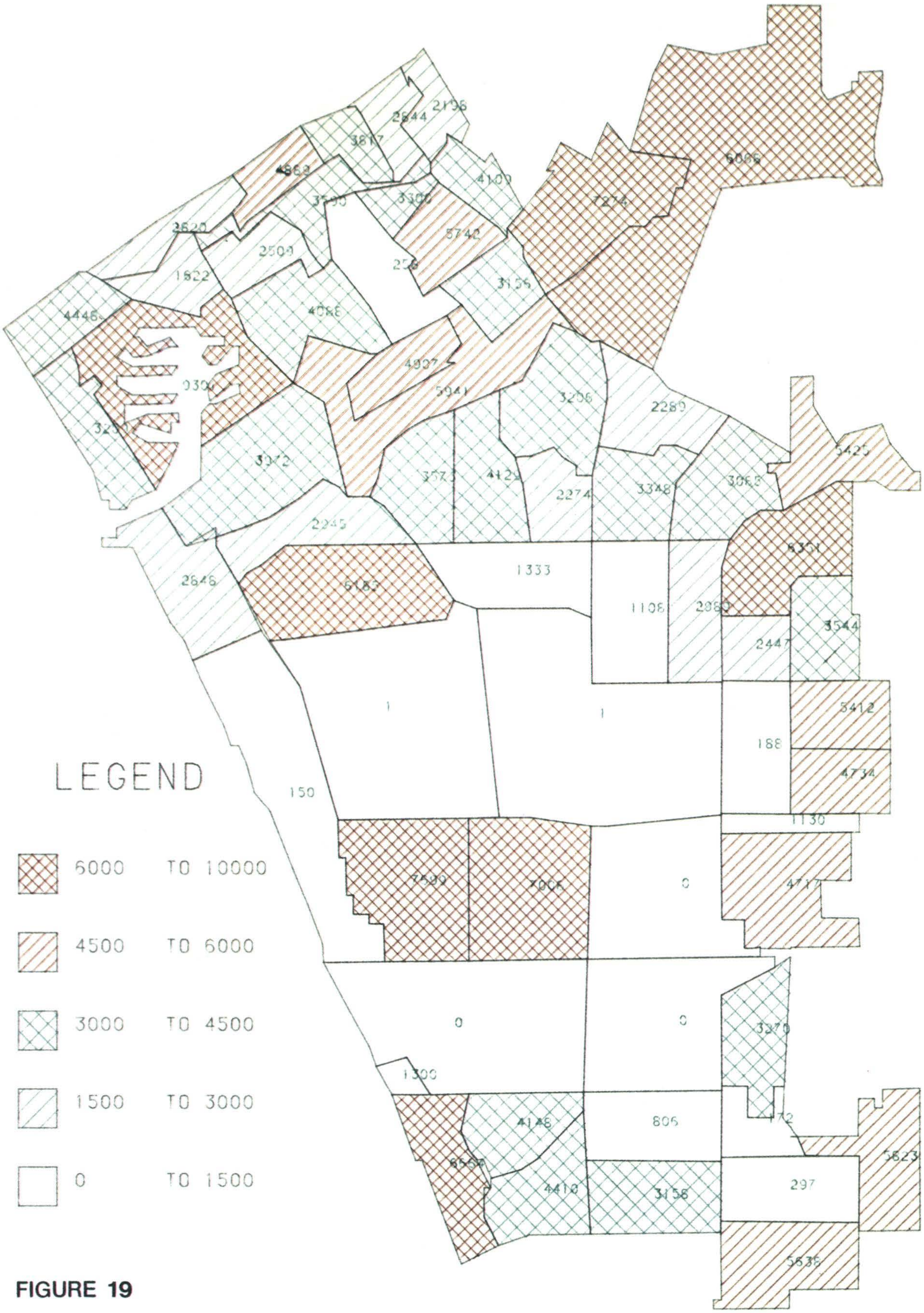


FIGURE 19

1992 POPULATION BY STUDY AREA ZONE

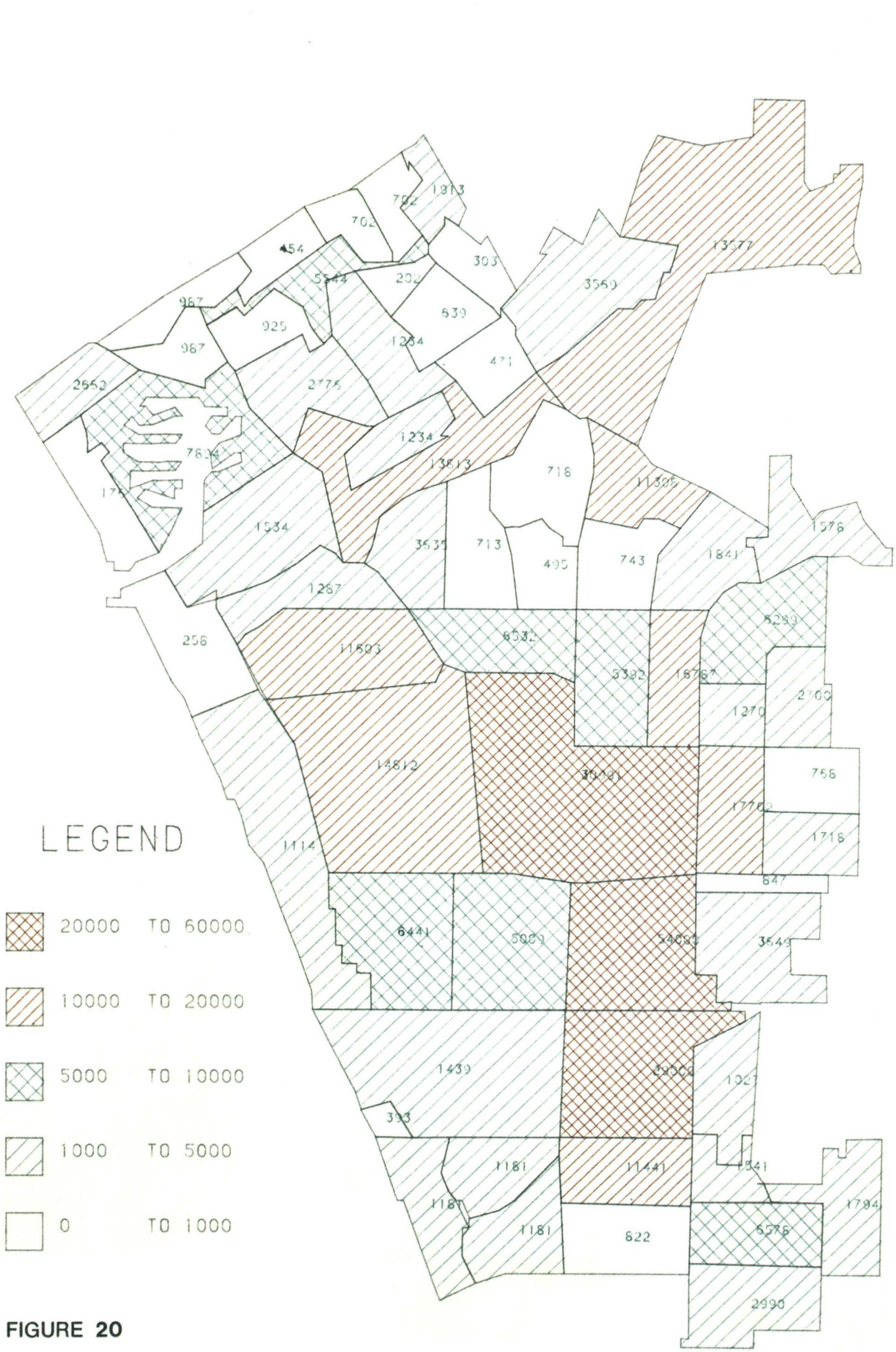


FIGURE 20

1992 EMPLOYMENT BY STUDY AREA ZONE

B. Proposed Improvements

The basic purpose of this section is to identify improvement projects that are responsive to both existing and future highway capacity deficiencies in the study area. The methodology employed was to develop packages of Transportation System Management (TSM), highway, transit (bus), and rail alternatives that mitigate both existing and future roadway capacity deficiencies.

1. Transportation System Management (TSM) Improvements

TSM expands the scope of traditional transportation planning to include strategies that will improve service and operation, and thus, increase mobility and the general efficiency of the system. TSM improvements are generally low-cost actions intended to either enhance vehicle flow or shift demand on the existing transportation facility. The major areas of TSM fall into categories of traffic engineering improvements and demand management improvements.

a. Traffic Engineering Improvements

Traffic engineering improvements are generally used to enhance the capacity of the transportation system and improve traffic flow. The improvements proposed in this analysis evolved from preceding studies in the area and from consultation with the traffic engineers and other interested parties in the jurisdictions located in the study area. The number of improvements developed for each arterial is directly related to both level of arterial deficiency and the options available for improvement of those deficiencies. The TSM improvements proposed were developed to meet the existing capacity deficiencies and can be implemented by 1987. These improvements are described in detail in Appendix C.

b. Demand Management Improvements

Demand management involves the implementation of those measures which encourage people to change their mode of travel or not to make a trip at all. The end result is that there is less demand being made on the transportation system. The intent of these measures is to move individuals away from driving their automobiles alone. Most of these measures are aimed at changing the number or mode of work trips because of the peaking of congestion related to rush hour work travel. Most work trips occur during the morning and evening peak periods, corresponding to the normal work hours. The transportation system thus must be designed to accommodate

peak loads. If this peak could be flattened and the system utilized more efficiently over the entire day, the need for new facilities would be lessened.

The following sections examine a number of these measures and describe some of the steps that might be taken to implement them. The measures include all forms of ridesharing, pricing incentives and disincentives, parking management schemes and telecommunications. Since implementation of these demand management strategies often requires new ordinances or zoning changes by local governments, the following sections merely describe the array of alternatives. Furthermore, the regional model (UTPS/-RTMS) employed in this study does not have the capability of directly evaluating the effect of demand management strategies on the study area network. Thus, the reduction of vehicle trips and its effect on congestion relief due to implementation of these strategies cannot be measured. However, the literature leads us to believe that if jurisdictions instituted these strategies, they could cumulatively reduce vehicle trips in the study area by about 15 percent.[2], [3], [4]

RIDESHARING

There are a number of measures which can be taken to increase the ridesharing mode share within the study area. The strategies for encouraging ridesharing vary from providing financial incentives and disincentives to providing facilities such as high occupancy vehicle (HOV) lanes. Since the most effective means of producing greater auto occupancy for work trips is by concentrating on organizing ridesharing by place of employment, the majority of the measures described are employer-based and hence require the cooperation of the private sector. These employer-directed strategies involve implementing the following actions:

Carpool and Vanpool Matching and Promotion: This consists of government action making it mandatory for employers with more than 100 employees (and voluntary for others) to provide in-house rideshare matching assistance, to promote ridesharing, to sponsor employer-based incentives, and to provide other ridesharing encourage-

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2 Transportation System Management: An Assessment of Impacts, Alan M. Voorhees, Inc., 1978.

3 South Bay Corridor Study Phase II, De Leuw, Cather & Company 1977.

4 Experiences In Transportation System Management, Transportation Research Board 81, November 1981.

ment activities. This action could require employers to provide:

- o All employees with written information regarding a carpool-vanpool matching service;

- o Employee transportation coordinators to publicize and encourage carpooling-vanpooling, update matchlists, introduce prospective ridesharers, and generally assist employees in forming and maintaining ridesharing arrangements.

<u>Financial Incentives for Ridesharers</u>: Financial incentives involve the payment by an employer of various kinds of direct or indirect subsidies to their employees to encourage ridesharing. Ridesharing subsidies may include:

- o An employer providing direct cash payments to all persons, either riders or drivers who rideshare with two or more people fifteen or more days each month; alternatively, the payment could be based on mileage traveled or graduated by the size of the pool;

- o Special fringe benefits such as accrual of a "bonus" vacation day for every 100 days worked in a carpool; and

- o Company discounts for various kinds of goods or services for which only carpoolers are eligible (those might involve no cost to the employer other than time spent making arrangements).

<u>Financial Incentives for Vanpoolers</u>: To stimulate the increased use of vanpools, companies or individuals purchasing vans for principal use as commuter vehicles could be given financial incentives such as:

- o Special investment tax credits and accelerated depreciation allowances;

- o Individual van owners could be given similar tax credits upon purchase and annual tax credits, based on the number of passenger-miles of commuter services provided.

TRANSIT PROMOTION AND INCENTIVES

There are a number of measures which can be taken to promote the use of transit within the study area. These measures vary from providing financial incentives to providing facilities such as high occupancy vehicle (HOV) lanes. The cooperation of the private sector and participation of private bus companies are needed to make these programs effective. These programs include the following:

- Provide all employees with written information regarding the transit system and services.
- Provide a single telephone number which can be dialed to obtain transit information on all service within the study area.
- Develop a unified information and advertising program for transit services within the study area.
- Provide easy intersystem transfer arrangements and improve transit services to provide more convenient, faster trips between a greater number of location within the study area.
- Provide financial incentives for bus users similar to those for ridesharing (e.g., subsidize bus passes).

MODIFIED WORK SCHEDULES AND FLEX-TIME

The first concept, of Modified Work Schedule (MWS), involves rescheduling the normal 40 hours, 5-day work week to a schedule that has longer hours per day and fewer work days per week. The actual number of work trips made would be decreased by the institution of either a 4/40 (10 hours 4 days a week) or 9/80 (80 hours over 9 days in a two-week period) work schedule. This strategy also could be used as an incentive for promoting ridesharing modes such as carpools, vanpools, and buses.

The second concept, flex-time would allow flexible work hours so that employees can come to work at staggering hours. The absolute number of trips would not be reduced by instituting staggering work hours but some peak hour work trips would be eliminated, thus alleviating demand on the transportation system. However, this strategy can be counterproductive for scheduled ridesharing modes.

INCREASED USE OF BICYCLES

The bicycle provides a mode of travel that not only reduces congestion but is both nonpolluting and energy efficient. This strategy involves implementing a program to promote bicycling within the study area. In order to do this a number of measures would need to be taken:

- Increased provision of bicycle facilities, such as racks or lockers at both places of employment and public transportation facilities.

- Training and education programs on safe bicycling practices need to be provided.

- Increased enforcement of bicycling and driving laws in order to provide a safer climate for bicycle use.

- Marketing programs to make the public aware of the bicycle as a viable means of transportation.

- Bicycling as a mode of transportation needs to be considered in the planning of new transportation facilities, such as the proposed light rail transit line.

TRAFFIC SIGNAL SYNCHRONIZATION

Traffic signals at high volume intersections should be modified to operate as part of an interconnected system of regulated signals. The synchronized system would have the capability to modify its cycle based upon traffic volumes. The traffic flow and energy impacts of traffic signal synchronization produce tangible and meaningful monetary benefits in reduced direct costs of vehicle operation. Further substantive benefits are reduced air pollutant emissions as a result of reduced stops and delays at traffic signals. The principal impacts of an interconnected traffic signal system are the following:

- Reduction in stops at traffic signals

- Reduction in delays at traffic signals

- Resulting overall reductions in

  -- total vehicle hours of travel
  -- fuel consumption
  -- hydrocarbon and carbon monoxide emissions

- Reduction in direct cost of operation due to reduced stops and idling time.

- Reductions in travelers time cost.

PARKING-RELATED STRATEGIES

A serious transportation problem involves free employee parking. The harm caused by free parking is not the overuse of parking itself, but rather the increased driving it causes. Our research indicates that for many commuters the price of parking is a key variable in the mode choice decision for work trips. The studies consistently demonstrate that the offer of free parking at work increases the share of commuters who drive to work alone. There are several parking related strategies developed here to discourage the drive-alone mode and thereby to promote ridesharing and to encourage transit usage. These strategies might include:

1. Preferential parking for ridesharers
2. Amendment of parking requirement in local zoning ordinance
3. Elimination of free employee parking
4. Residential parking permit program
5. Increase in the cost of commercial parking
6. Removal of on-street parking
7. Stricter enforcement of on-street parking codes

1. Preferential Parking for Ridesharers

This policy involves giving carpoolers a preferential parking privilege at their place of work. A variety of techniques has been used to enhance the convenience of parking for carpoolers and in some instances to produce significant traveling and cost savings. Techniques include:

- Give guaranteed space to carpoolers or set up a priority system for issuing parking permits.

- In large lots, assign the closest, most convenient spaces to carpoolers.

- If inside spaces are available, assign as many as possible to carpoolers.

Preferential parking is an incentive that can be implemented voluntarily by a wide range of employers. It is truly a low-cost, immediate action strategy. The employer is required to set up the program and to administer the preferential scheme. The cost of administration and enforcement is nominal and technically simple.

2. Amendment of Parking Requirements in Local Zoning Ordinances

Amendment of local zoning laws to reduce the number of off-street parking spaces that are required for new land uses will reduce the supply of parking, and will cause the remaining spaces to be more expensive and less conveniently located. Auto travel costs and travel will increase, thereby inducing auto travelers to shift to high occupancy vehicles or nonmotorized modes. Amendment of parking requirements offers a positive cost advantage to existing parking operators in that a general scarcity of spaces increases the value of each space. Building operators and owners would also benefit. Under a strategy that merely repeals existing mandatory requirements, developers would be free to provide parking in response to market demands.

In order to discourage auto usage, current local parking requirements should be modified. One way of modifying current ordinances would be to set an upper limit on the number of spaces that are allowed for various land uses. The limit should reflect average rather than peak demand. A certain percentage could be required for carpools. The limitation need not be uniform for all buildings. For example, a set of standards could be devised that allowed little or no parking for a building in an area well-served by transit, and adequate parking in areas without any transit. Another possible innovation would be to require developers and building owners to pay an amount equal to the cost of an off-street parking facility, which could then be used for investment in transit, incentives for nonmotorized modes (e.g. bicycle racks), or other measures to promote alternatives to the auto.

3. Elimination of Free Employee Parking

The purpose of this strategy is to eliminate all free and subsidized employee parking by requiring employees to pay prevailing commercial parking rates. Employers should also be encouraged to assist employees in switching from low-occupancy autos to nonmotorized or high-occupancy vehicle modes. Free employee parking typically accounts for approximately 75% of the off-street parking supply. In addition to free spaces, many employee spaces are often subsidized. Such subsidies put the cost of employee parking substantially below commercial rates. It can also be assumed that many employees who pay subsidized parking are fully reimbursed by their employers.

The current practice of providing free parking should be substituted with the practice of charging prevailing commercial rates plus any parking taxes. In order to be most effective, existing facilities should be included in such an effort. A taxing approach is one alternative for eliminating free parking. For example, a tax could be imposed on the employer who provides free spaces to employees with the hope that the employer passes this added cost on to his employees. Government agencies can implement this measure by administrative rule. In order to enact this measure in the private sector, the local government would need to pass an ordinance setting forth a regulatory scheme. To gain control of future private parking facilities, building or use permits could be withheld until the owner of the facility agreed to adhere to government-imposed commercial daily rates. An amendment to the existing zoning ordinance that requires the issuance of use permits would be necessary.

4. Residential Parking Permit Program

Residential permit programs limit the time nonresidents can park in designated neighborhoods during work hours. Residents of participating neighborhoods receive a sticker exempting them from the time limitation. Such a program prevents residential neighborhoods from being subject to commuting spillover parking. Parking in residential areas is attractive to commuters because it is free and therefore allows them to avoid the costs of commercial facilities. However, commuters often contribute to increased congestion and noise in residential neighborhoods. Residential parking permit programs can be enacted as a zoning or parking ordinance. The ordinance should specify such benefits of the program as reducing congestion and air pollution. The ordinance should also state the procedures for granting and revoking permits, as well as exemptions and penalty procedures. The ordinance should include the following important considerations:

- o Standards for determining whether a neighborhood is eligible for a permit program.
- o Procedures for including a neighborhood in the program.
- o Treatment of visitor parking and other exemptions.
- o Procedures for issuing permits.
- o Requirement for posting signs.
- o Penalties for violations.

Although this measure only affects a small percentage of total commuter parking, it has the advantage that it has an identifiable support group, the residents. Commercial parking operators may also support this measure if they perceive it as increasing the cost of parking at commercial facilities.

5. Increase in the Cost of Commercial Parking

The purpose of increasing commercial parking costs through taxation is to increase the cost of auto travel, thereby causing auto driving to shift to transit, ridesharing, and other nonmotorized modes. Commercial parking includes all parking spaces for which a fee is charged.

The current level of parking prices can be raised through taxes in two ways. First, existing taxes and fees can be increased. This method indirectly raises parking prices by increasing the cost of operating a facility. A second approach is a direct tax imposed on the parking facility patron. This tax can be levied either as a percentage of the current rate or as a flat surcharge. While a percentage tax of even 8% to 10% has some effect on travel choice, a significant shift from solo occupant autos will not occur until the rate reaches 50%. The tax burden can be varied geographically with spaces in some parts of the study area taxed more heavily than those in other parts. For example, parking facilities in the employment and activity centers will require greater absolute prices to affect travel choice than less centrally located facilities. Parking taxes can also be designed to affect only a limited target group. For example, to discourage commuters, the tax could be imposed only on patrons who park in facilities before 10 a.m. Municipalities which have been given the power to tax may impose a parking tax. A parking tax can be implemented either by including parking costs within the scope of the existing sales tax, or by levying a special tax directly on parking.

The cost of operating a parking facility includes property and business taxes and license and permit fees. By contributing to the cost of parking, current taxes influence the price of parking, which can be used to fund alternative modes. Another advantage is that parking taxes can be imposed in stages to coincide with improvements in alternative transportation modes.

6. Removal of On-street Parking

On-street or curb parking reduces the capacity of streets for the movement of autos and transit vehicles. Where curbside parking is completely eliminated, an additional lane is made available. In addition, since curb-side parking for short-term parkers in the study area is much less expensive than off-street lots and garages, many drivers circle a block repeatedly to await an available curb space, rather than going directly to an off-street parking location. This, of course, adds to congestion. The removal of on-street parking within employment and activity centers can increase traffic flow and add to capacity.

7. Stricter Enforcement of On-street Parking Codes

One vehicle parked illegally in a no-parking zone can have a dramatically adverse effect upon the flow of traffic. By blocking movement in a lane it can reduce the carrying capacity of the street by one-fourth or more. The most effective way to reduce the incidence of parking violations is to increase the probability of a traffic citation. Thus, the implementation of this measure would increase traffic flows and add capacity within centers.

TELECOMMUNICATIONS

This strategy involves the use of telecommunications technology to substitute for travel. The need for travel very often derives simply from the need to communicate some kind of information, such as data, ideas, or formal documents. With the use of telecommunications, it is becoming increasingly easy to accurately and cost-effectively transport the information directly, without transporting the person as well. While there are a number of different kinds of trips well suited to telecommunications substitution (the interregional business trip; local work-related travel including the commute; some shopping, banking, and entertainment trips; education trips); work trips represent the greatest potential for travel reduction because of their predominance in total trip-making, regularity, and peaking characteristics.

People whose jobs now involve or could involve telecommunications technology such as computer operators and word processors will often be able to work at home, avoiding a trip during peak hours. Working at home is also an option for many others whose jobs may not directly involve telecommunications devices (except possibly the telephone)--jobs containing such elements as keypunching, typing, other clerical work, thinking, writing, and research. Work-at-home may be full-time, or more commonly, could be one or a few days a week on average, with trips being made to the office on the other days. It could even mean simply working at home for two hours in the morning and then driving to work, thereby shifting the trip to off-peak hours.

Another alternative which has received some attention is the concept of neighborhood work centers, in which jobs using telecommunications technology are performed in small centers located close to residential areas rather than in a central business district. The center may be a satellite of a single large corporation, or it may lease facilities to a number of organizations. Again, an employee may work at the neighborhood center full time, or split time in some combination among home, neighborhood center, and main office.

The use of teleconferencing technology (from the well-known telephone conference call, right on up through full-motion videoconferencing, and including computer conferencing, or "electronic mail") can reduce work-related travel during the day. While by definition not as heavy as peak-period commute travel, off-peak trips can still result in congestion, and teleconferencing can perhaps lead to a noticeably improved midday level of service.

The study area (and in general, the entire South Bay Area), is in some ways ideally suited to large scale telecommunications substitution, due to its heavy concentration of aerospace, electronics, and other "high-tech" employment. Those kinds of employees use computers extensively on the job, are likely to have personal computers at home (often through purchase discounts provided by their employer), and often use their own or the company's computer terminal to work at home on evenings and weekends. Thus, the initial barriers of (lack of) computer literacy and enabling the remote terminal microcomputer to communicate with the mainframe computer have largely been overcome in the study area.

The role of the private sector in encouraging teleworking is obvious. As for the public sector, local governments can promote teleworking by:

- visibly telecommuting themselves;
- establishing it as an official policy and then "marketing" the concept;
- providing incentives to employers to encourage telecommuting, such as tax breaks, or a reduction in parking requirements (as is now done in many places for employers who establish ridesharing programs).

While it may seem counterproductive for a city to encourage people not to work there, it should be remembered that it is the "overdesirability" of the location that leads to such a need. If the city is to remain desirable, it must take some steps to lessen the demand for travel within and around it. And to the extent that it is successful in remaining desirable, it need not fear loss of revenue; as many people will continue to live and/or work there as can comfortably do so. In fact, demand-reduction techniques such as teleworking allow more people to work there comfortably than would otherwise be possible.

2. Highway Improvements

The highway improvement projects attempt to eliminate primary capacity deficiencies for corridors and for individual arterials where appropriate. These highway improvements also strive to develop continuity of arterial cross sections, completion of missing sections of arterial routes and construction of new arterial routes, as well as improving access to established or developing areas. Again, the number of improvements proposed for each arterial is directly related to both the level of the deficiency and the options available for improvement of these deficiencies. These improvements were developed to meet existing deficiencies as well as those projected by the year 1987 and 1992. Two general categories of improvements are recommended:

- Widening of facilities in order to provide increased numbers of traffic lanes.

- Constructing an arterial segment that presently does not exist to complete portions of the existing network and to provide access to new developments.

The major proposed highway improvements are described in detail in Appendix D.

3. Bus Transit

As described in Section II-E, both public transit and private transit (airport buses and subscription bus service for work trips) are important components of existing transportation facilities in the study area. Future public bus service, however, will be affected by the loss of the Proposition A-funded fare subsidy in 1985. The probable result of the fare increase will be a decline in ridership and possibly a corresponding reduction in service. Thus, it was felt that enhancing the existing public bus service was not a reasonable alternative to propose for addressing future deficiencies in the study area. For the purposes of this study, it was assumed that public bus fares and level of service remained constant throughout the analysis time period (1980-1992). Therefore, public bus ridership predicted for 1987 and 1992 should be viewed as the "best case".

In terms of expanding bus transit service, then, attention was focused primarily on the private sector. In examining transportation deficiencies for 1987 and 1992, an effort was made to identify origin-destination pairs which had a significant unserved transit demand. Such pairs would suggest new routes or extensions of the old ones to meet that demand. No such origin-destination pairs were found, however, indicating that future demand patterns for trips with at least one end in the study area will not differ significantly geographically from current patterns.

Since no new routes or extensions were necessary, future private bus service to the study area was enhanced by doubling the frequency of all existing private buses. This transit alternative was the same for 1987 and for 1992. However, it should be cautioned that the modeling process does not handle the special characteristics of subscription and airport bus services very well. Accordingly, the subscription and airport bus ridership figures produced by the model should be interpreted with care and should perhaps be accepted more as qualitative indicators of change rather than strictly quantitative.

4. Rail Transit

Interest in light rail transit in the study area had been building before this study began, focusing on the 4.5 mile abandoned Atchison, Topeka, and Santa Fe (ATSF) line from El Segundo to Redondo Beach (see Figure 7 of Section II-G). The El Segundo Employers Association completed a preliminary feasibility study for the so-called South Bay Trolley in March, 1982. Subsequently, the LAX Area TSM/Corridor Study requested the California Department of Transportation (Caltrans) to do an engineering feasibility study for a light rail line including the ATSF abandoned right-of-way, and then extending north to Lincoln Boulevard at Route 90 (Figure 21). This study was completed in June, 1983. Finally, the Los Angeles County Transportation Commission (LACTC) studied four rail lines (three light, one heavy) in the "West Los Angeles/South Bay Corridor". One of these lines studied is identical to the alignment of the Caltrans study. Stage II of LACTC's Rail Patronage Analysis Study was completed in October, 1983.

For the purposes of this study, two light rail alignments were analyzed, differing only from Rosecrans Avenue south. The first is the alignment of the Caltrans feasibility study, referred to here as the "Redondo line". The second is the LACTC- and locally-preferred (unanimously approved by all 15 South Bay Cities) alternative of the LACTC study, referred to here as the "Hawthorne line." This line, identical to the Redondo line from Lincoln Boulevard to Rosecrans Avenue, proceeds southeast from Rosecrans Avenue at Aviation Boulevard in the ATSF right-of-way to Hawthorne Boulevard, and continues in the Hawthorne Boulevard median to Pacific Coast Highway. Both routes are shown in Figure 21. As for operating characteristics, the LACTC study assumed single-car trains operating every six minutes; this assumption was replicated in the present study.

C. Multimodal Packages

In Section B above, four categories of proposed transportation improvements were discussed: TSM, highway, bus transit, and rail transit. In modeling the transportation system scenarios for 1987 and 1992, the alternatives in these categories were sequentially added to the system to result in multimodal packages of transportation alternatives. The 10 model runs which were performed are summarized in Table 10; they are described in more detail below. As mentioned above (Section B.1.b), not all of the TSM and highway alternatives listed above will be explicitly modeled in the UTPS process. Some alternatives (such as Demand Management Improvements and intersection widenings) cannot be physically accommodated by the model; others (such as relocating an on-off ramp) would

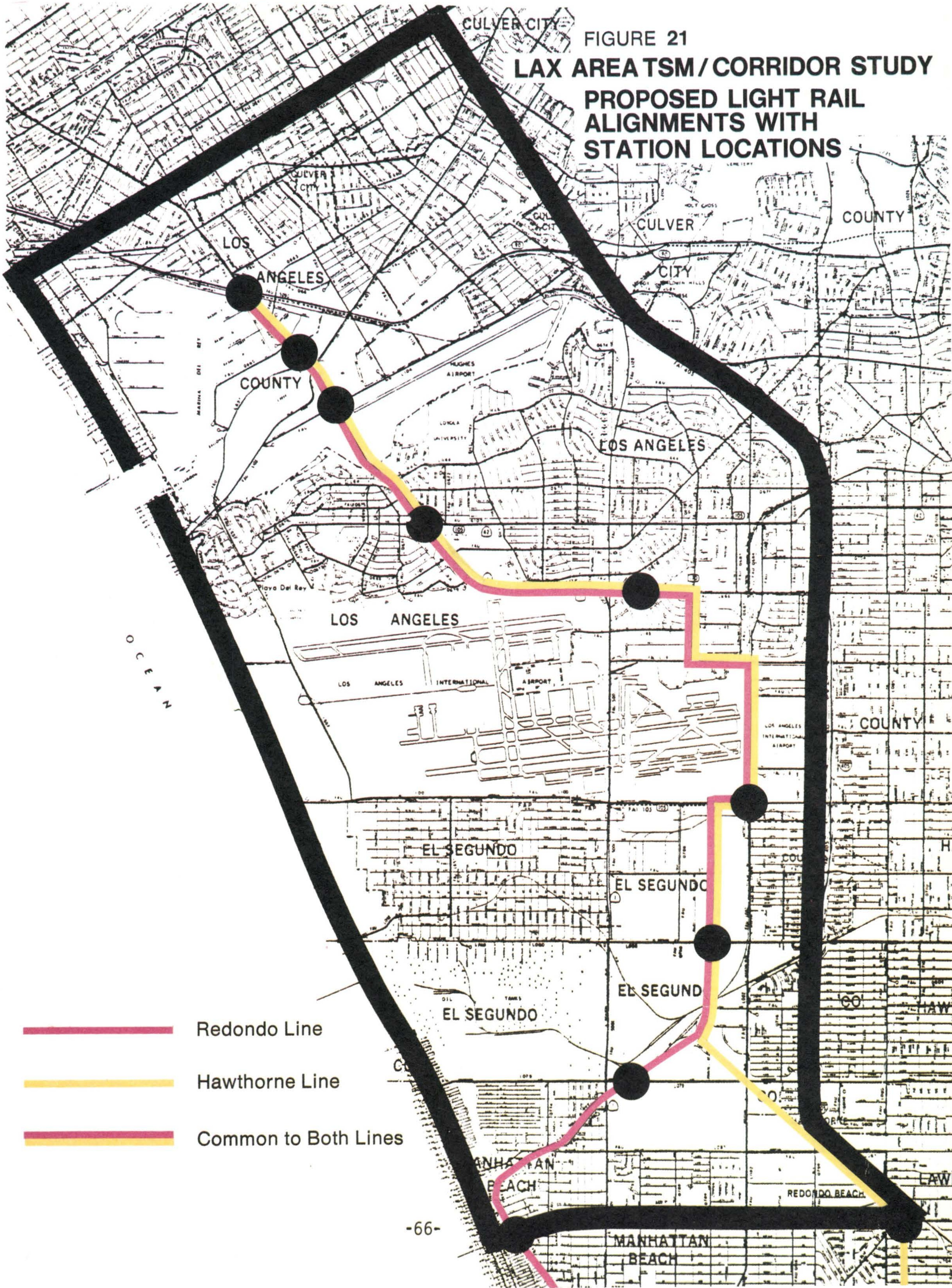


FIGURE 21
LAX AREA TSM / CORRIDOR STUDY
PROPOSED LIGHT RAIL ALIGNMENTS WITH STATION LOCATIONS

TABLE 10

LAX Area Corridor Study

Computer Model Runs

1. 1980 Demand with 1980 System (base case)
2. 1987 Demand with 1987 System*
3. 1987 Demand with 1987 System + TSM/Highway
4. 1987 Demand with 1987 System + TSM/Highway + Bus
5. 1992 Demand with 1992 System**
6. 1992 Demand with 1992 System + TSM/Highway
7. 1992 Demand with 1992 System + TSM/Highway + Bus
8. 1992 Demand with 1992 System + TSM/Highway + Bus + Rail (Hawthorne Line)
9. 1992 Demand with 1992 System + TSM/Highway + Bus + Rail (Redondo Line)
10. 1992 Demand with 1992 System + TSM/Highway + Bus + Rail (Hawthorne Line + Redondo Line)

* 1987 system includes 1980 system + study area improvements noted in the text.

** 1992 system is the 1995 RTP system + study area improvements noted in the text.

make only a negligible difference at the level of detail at which the model is operating. Thus, the below description of each transportation scenario contains a list of exactly what TSM/highway improvements are included in that scenario.

1980 DEMAND

1. With existing (1980) highway and transit system

1987 DEMAND

2. With base (1987) highway and transit systems

   -- due to funding constraints for public bus service, the 1987 base transit network is identical to the 1980 transit network

   -- the 1987 base highway network is the 1980 network plus those improvements which are highly probable to be in place by 1987. Those improvements are (the numbers in parentheses correspond to Figure 22):

      o Bay Street/Jefferson Boulevard to Hughes Way (3): Extend as a 4-lane roadway.

      o Sepulveda/Playa Street to Sawtelle Boulevard (6): Add one through lane each direction (making six) by widening, parking prohibitions (west side only), and restriping.

      o Hughes Way/Lincoln Boulevard to (extended) Centinela Avenue (9): Improve and widen to 4-lanes.

      o Centinela Avenue/Jefferson Boulevard to Mesmer Street (10): Extend as a 4-lane roadway south-east to rejoin old Centinela Avenue at Mesmer Street.

      o Westchester Parkway/Pershing Drive to Sepulveda Boulevard (12): Construct a new 4-lane roadway intersecting Sepulveda at Will Rogers.

      o La Tijera Boulevard/88th Street to Westchester Parkway (13): Extend as a 4-to-6 lane roadway, with left turns from northbound (new) La Tijera Boulevard to westbound 88th Street prohibited.

      o Imperial Highway/Hughes Way to La Cienega Boulevard (16): Add one eastbound lane (reversible lane) by removing the asphalt median and restriping (1987 only).

- Continental Avenue/El Segundo Boulevard to Mariposa Avenue at Airport Street (17): Extend to provide 6-lane capacity.

- Sepulveda Boulevard/El Segundo Boulevard to Rosecrans Avenue (18): Add one through lane each direction (making eight) by widening.

- El Segundo Boulevard/Aviation Boulevard to I-405 southbound on-ramp (19): Add one eastbound lane (widening and restriping)

3. With 1987 base and TSM/highway alternatives

-- TSM/highway alternatives are those which appear at this time to be less likely (but still possible) to be in place by 1987, either because of their cost, their controversial status, or the magnitude of the perceived need for them. Those improvements are:

  - Lincoln Boulevard/Venice Boulevard to Sepulveda Boulevard (1): Provide a consistent 6-lane capacity. Requires minor widening from Fiji Way to Jefferson Boulevard, parking restrictions from 83rd Street to Manchester Avenue, and addition of one through lane each direction from Manchester Avenue to Sepulveda Boulevard.

  - Admiralty Way/Fiji Way to Culver Boulevard (2): Extend as a 4-lane divided roadway.

  - Bay Street/Culver Boulevard to Jefferson Boulevard (3): Extend as a 4-lane roadway, including a bridge over Ballona Creek.

  - Culver Boulevard/Marina Freeway to Sepulveda Boulevard (4): Improve to a consistent 4-lane section plus turning lanes; requires peak-hour parking restrictions in some sections.

  - Jefferson Boulevard/Centinela Avenue to Inglewood Boulevard (5): Restrict peak-hour parking to achieve full 6-lanes.

  - Culver Boulevard/(extended) Falmouth Avenue to Marina Freeway (7): Realign and widen from 4-lanes to a 6-lane divided section.

  - Falmouth Avenue/Culver Boulevard to Manchester Avenue (8): Extend north as a 4-lane section.

  - I-405/I-10 TO I-110 (11): Restripe to add another lane in each direction.

- o Sepulveda Boulevard/96th Street to Lincoln Boulevard (14): Add one northbound lane (making five).

- o Aviation Boulevard/Arbor Vitae Street to Manchester Avenue (15): Restrict peak period parking (6:30-9 a.m., 3:00-6:30 p.m.).

- o Sepulveda Boulevard/Rosecrans Avenue to Valley Drive (18): Add one through lane each direction (to make eight) by widening.

4. With 1987 base plus TSM/highway plus bus alternatives

   -- the bus alternative consists of doubling the frequency of service for private sector (airport and subscription) bus in the study area.

1992 DEMAND

5. With base (1992) highway and transit systems

   -- for the study area, the 1992 base transit system will be identical with the 1980 system, except for the addition of the I-105 transitway. Outside the study area, the base network includes the LA-Long Beach rail transit line.

   -- the 1992 base highway system is the 1987 base highway network plus those improvements which are highly probable to be in place by 1992. Those improvements include (the numbers in parentheses correspond to Figure 23):

     - o Aviation Boulevard/Imperial Highway to (N. of) El Segundo Boulevard (18): Add a through lane in each direction (total of six).

     - o El Segundo Boulevard/(E. of) Sepulveda Boulevard to (W. of) Aviation Boulevard (20): Add one eastbound lane (widening and restriping).

     - o Douglas Street/Alaska Street to Park Place (21): Connect over the railroad tracks to make a continuous (6-lane) route from Imperial Highway to Rosecrans Avenue.

     - o Aviation Boulevard/(S. of) El Segundo Boulevard to Rosecrans Avenue (22): Add through lane each direction (total of six).

- I-105 (virtually complete by 1992) (25)

In addition, improvements (2), (3), (8), and (11) of the 1987 base plus TSM/highway model run are included in the 1992 base highway system as alternatives (3), (4), (12), and (11), respectively, in Figure 23.

6. With 1992 base plus TSM/highway alternatives

-- TSM/highway alternatives include the 1987 TSM/highway alternatives not already incorporated into the 1992 base network, plus the following:

  - Marina Freeway/Lincoln Boulevard to Washington Street (2): Extend as a 4-lane arterial in the abandoned railroad right-of-way.

  - Falmouth Avenue/Manchester Avenue to (new) Westchester Parkway (13): Extend south as a 4-lane section.

  - Airport Street/Maple Avenue to Imperial Highway (17): Extend north as 4-lane roadway to provide through route from Imperial Highway to El Segundo Boulevard.

  - Redondo Avenue/Rosecrans Avenue to Marine Avenue (23): Provide through 6-lane capacity.

  - Hindry Avenue/Rosecrans Avenue to Compton Avenue (24): 147th Street/Aviation Boulevard to Ocean Gate: Widen and extend Hindry Avenue southeast to meet Freeman at Compton Avenue, with four through lanes plus parking. Widen (to four lanes) and extend 147th west to Aviation (under ATSF tracks), and east (with a jog at Hindry) under I-405 to Ocean Gate in existing railroad right-of-way.

7. With 1992 base plus TSM/highway plus bus alternatives

-- the 1992 bus alternative is identical to the 1987 bus alternative.

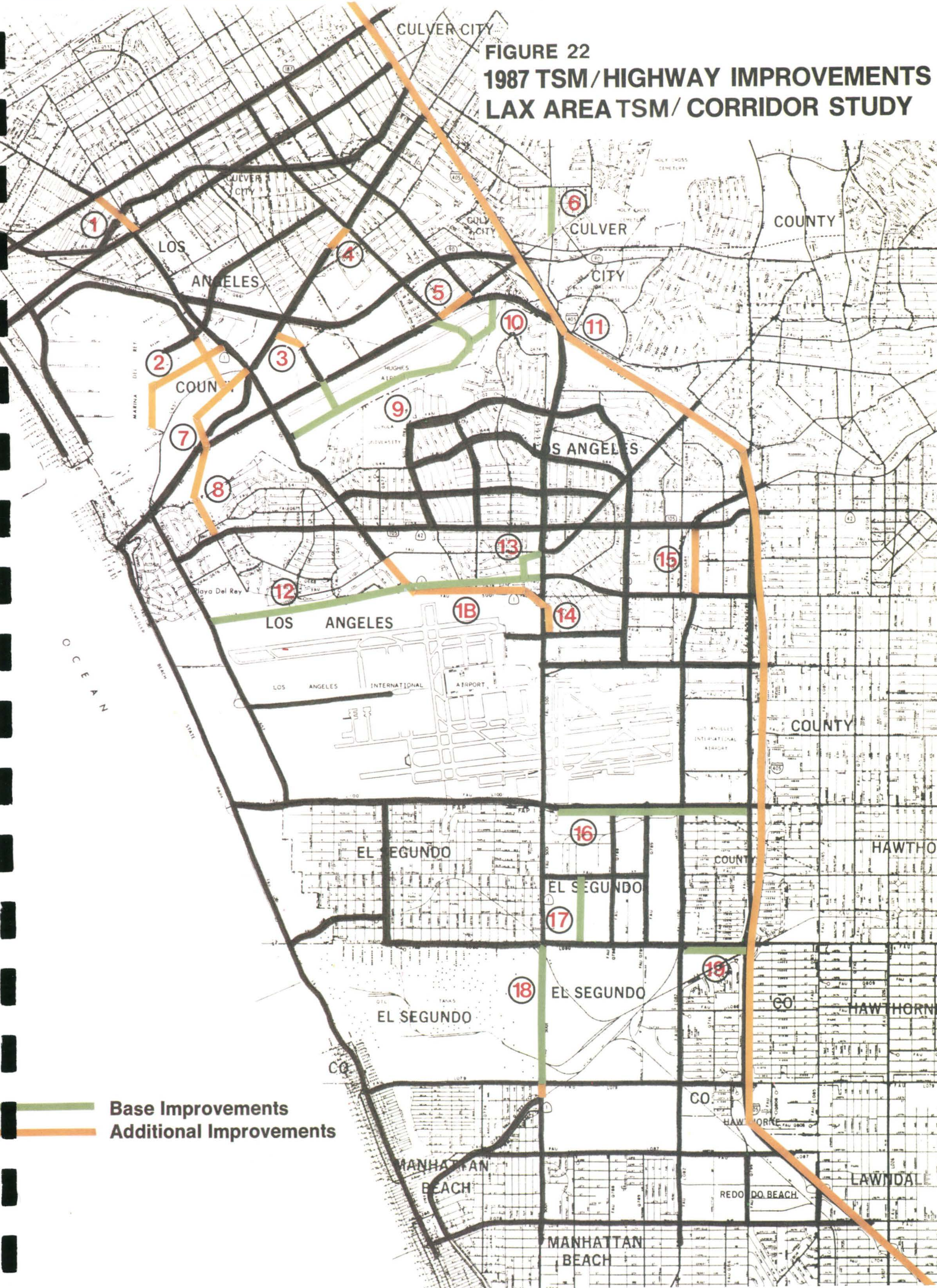
8. With 1992 base plus TSM/highway plus bus plus rail (Hawthorne line)

9. With 1992 base plus TSM/highway plus bus plus rail (Redondo line)

10. With 1992 base plus TSM/highway plus bus plus rail (Hawthorne plus Redondo lines)

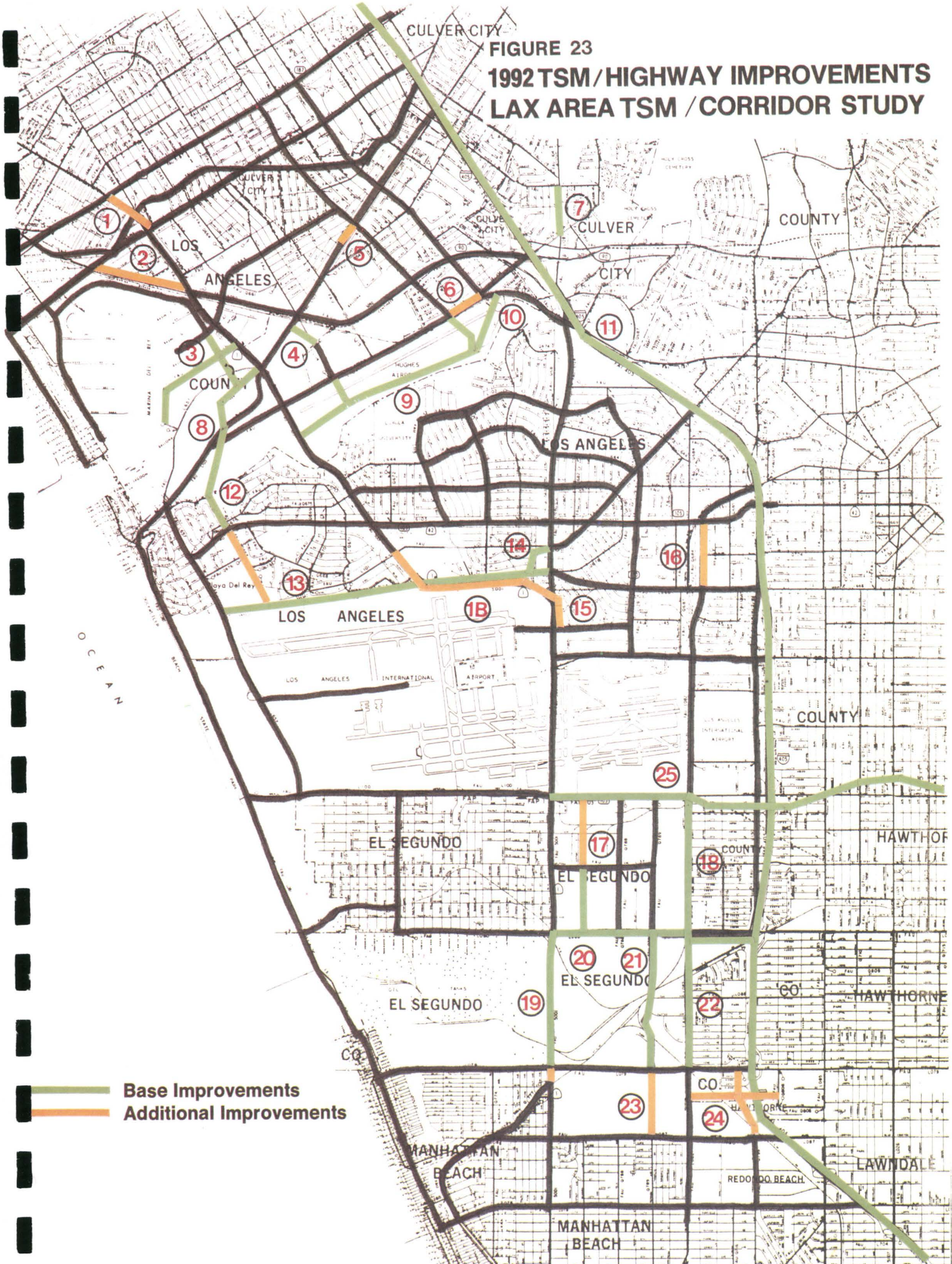
-- the Hawthorne line in #8 will be treated as the main line, with the Redondo leg south of Rosecrans treated as a branch feeder.

FIGURE 22
1987 TSM/HIGHWAY IMPROVEMENTS
LAX AREA TSM/ CORRIDOR STUDY



Base Improvements
Additional Improvements

FIGURE 23
1992 TSM / HIGHWAY IMPROVEMENTS
LAX AREA TSM / CORRIDOR STUDY



V. FUTURE TRAFFIC VOLUMES (1987 AND 1992) AND CAPACITY DEFICIENCIES

A. 1987 Transportation Characteristics

1. Trip Generation

Tables 11 and 12 compare 1987 trip productions and trip attractions of the study area, Los Angeles County, and the SCAG region, for total trips and HBW trips, respectively. Focusing first on Table 11, for total trips, it can be seen that the study area accounts for 3.3% of Los Angeles County trip productions and 2.1% of SCAG region trip productions. For trip attractions the percentages are 4.6 and 3.0, respectively. Comparison to the corresponding figures for 1980 (Section III. B.1) indicates that the study area is growing slightly faster than the county and region as a whole. Study area trip attractions are growing faster than trip productions, as evidenced by the fact that trip attractions in 1987 are 42% higher than trip productions, compared to 18% for 1980. This is logical since most of the growth in the study area is employment-related rather than population-related. Similarly, a direct comparison of study area trip productions and trip attractions between 1980 and 1987 shows that trip productions increase 14.4% while trip attractions increase 37.5%.

These conclusions are even more forceful when HBW trips only (Table 12) are examined. For example, HBW trip attractions increase 46.6% between 1980 and 1987, and 1987 HBW attractions exceed productions by 135.5%.

2. Trip Distribution

While the previous section demonstrates that the absolute number of trips generated by the study area increases from 1980 to 1987, it remains to be seen whether the pattern of trip distribution changes. Trip distribution changes will be a consequence of shifts in population and employment throughout the region, as well as changes in the accessibility of the study area to other parts of the region. For example, if population in Orange County increases proportionally more than in the rest of the region, then (all other things being equal) we would expect a greater percentage of the trips attracted to the study area to be produced in Orange County. Similarly, if the study area becomes significantly easier to get to from some places than before (as could be the case with the construction of I-105), then (again, other things being equal) the model will distribute proportionally more trips to the study area from those places than before.

TABLE 11

1987 24-Hour Trip Productions and Trip Attractions--All Trip Types

	Productions	Attractions
Study Area	897,822	1,276,174
Los Angeles County	27,337,503	27,889,962
SCAG Region	43,101,583	43,101,583

TABLE 12

1987 24-hour Trip Productions and Trip Attractions--HBW Trips

	Productions	Attractions
Study area	146,470	344,953
Los Angeles County	4,889,661	5,340,026
SCAG region	7,811,684	7,811,684

Figures 24 and 25 present the trip distributions of total 1987 study area trip productions and trip attractions, respectively. Comparison of Figures 10 and 24, reveals that a higher proportion of the productions remain in the study area for 1987 than for 1980 (43% versus 36%), while the rest of Los Angeles County attracts a lower proportion. However, Los Angeles County as a whole still attracts over 99% of the trips produced by the study area, with the proportions for the other counties remaining relatively unchanged.

Trip attraction patterns are more stable between 1980 and 1987. Comparison of Figures 11 and 25 indicate that no subregion's proportion changes by more than one percentage point from 1980 to 1987.

Figures 26 and 27 portray the respective trip distributions for 1987 HBW study area trip productions and trip attractions. Comparison of Figures 12 and 26, shows that the major difference, as for total trip productions, is that the study area retains a higher proportion of the trips it produces for 1987 than for 1980 (42% versus 33%); the other important subregions attract a lower proportion. For HBW trip attractions (figures 13 and 27), the pattern is reversed: the study area produces a slightly lower proportion of the HBW trips it attracts in 1987 than in 1980, while the other subregions produce higher proportions of the trips. In particular, the outlying counties produce nearly 5% of the 1987 HBW trips attracted to the study area, with Orange County accounting for 4% of them. Thus, the growing magnetism of the study area is demonstrated in that it retains an increasing proportion of the (increasing number of) trips it produces, while an increasing proportion of (the increasing number of) trips it attracts are produced from farther away.

3. Mode Split

Table 13 compares the 1987 base mode splits for the study area with those of Los Angeles County and the SCAG region. As in 1980, shared ride splits are higher and transit splits are lower for the study area than for the county and region as a whole. Also, as in 1980 within the study area, the proportion of shared ride trips (and average auto occupancy) is higher for productions than for attractions, while the reverse is true for the drive alone and transit shares.

Comparing the study area figures for 1980 and 1987 to assess any trends indicates that the shared ride splits increase from 1980 to 1987, while the drive alone splits decrease. Thus, the average auto occupancies increase from 1980 to 1987 as well. The inference is that the time and cost advantages (due to carpool lanes, ramp meter bypasses, and lower assumed operating cost per person) applied by the model to shared-ride trips are sufficient, in view of the increasing congestion on the regular highway system, to attract a higher proportion of

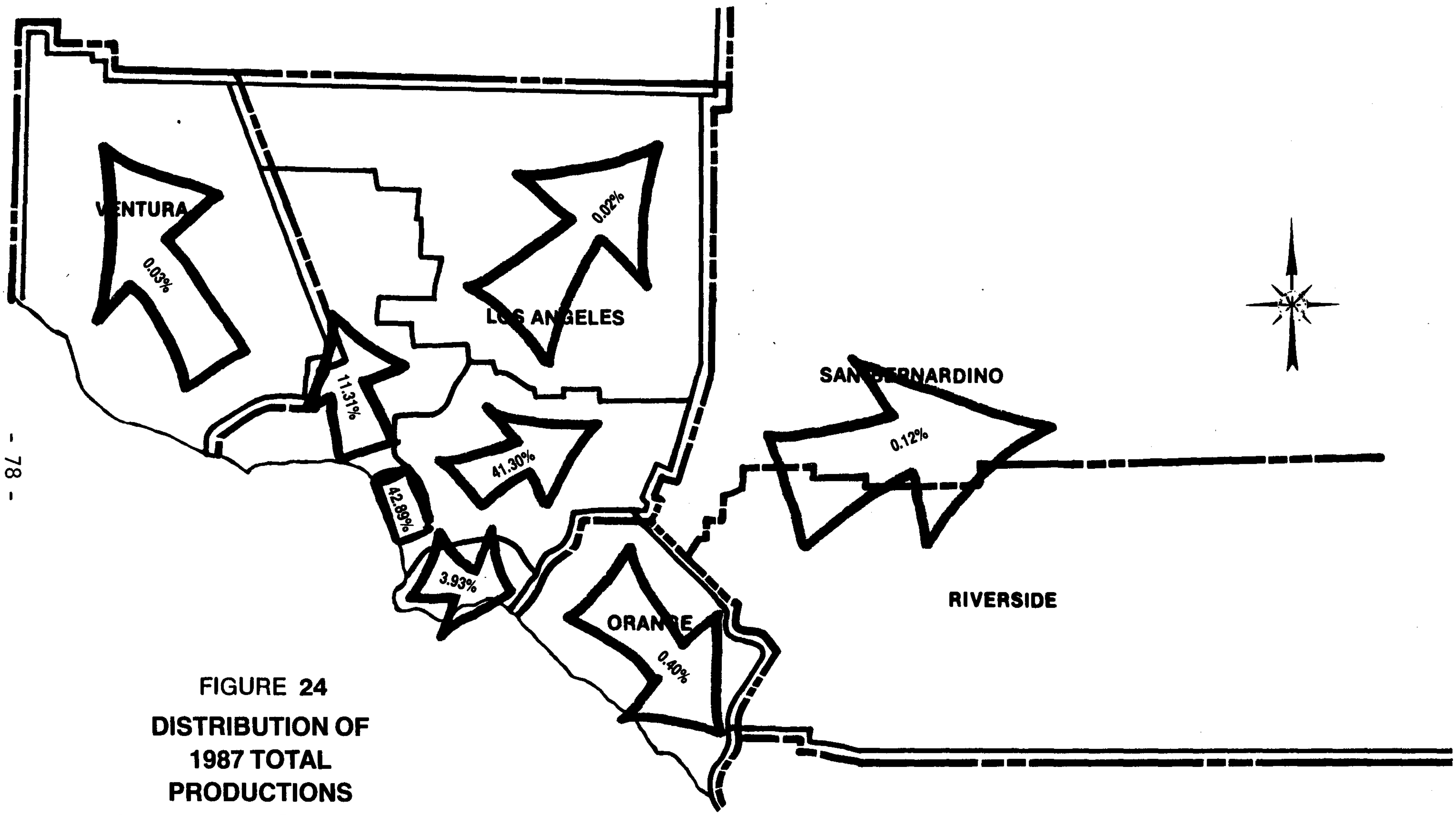


FIGURE 24
DISTRIBUTION OF 1987 TOTAL PRODUCTIONS from the LAX Study Area

County Boundary Line

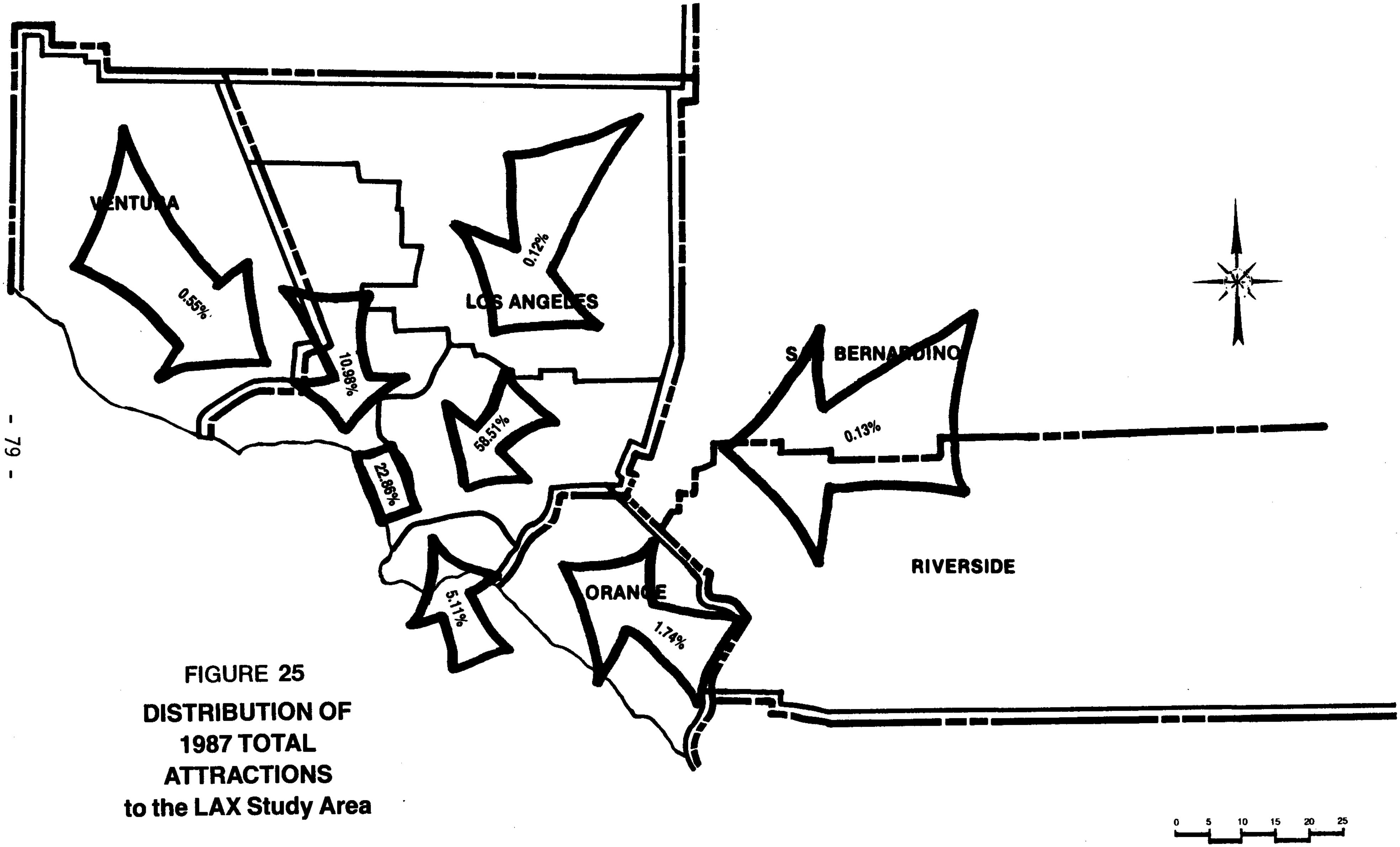


FIGURE 25

DISTRIBUTION OF 1987 TOTAL ATTRACTIONS to the LAX Study Area

County Boundary Line

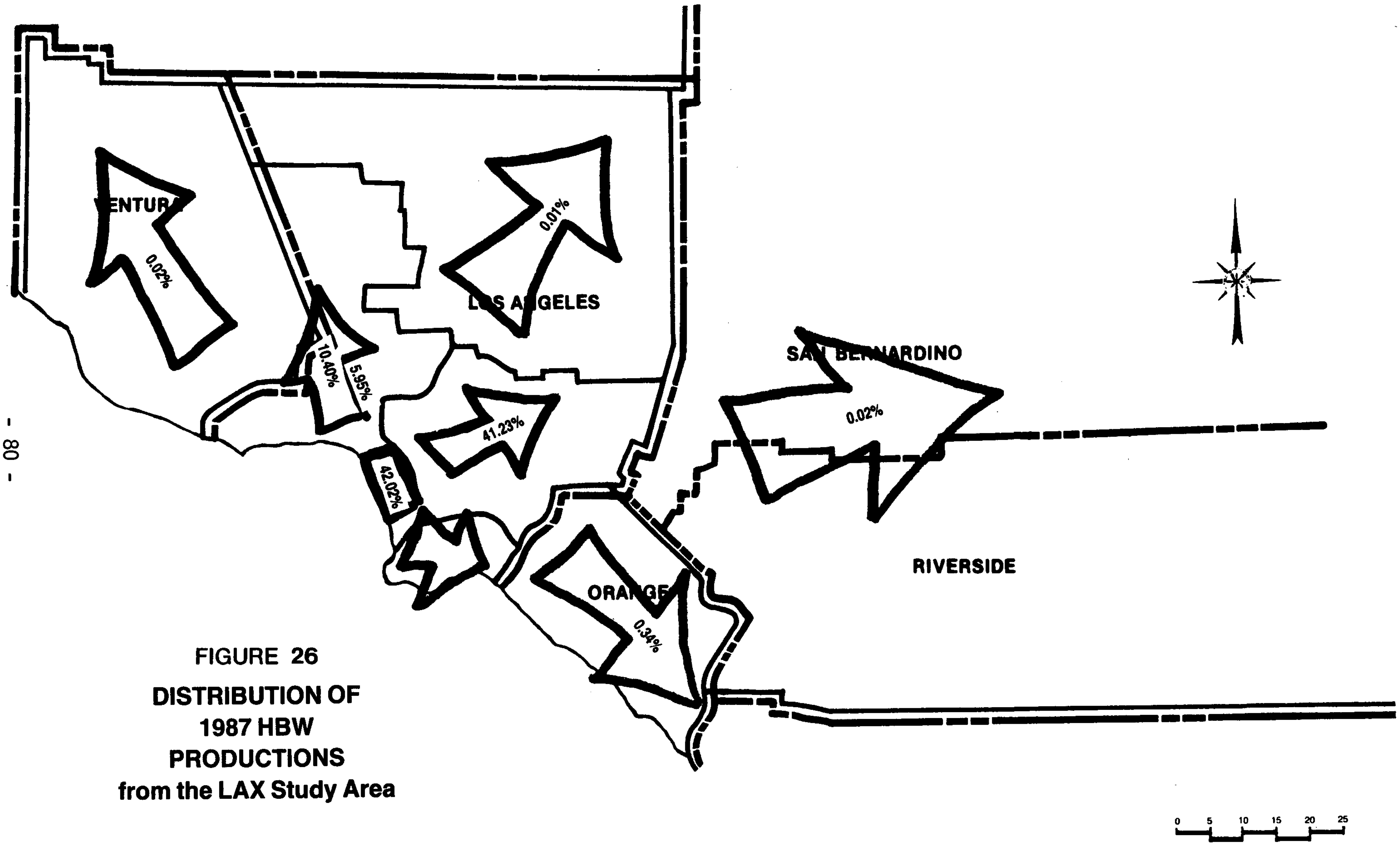


FIGURE 26

DISTRIBUTION OF 1987 HBW PRODUCTIONS from the LAX Study Area

County Boundary Line

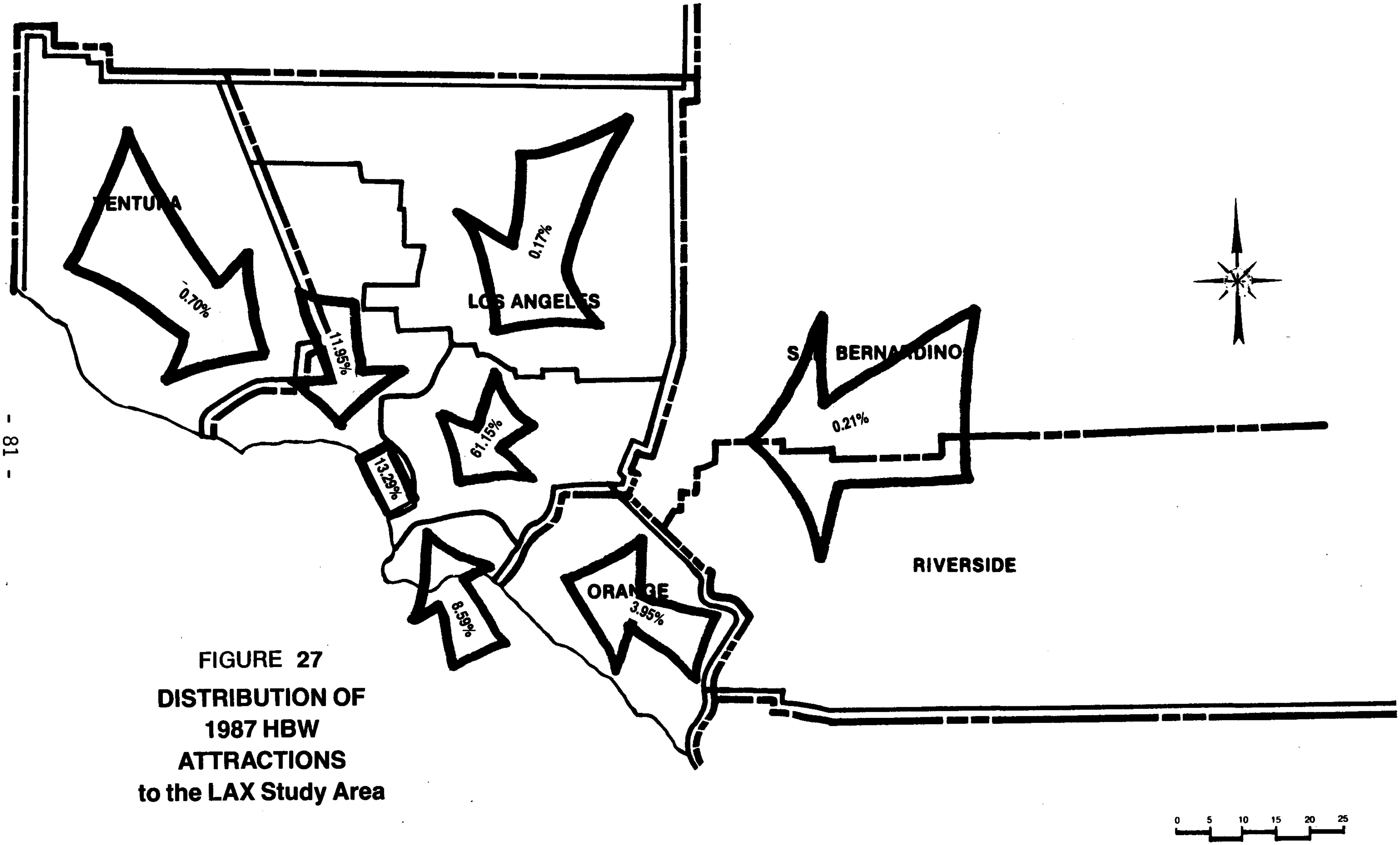


FIGURE 27

DISTRIBUTION OF 1987 HBW ATTRACTIONS to the LAX Study Area

▬ ▬ ▬ County Boundary Line

people to carpools and vanpools and away from driving alone. The transit splits for the study area decrease slightly from 1980 to 1987; the trips lost to the transit mode seem to be picked up by the shared-ride mode. Incidentally, the decrease in transit splits is counter to the trends for Los Angeles County and the region.

Table 14 compares the study area splits for the 1987 base case and 1987 base plus TSM/highway plus bus improvements (a separate mode split analysis was not performed for the 1987 base plus TSM/highway alternative, because local street improvements would not be expected to significantly alter the shares of each mode). Trip production splits do not change at all with the TSM/highway plus bus improvements, which is not surprising since the bus enhancements that were modelled serve trips inbound (attracted) to the study area rather than outbound. The trip attraction splits changed slightly, with the transit share increasing from 4.1% to 4.3% and the shares of each of the other two modes decreasing by 0.1%. Overall, then, the TSM/highway and bus transit improvements have little effect on the choice of mode for trips to and from the study area.

4. Highway Assignment

Table 15 summarizes the findings for the 1987 conditions in a similar fashion to those for 1980 (Table 5). As has been described before (Section IV. C.), a total of ten transportation scenarios were tested in the model. The figures in Table 15 refer to the three scenarios based on the 1987 conditions: the inclusion of the base improvements for 1987, the inclusion of the additional TSM/highway improvements, and the addition to the latter of the bus transit improvements.

Despite the fact that the 1987 base network includes some capacity-enhancing improvements to the 1980 system, the increased travel demand in 1987 means that 35% percent of the major arterial miles are classified as congested (compared to 25% for 1980). Addition of TSM/highway improvements to the 1987 base brings the proportion of congested miles down to 32% (still higher than in 1980), while the additional enhancement of transit has a negligible effect on the highway congestion.

B. 1987 Deficiency Analysis of Selected Major Arterials

Identification of likely future (1987, 1992) traffic problems was made in a similar manner to that for the identification of current problems.

Average V/C ratios and corresponding levels of service for all the arterials have been summarized in Table 16 and are shown in Figures 28 through 30. This table indicates that, under future traffic volume conditions (1987 base case), all arterials either experience a deterioration in terms of level

TABLE 13

1987 (Base) Mode Splits and Average Auto Occupancy: Home-Based Work Trips

	Study Area	Los Angeles County	SCAG Region
Productions			
Drive Alone (%)	72.0	70.8	73.3
Shared Ride (%)	24.5	19.0	19.9
Transit (%)	3.5	9.3	6.8
Auto Occupancy	1.18	1.14	1.14
Attractions			
Drive Alone (%)	73.7	70.7	73.3
Shared Ride (%)	22.2	20.4	19.9
Transit (%)	4.1	8.9	6.8
Auto Occupancy	1.16	1.15	1.14

TABLE 14

1987 Mode Split and Average Auto Occupancy Comparisons

	1987 Base	Base + TSM/ Highway + Bus
Productions		
Drive Alone (%)	72.0	72.0
Shared Ride (%)	24.5	24.5
Transit (%)	3.5	3.5
Auto Occupancy	1.18	1.18
Attractions		
Drive Alone (%)	73.7	73.6
Shared Ride (%)	22.2	22.1
Transit (%)	4.1	4.3
Auto Occupancy	1.16	1.16

TABLE 15
Miles of Major Arterial
by V/C category (1987)

Scenario	V/C < 0.75	0.75 ≤ V/C < 1.00	1.00 ≤ V/C < 1.25	V/C ≥ 1.25
1987 Base	83.54 (44%)	39.41 (21%)	32.89 (17%)	35.24 (18%)
1987 Base + TSM/Highway	90.88 (47%)	40.59 (21%)	31.73 (16%)	30.82 (16%)
1987 Base + TSM/Highway + Transit	89.31 (46%)	41.30 (21%)	32.79 (17%)	30.62 (16%)

of service or stay the same. In the future year (1987), fourteen segments of different arterials show V/C ratios indicating Level of Service "F^1," and "F^2," and fourteen other segments of arterials operate at Level of Service "F." The existing levels of service for these segments are "C" through "F." Vista Del Mar Avenue (from Manhattan Beach Boulevard to Imperial, northbound) and Centinela Avenue (from Venice to Jefferson, in both directions) are expected to receive the most dramatic decline in their level of highway service from their present level "D" to F". La Tijera Boulevard (from I-405 to Airport Boulevard, westbound) and Imperial Highway (from I-405 to Sepulveda, westbound) would also operate in the future at a level of service "F^2," and "F1," respectively, a decline from their present level of service "F." Three arterials: I-405, El Segundo Boulevard and Lincoln Boulevard, would remain at their existing Level of Service "F". Only one segment on La Cienega Boulevard (from I-405 to Imperial, southbound) is expected to improve its level of congestion even though its level of service designation will remain the same.

Implementation of proposed TSM/Highway Improvements for 1987 would increase the capacity of the 1987 system while reducing the traffic congestion to some extent but not to the 1980 level. Under this alternative, all arterials either experience an improvement of their level of service or stay the same. In the future year (1987, TSM/Highway alternative), two arterials show V/C ratios indicating level of service "E" which is an improvement in their level of highway service from the 1987 system level "F". These are Centinela Avenue (from Venice to Sepulveda, southbound) and Lincoln Boulevard (from Marina Freeway to Venice, northbound). Twenty-seven other segments of arterials would either remain at their existing level of service "E", "F", "F^1", "F^2," or maintain their 1987 system level of service.

The third alternative (1987, bus-transit improvements) has little effect on the traffic congestion and shows small differences in operational impacts under the existing or 1987 system conditions. All arterials either would remain at their 1987 TSM/Highway alternative level of service or improve slightly. Under this alternative, the bus-transit ridership will increase somewhat (from 15,857 to 17,990), but is not large enough to have an effect on the system congestion even though the demand volume will be reduced to some extent.

TABLE 16

Future (1987) Arterials Deficiency Analyses
V/C Ratio (Level of Service)

	1980 ALT I	1987 ALT II	1987 ALT III	1987 ALT IV
1. Rosecrans Boulevard				
I-405 to Aviation (WB)	1.23 (F)	1.83 (F[2])	1.88 (F[2])	1.87 (F[2])
I-405 to Sepulveda (WB)	.87 (D)	1.26 (F[1])	1.24 (F)	1.24 (F)
2. El Segundo Boulevard				
I-405 to Douglas (WB)	1.33 (F[1])	1.78 (F[2])	1.70 (F[2])	1.69 (F[2])
I-405 to Sepulveda (WB)	1.07 (F)	1.20 (F)	1.14 (F)	1.14 (F)
3. La Tijera Boulevard				
I-405 to Airport Blvd (WB)	1.12 (F)	1.58 (F[2])	1.44 (F[1])	1.43 (F[1])
I-405 to Manchester (WB)	.88 (D)	1.25 (F[1])	1.14 (F)	1.12 (F)
Airport Blvd to I-405 (EB)	1.04 (F)	1.17 (F)	1.08 (F)	1.07 (F)
4. Lincoln Boulevard				
Venice to Marina Fwy (SB)	1.33 (F[1])	1.50 (F[2])	1.35 (F[1])	1.34 (F[1])
Marina Fwy to Venice (NB)	1.23 (F)	1.22 (F)	.99 (E)	.99 (E)
Venice to Sepulveda (SB)	.91 (E)	1.11 (F)	.99 (E)	.98 (E)
5. Culver Boulevard				
Vista Del Mar to Jefferson (EB)	1.16 (F)	1.45 (F[1])	1.25 (F[1])	1.25 (F[1])

[1] Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

[2] Volume/capacity ratios equal to or greater than 1.50.

TABLE 16 (continued)

Future (1987) Arterials Deficiency Analyses
V/C Ratio (Level of Service)

	1980 ALT I	1987 ALT II	1987 ALT III	1987 ALT IV
6. I-405				
Venice to Manhattan Beach Blvd (SB)	1.26 (F[1])	1.43 (F[1])	1.28 (F[1])	1.28 (F[1])
Manhattan Beach Blvd to Venice (NB)	1.23 (F)	1.32 (F[1])	1.26 (F[1])	1.26 (F[1])
7. Century Boulevard				
I-405 to Airport Blvd (WB)	1.15 (F)	1.43 (F[1])	1.33 (F[1])	1.33 (F[1])
I-405 to LAX (WB)	.77 (C)	1.16 (F)	1.16 (F)	1.16 (F)
8. Imperial Highway				
I-405 to Sepulveda (WB)	1.08 (F)	1.42 (F[1])	1.36 (F[1])	1.35 (F[1])
Pacific Coast Highway to Sepulveda (EB)	.76 (C)	1.12 (F)	1.10 (F)	1.10 (F)
9. Compton Avenue				
I-405 to Aviation (WB)	.82 (D)	1.34 (F[1])	1.31 (F[1])	1.31 (F[1])

[1] Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

[2] Volume/capacity ratios equal to or greater than 1.50.

TABLE 16 (continued)

Future (1987) Arterials Deficiency Analyses
V/C Ratio (Level of Service)

	1980 ALT I	1987 ALT II	1987 ALT III	1987 ALT IV
10. Aviation Boulevard				
Manhattan Beach Blvd to El Segundo (NB)	1.24 (F)	1.31 (F[1])	1.47 (F[1])	1.47 (F[1])
Manhattan Beach Blvd. to Imperial (NB)	1.10 (F)	1.19 (F)	1.32 (F[1])	1.32 (F[1])
Manchester to Imperial (SB)	.99 (E)	.98 (E)	1.14 (F)	1.13 (F)
11. Sepulveda Boulevard				
Venice to Manhattan Beach Blvd (SB)	1.17 (F)	1.29 (F[1])	1.27 (F[1])	1.26 (F[1])
Manhattan Beach Blvd to Venice (NB)	.96 (E)	.96 (E)	.94 (E)	.94 (E)
12. Vista Del Mar Avenue				
Manhattan Beach Blvd. to Imperial (NB)	.92 (E)	1.24 (F)	1.11 (F)	1.10 (F)
13. Centinela Avenue				
Venice to Jefferson (SB)	.83 (D)	1.15 (F)	.91 (E)	.90 (D)
Jefferson to Sepulveda (SB)	.82 (D)	1.14 (F)	.92 (E)	.90 (D)

[1] Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

[2] Volume/capacity ratios equal to or greater than 1.50.

TABLE 16 (continued)

Future (1987) Arterials Deficiency Analyses
V/C Ratio (Level of Service)

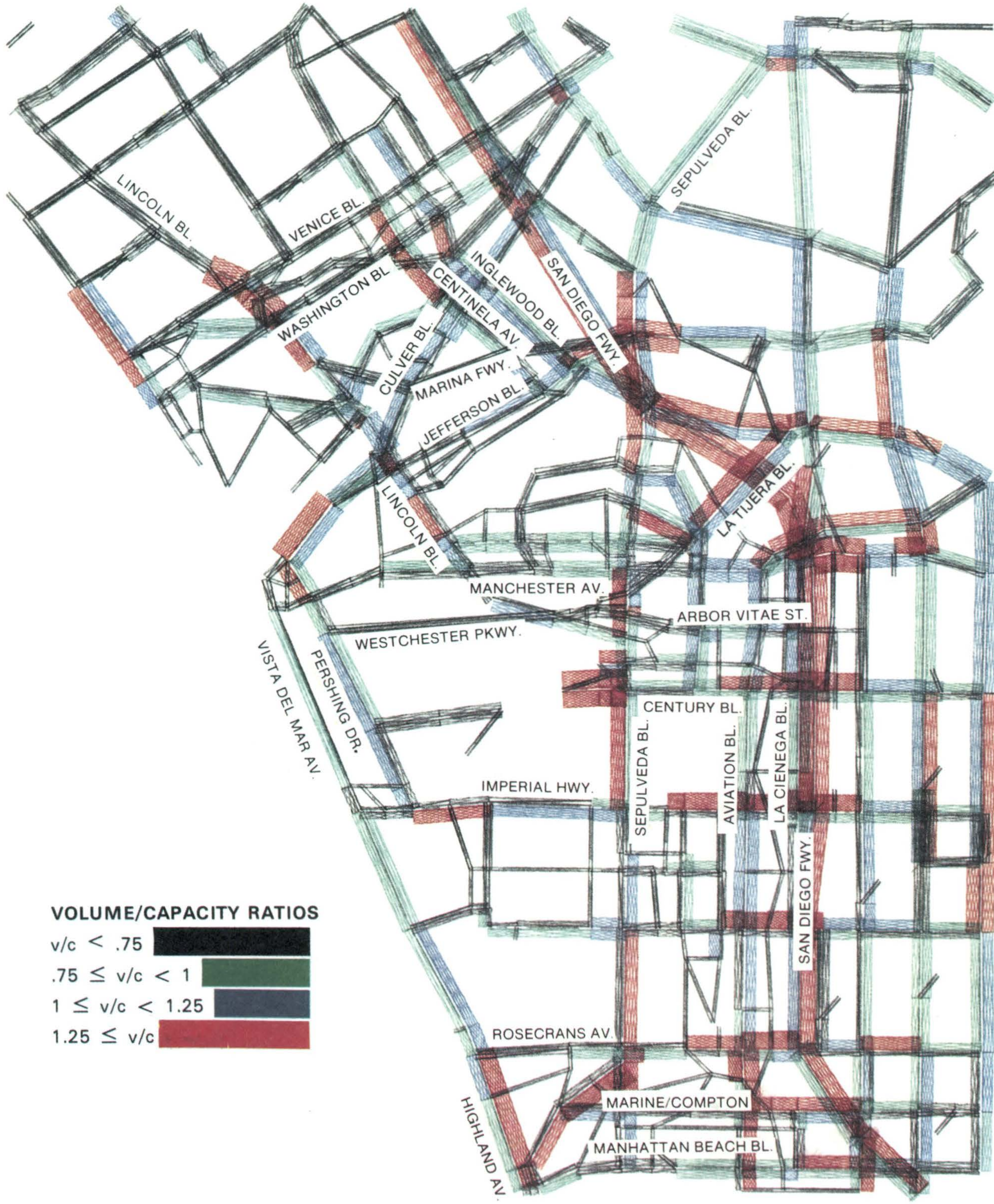
		1980 ALT I	1987 ALT II	1987 ALT III	1987 ALT IV
14.	Inglewood Boulevard				
	Venice to Jefferson (SB)	.90 (D)	1.12 (F)	1.01 (F)	1.03 (F)
15.	Pershing Drive				
	Manchester to Imperial (SB)	.80 (C)	1.08 (F)	1.09 (F)	1.08 (F)
16.	La Cienega Boulevard				
	Century to El Segundo (SB)	1.17 (F)	1.03 (F)	1.11 (F)	1.11 (F)
	Manchester to Imperial (SB)	.91 (E)	1.03 (F)	.93 (E)	.93 (E)
	I-405 to Imperial (SB)	1.11 (F)	.98 (E)	1.05 (F)	1.05 (F)
17.	Falmouth Avenue				
	Culver to Manchester (SB)	new	new	1.46 (F[1])	1.46 (F[1])

[1] Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

[2] Volume/capacity ratios equal to or greater than 1.50.

FIGURE 28

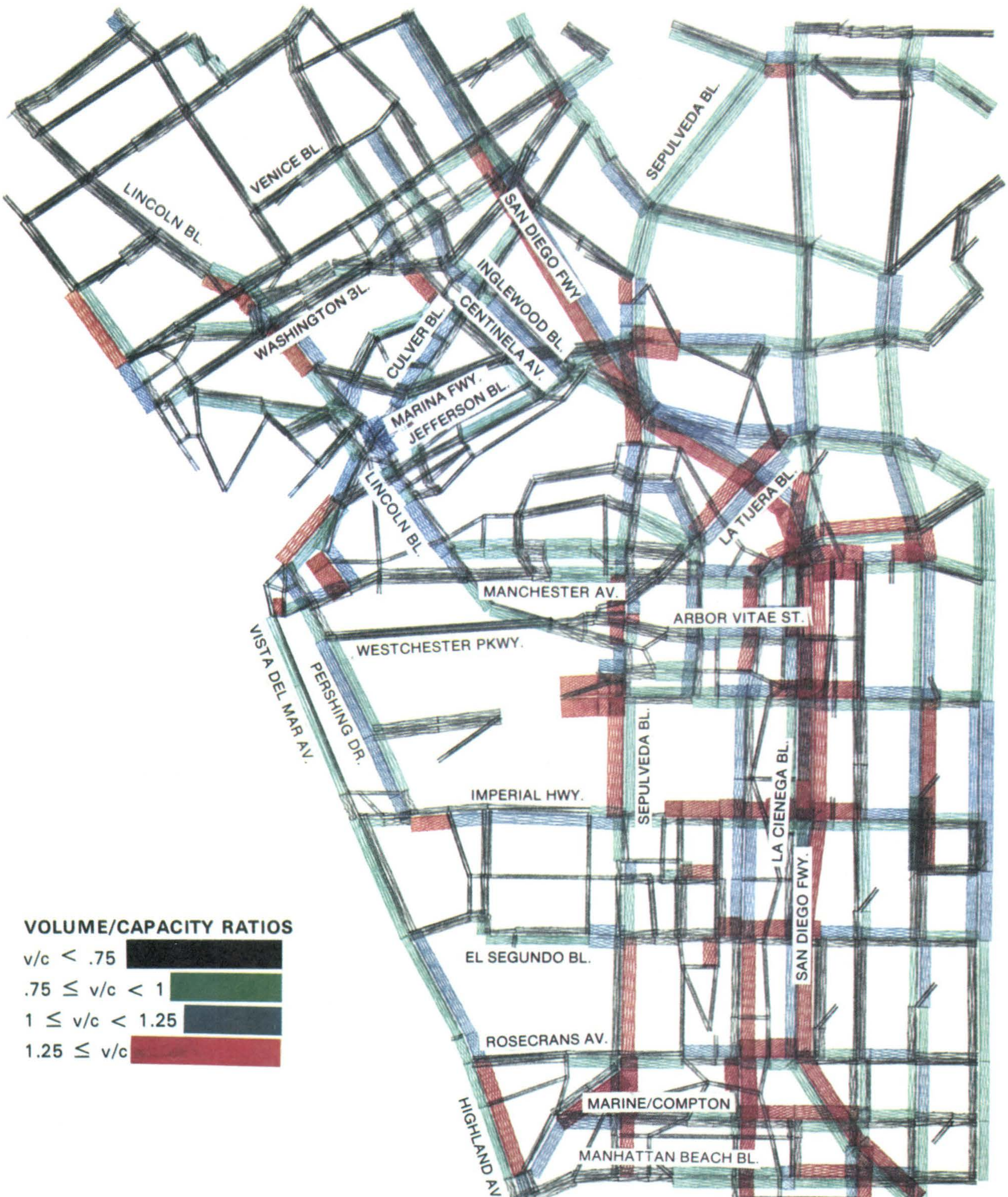
LAX AREA TSM/CORRIDOR STUDY



YEAR 1987 ALTERNATIVE 2

FIGURE 29

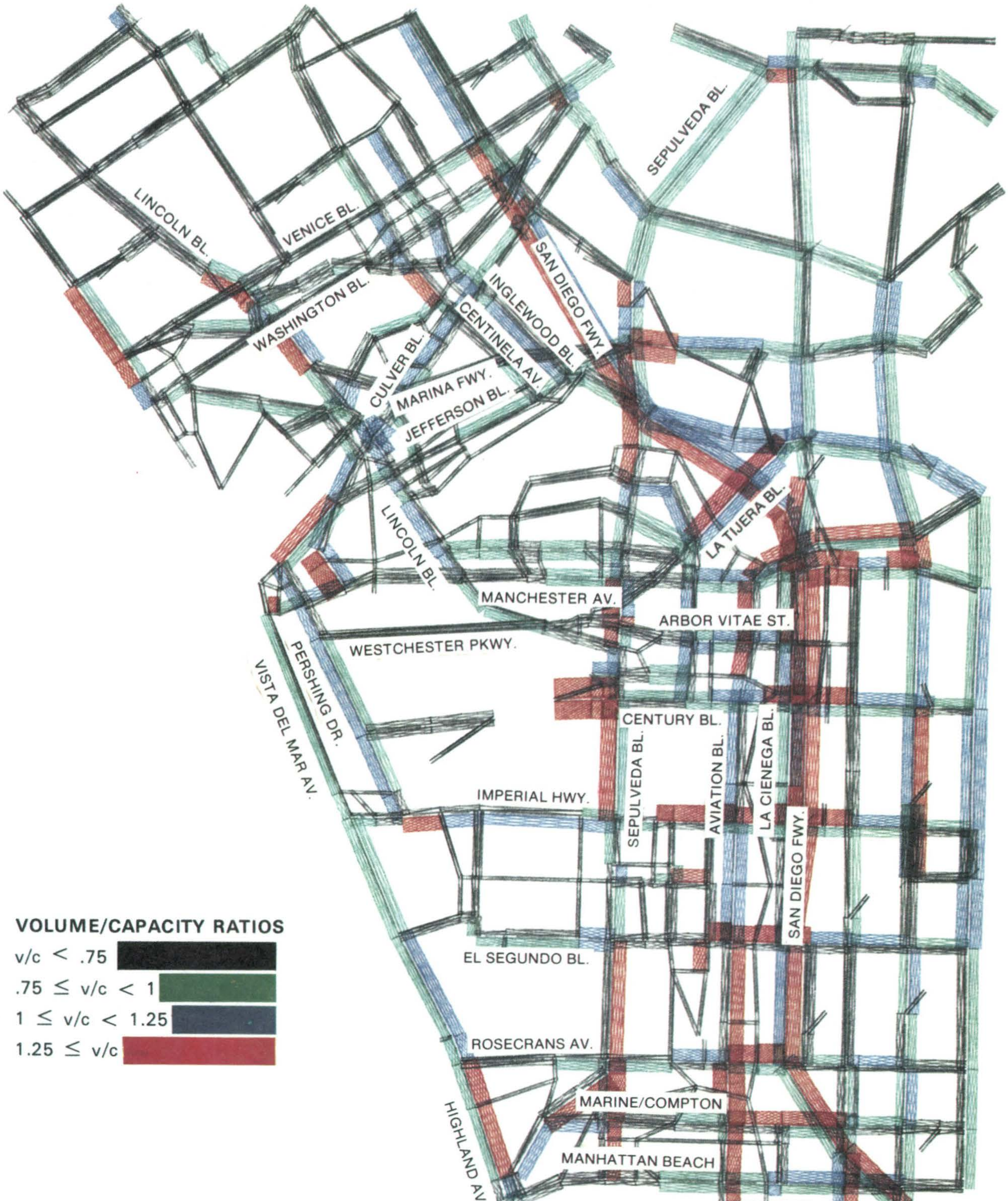
LAX AREA TSM/CORRIDOR STUDY



YEAR 1987 ALTERNATIVE 3

FIGURE 30

LAX AREA TSM/CORRIDOR STUDY



YEAR 1987 ALTERNATIVE 4

Table 17 presents existing and future (1987) average morning peak period traffic volume (2-hours) for each arterial and their percentage changes over the existing demand volumes. All of the arterial show volume increases and only one arterial, La Cienega Boulevard, from I-405 to Imperial Highway shows a tremendous (20 percent) decrease. The largest volume increases occur in Imperial Highway, Culver Boulevard and Compton Avenue with 86, 68, and 60 percent increase, respectively. Corridor that contain north-south oriented arterials show an average increase of 25 percent and east-west oriented arterial show an average increase of 47 percent. A comparison of the traffic volume increases from 1987 system and alternative (Proposed Improvements) over the existing 1980 system (shown in Table 17) again indicates that the improvement proposed will decrease the north-south and east-west demand volumes by 9 and 2 percent, respectively, while providing for more capacity. Since the magnitude of arterial deficiency is very high, the proposed TSM/Highway Improvement for 1987 is not adequate to compensate for the degree of congestion experienced in the study area. Thus further deterioration of traffic service can be expected.

C. 1992 Transportation Characteristics

1. Trip Generation

For ease of comparison, 1980, 1987, and 1992 trip productions and trip attractions for the study area, Los Angeles County, and the SCAG region are presented in Tables 18 and 19 for total and HBW trips, respectively. Table 18 shows that total 1992 study area trip productions increase 4.2% over 1987, for an overall increase from 1980 of 19.2%. Total 1992 trip attractions increase 8.2% over 1987, for an overall increase of 48.7%. Trip attractions exceed trip productions by 47.5%. Study area 1992 trip productions compose 3.3% of Los Angeles County trip productions and 2.0% of SCAG region trip productions (i.e., between 1987 and 1992, regional trip productions increase slightly more, proportionally, than the study area). Study area trip attractions are 4.8% and 3.0% of L. A. County and SCAG region trip attractions, respectively.

Turning to HBW trips, Table 19 indicates that 1992 study area HBW trip productions increase 2.8% over 1987, or 9.5% over 1980. HBW trip attractions rise 16.6% over 1987 levels, or 71.0% overall from 1980. Study area HBW trip attractions exceed trip productions by 167.0%. 1992 HBW trip productions for the study area form 3.0% and 1.8% of L. A. County and SCAG region trip productions, respectively; the corresponding percentages for trip attractions are 7.2 and 5.0. Thus, again, the study area attracts trips, especially work trips, far out of proportion to its size.

TABLE 17

Future (1987) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 hours)

	1980 ALT I	1987 ALT II	Percent Change (from 1980)	1987 ALT III	Percent Change (from 1980)	1987 ALT IV
1. Rosecrans Boulevard						
I-405 to Sepulveda	3,476	4,516	+30	4,461	+28	4,141
I-405 to Aviation	4,417	6,575	+49	6,763	+33	6,227
2. El Segundo Boulevard						
I-405 to Sepulveda	3,562	4,310	+21	4,122	+16	4,486
I-405 to Douglas	4,766	6,404	+34	6,114	+28	6,073
3. La Tijera Boulevard						
I-405 to Manchester	2,133	2,999	+41	2,749	+29	2,737
I-405 to Airport Blvd	2,691	3,788	+41	3,439	+28	3,427
Airport Blvd to I-405	2,495	2,794	+12	2,582	+ 3	2,572
4. Lincoln Boulevard						
Venice to Sepulveda	2,791	3,428	+23	3,589	+29	3,583
Venice to Marina Fwy	3,765	4,266	+13	4,852	+29	4,836
Marina Fwy to Venice	3,471	3,451	- 1	3,540	+ 2	3,551
5. Culver Boulevard						
Vista Del Mar to Jefferson	2,775	4,651	+68	3,061	+10	3,050
Pacific Coast Highway to Sepulveda	1,610	2,448	+52	2,277	+41	2,294

TABLE 17 (continued)

Future (1987) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 hours)

	1980 ALT I	1987 ALT II	Percent Change (from 1980)	1987 ALT III	Percent Change (from 1980)	1987 ALT IV
6. I-405						
Venice to Manhattan Beach Blvd	16,220	19,377	+19	21,863	+35	21,840
Manhattan Beach Blvd to Venice	16,165	17,891	+11	21,374	+32	21,320
7. Century Boulevard						
I-405 to LAX	3,536	5,112	+45	4,986	+41	4,973
I-405 to Airport Blvd	5,534	6,864	+24	6,394	+16	6,364
8. Imperial Highway						
I-405 to Sepulveda	3,876	7,194	+86	6,869	+77	6,841
Pacific Coast Highway to Sepulveda	1,753	2,683	+53	2,629	+50	2,633
9. Compton Avenue						
I-405 to Aviation	1,992	3,196	+60	3,218	+61	3,223
10. Aviation Boulevard						
Manhattan Beach Blvd to Imperial	2,763	2,843	+ 3	3,129	+13	3,029
Manchester to Imperial	2,756	3,023	+10	3,320	+21	3,120
Manhattan Beach Blvd to El Segundo	2,977	3,489	+17	3,518	+18	3,516

TABLE 17 (continued)

Future (1987) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 hours)

	1980 ALT I	1987 ALT II	Percent Change (from 1980)	1987 ALT III	Percent Change (from 1980)	1987 ALT IV
11. Sepulveda Boulevard						
Venice to Manhattan Beach Blvd	4,412	4,948	+12	4,918	+11	4,715
Manhattan Beach Blvd to Venice	3,585	3,877	+ 8	3,792	+ 6	3,612
12. Vista Del Mar Avenue						
Manhattan Beach Blvd to Imperial	1,728	2,204	+28	2,059	+19	2,077
13. Centinela Avenue						
Venice to Jefferson	1,910	2,746	+44	2,194	+15	2,197
Jefferson to Sepulveda	3,022	4,103	+36	3,300	+ 9	3,339
14. Inglewood Boulevard						
Venice to Jefferson	1,671	2,081	+25	1,900	+14	1,921
15. Pershing Drive						
Manchester to Imperial	2,884	3,867	+34	3,924	+36	3,936

TABLE 17 (continued)

Future (1987) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 hours)

	1980 ALT I	1987 ALT II	Percent Change (from 1980)	1987 ALT III	Percent Change (from 1980)	1987 ALT IV
16. La Cienega Boulevard						
Century to El Segundo	2,793	2,458	-12	2,657	- 5	2,664
Manchester to Imperial	2,641	2,478	- 6	2,246	-15	2,278
I-405 to Imperial	2,939	2,339	-20	2,528	-14	2,558
17. Falmouth Avenue						
Culver to Manchester	new	new	--	2,390	--	2,418

TABLE 18

1980, 1987, 1992 24-Hour Trip Productions and Trip Attractions--All Trip Types

	Productions	% Increase	(Cum. %)	Attractions	% Increase	(Cum. %)
Study Area						
1980	784,692	--	--	928,003	--	--
1987	897,822	14.4	(14.4)	1,276,174	37.5	(35.7)
1992	935,703	4.2	(19.2)	1,380,303	8.2	(48.7)
Los Angeles County						
1980	25,809,422	--	--	26,407,806	--	--
1987	27,337,503	5.9	(5.9)	27,889,962	5.6	(5.6)
1992	28,452,825	4.1	(10.2)	28,760,838	3.1	(8.9)
SCAG Region						
1980	38,935,276	--	--	38,935,276	--	--
1987	43,101,583	10.7	(10.7)	43,101,583	10.7	(10.7)
1992	46,163,833	7.1	(18.6)	46,163,833	7.1	(18.6)

TABLE 19

1980, 1987, 1992 24-Hour Trip Productions and Trip Attractions--HBW Trips

	Productions	% Increase	(Cum. %)	Attractions	% Increase	(Cum. %)
Study Area						
1980	137,600	--	--	235,259	--	--
1987	146,470	6.4	(6.4)	344,953	46.6	(46.6)
1992	150,637	2.8	(9.5)	402,259	16.6	(71.0)
Los Angeles County						
1980	4,601,148	--	--	5,006,950	--	--
1987	4,889,661	6.3	(6.3)	5,340,026	6.7	(6.7)
1992	5,103,757	4.4	(10.9)	5,560,550	4.1	(11.1)
SCAG Region						
1980	7,041,469	--	--	7,041,469	--	--
1987	7,811,684	10.9	(10.9)	7,811,684	10.9	(10.9)
1992	8,380,852	7.3	(19.0)	8,380,852	7.3	(19.0)

2. Trip Distribution

Figures 31 and 32 display the trip distribution of total 1992 study area trip productions and trip attractions. Comparing 1992 and 1987 trip productions (Figures 31 and 24) shows a continuation of the trend for a higher percentage of the trips to be retained by the study area, with a lower percentage attracted to the other parts of Los Angeles County. The outlying counties attract a marginally higher proportion of trips, but still account for less than 1% of the total study area productions.

Comparing 1992 and 1987 trip attractions (Figures 32 and 25), reveals that again, there is again no greater than one percentage point difference between 1987 and 1992 for the proportions of trips produced by each subregion. The samedistributions (Figure 10). Thus, the distribution pattern of productions for total trips attracted to the study area remains fairly constant (at least when aggregated by subregion) from 1980 to 1992.

As for HBW trips, comparison of Figures 26 (1987) and 33 (1992) shows that again, the study area attracts a higher proportion (over 45%) of the trips it produces, while the other subregions attract relatively fewer trips. Again, the reverse is true for HBW trip attractions, with the study area producing a lower percentage of the trips attracted to it in 1992 (Figure 34) than in 1987 (Figure 27), and with most of the other subregions producing a higher percentage. However, none of the variations between the 1987 and 1992 HBW trip attraction proportions are greater than one percentage point.

3. Mode Split

Table 20 presents the 1992 base mode splits for the study area, Los Angeles County, and the SCAG region. As before, the study area exhibits relatively higher levels of ridesharing and lower levels of transit ridership than Los Angeles County and the region. Comparing study area 1992 splits (Table 20) to study area 1987 and 1980 splits (Tables 4 and) indicates a continuation of the trends toward an increasing shared ride percentage and decreasing drive alone and transit shares (except for a minor increase in the transit share for trip productions from 3.5% to 3.7% between 1987 and 1992). For productions, these trends are not sufficient to increase the overall auto occupancy from 1987 to 1992, but the auto occupancy for trip attractions increases from 1.16 to 1.18 in the same time period.

Table 21 compares the study area splits for the 1992 base scenario to the other 1992 scenarios (except for the base plus TSM/highway alternative, for reasons given in Section A).

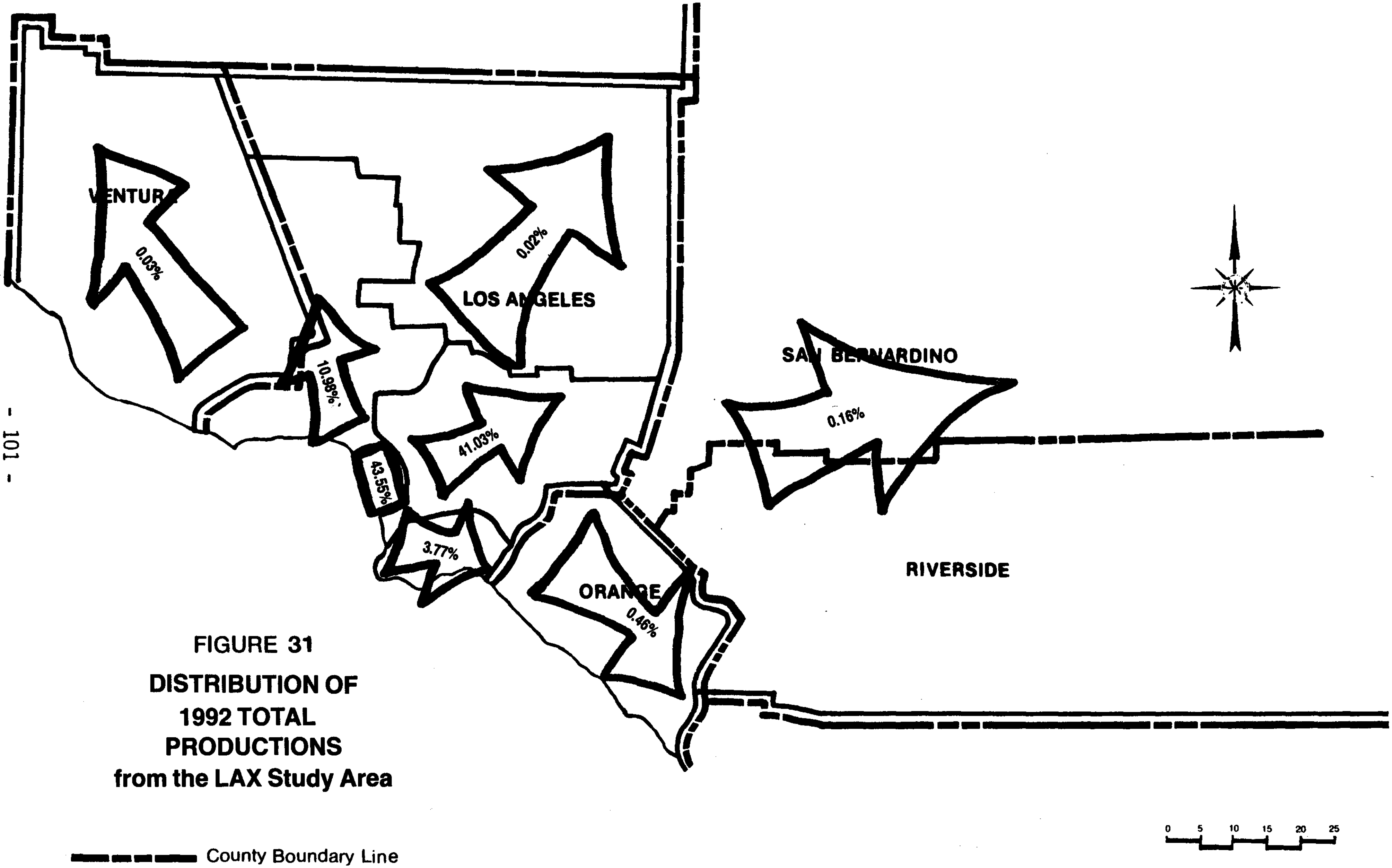


FIGURE 31

DISTRIBUTION OF 1992 TOTAL PRODUCTIONS from the LAX Study Area

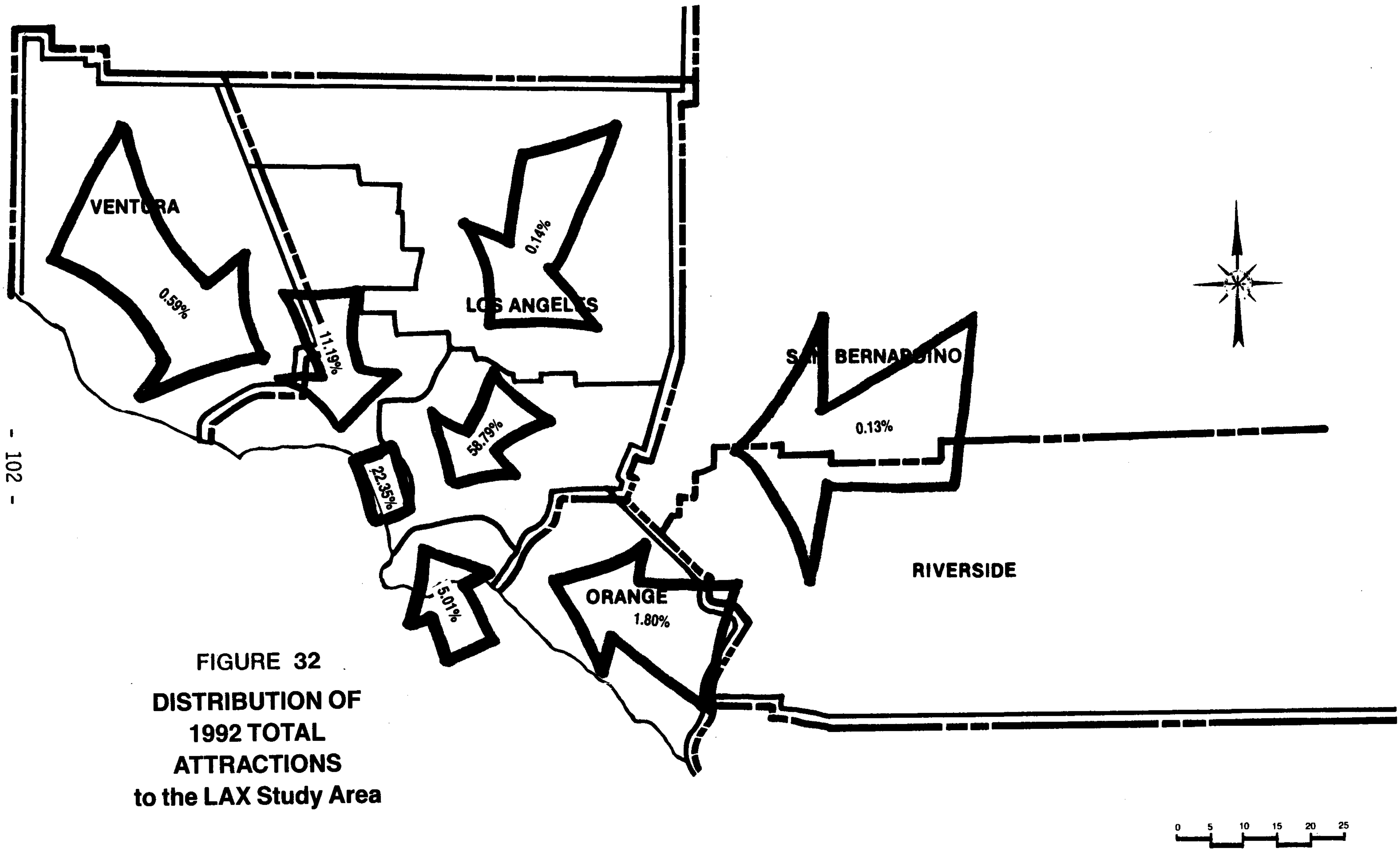


FIGURE 32

DISTRIBUTION OF 1992 TOTAL ATTRACTIONS to the LAX Study Area

County Boundary Line

TABLE 20

1992 (Base) Mode Splits and Average Auto Occupancy: Home-Based Work Trips

	Study Area	Los Angeles County	SCAG Region
Productions			
Drive Alone (%)	71.8	69.5	72.5
Shared Ride (%)	24.5	20.7	20.6
Transit (%)	3.7	9.8	6.9
Auto Occupancy	1.18	1.15	1.15
Attractions			
Drive Alone (%)	72.7	69.1	72.5
Shared Ride (%)	23.3	21.6	20.6
Transit (%)	4.0	9.3	6.9
Auto Occupancy	1.18	1.16	1.15

TABLE 21

1992 Mode Split and Auto Occupancy Comparisons

	1992 Base	Base + TSM/ Highway + Bus	Same + Rail (Hawthorne)	Same + Rail (Redondo)	Same + Rail (Both)
Productions					
Drive Alone (%)	71.8	71.8	71.6	71.6	71.6
Shared Ride (%)	24.5	24.5	24.4	24.5	24.3
Transit (%)	3.7	3.7	4.0	3.9	4.1
Auto Occupancy	1.18	1.18	1.18	1.18	1.18
Attractions					
Drive Alone (%)	72.7	72.6	72.6	72.6	72.4
Shared Ride (%)	23.3	23.2	23.1	23.2	23.1
Transit (%)	3.9	4.2	4.3	4.2	4.5
Auto Occupancy	1.17	1.17	1.17	1.17	1.17

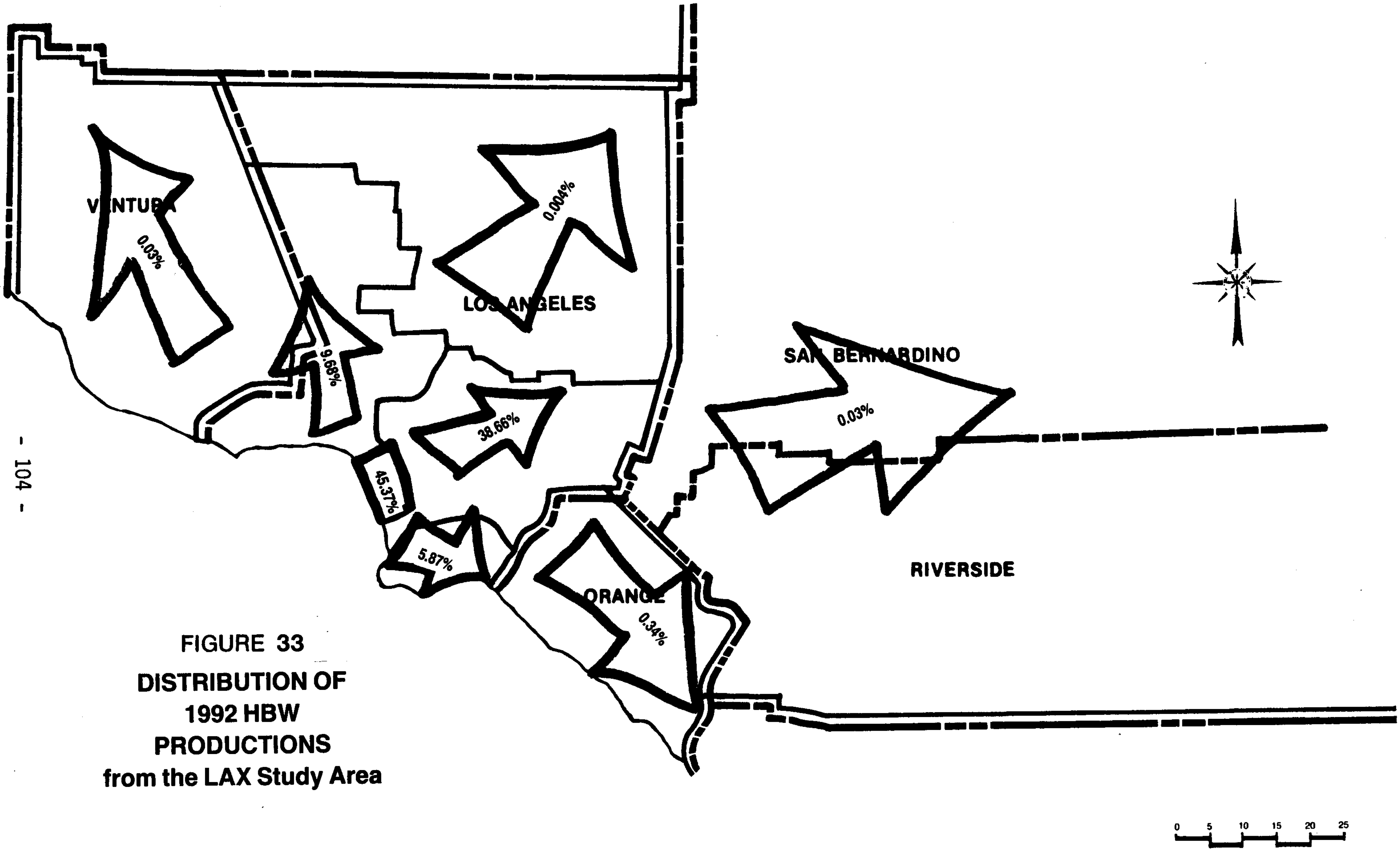


FIGURE 33

DISTRIBUTION OF 1992 HBW PRODUCTIONS from the LAX Study Area

County Boundary Line

TABLE 22

Miles of Major Arterial by V/C Category (1980, 1987, and 1992)

Scenario	V/C < 0.75	0.75 ≤ V/C < 1.00	1.00 ≤ V/C < 1.25	V/C ≥ 1.25
1980	95.75 (53%)	39.53 (22%)	27.93 (16%)	16.85 (9%)
1987 Base	83.54 (44%)	39.41 (21%)	32.89 (17%)	35.24 (18%)
1987 Base + TSM/Highway	90.88 (47%)	40.59 (21%)	31.73 (16%)	30.82 (16%)
1987 Base + TSM/Highway + Bus	89.31 (46%)	41.30 (21%)	32.79 (17%)	30.62 (16%)
1992 Base	89.45 (44%)	45.47 (23%)	28.15 (14%)	37.99 (19%)
1992 Base + TSM/Highway	93.17 (46%0)	42.73 (21%)	33.66 (16%)	34.08 (17%)
1992 Base + TSM/Highway + Bus	93.34 (46%)	42.56 (21%)	34.96 (17%)	32.78 (16%)
1992 Above + Rail (Hawthorne)	93.62 (46%)	41.74 (20%)	34.40 (17%)	33.88 (17%)
1992 Above + Rail (Redondo)	93.79 (46%)	43.33 (21%)	32.34 (16%)	33.83 (17%)
1992 Above + Rail (Hawthorne) and Redondo)	92.34 (45%)	43.64 (21%)	34.39 (17%)	33.27 (16%)

respectively. Similarly, while the overall proportion of uncongested miles remains nearly constant, a higher proportion of those miles are characterized by excellent operation for the TSM/highway scenario than for the 1992 base case (46% versus 44%). Such a trend is logically expected, given the combined effect of both base and alternative improvements in this scenario.

The final inclusion of the bus and rail scenarios, brings only negligible changes into the whole picture of the area, as can be seen from the slight variations in the proportion of congested miles (33 to 34%) for each of the last five scenarios tested. Thus, it appears that, in absolute terms, the increase in transit ridership due to bus and rail improvements is not sufficient to cause a significant reduction in congestion within the study area.

D. 1992 Deficiency Analysis of Selected Major Arterials

The analysis of the 1992 traffic volumes shows a similar picture to that of 1987 as compared to the 1980 conditions. Under 1992 traffic volume conditions, all arterials with few exceptions, either experience a deterioration in terms of level of service or stay the same. In the future year (1992), ten segments of different arterials show V/C ratios indicating Level of Service "F^2" and "F^1" and fifteen other segments operate at Level of Service "F" although their existing levels of service are "E" through "F" as shown in Table 23 and Figures 35 through 40. This table also reveals that most of these arterials are operating at much higher levels of congestion, despite the fact that their level of service category is unchanged from the 1987 level. This is because of the fact that the arterials fall into the upper-end of the volume/capacity ranges in each of their respective categories (described in Section III. C) in comparison to lower-end values for 1987 levels of service.

Four segments are expected to improve their level of highway service from "F" and "F^1" to "B" and "E" by 1992. These are Rosecrans Boulevard (from I-405 to Sepulveda westbound), Culver Boulevard (from Vista Del Mar to Jefferson eastbound) and Aviation Boulevard (from Manhattan Beach Blvd. and Manchester to Imperial northbound). The improved level of service in these four east-west oriented arterials is partially due to the opening of I-105 Freeway by the year 1992, but our analysis indicates that this freeway will operate at the level of service "F^1" at its birth. La Cienega Boulevard is the only north-south oriented arterial which is expected to improve its level of congestion slightly and this might be due to the addition lane to I-405 Freeway. Admiralty Way is expected to receive the most dramatic decline in its level of highway service from its present level "D" to "F".

TABLE 23

Future (1992) Arterials Deficiency Analyses

V/C Ratio (Level of Service)

	1987 ALT IV	1992 ALT V	1992 ALT VI	1992 ALT VII	1992 ALT IV	1992 ALT IX	1992 ALT X
1. Rosecrans Boulevard							
I-405 to Aviation (WB)	1.87 (F[2])	2.05 (F[2])	1.60 (F[2])	1.58 (F[2])	1.58 (F[2])	1.58 (F[2])	1.58 (F[2])
I-405 to Sepulveda (WB)	1.24 (F)	.67 (B)	1.02 (F)	1.01 (F)	1.01 (F)	1.01 (F)	1.01 (F)
2. El Segundo Boulevard							
I-405 to Douglas (WB)	1.69 (F[2])	1.73 (F[2])	1.52 (F[2])	1.54 (F[2])	1.51 (F[2])	1.53 (F[2])	1.53 (F[2])
I-405 to Sepulveda (WB)	1.14 (F)	1.11 (F)	1.03 (F)	1.04 (F)	1.03 (F)	1.04 (F)	1.04 (F)
3. La Tijera Boulevard							
I-405 to Airport Blvd (WB)	1.43 (F[1])	1.43 (F[1])	1.42 (F[1])	1.42 (F[1])	1.41 (F[1])	1.41 (F[1])	1.41 (F[1])
I-405 to Manchester (WB)	1.12 (F)	1.09 (F)	1.12 (F)	1.12 (F)	1.11 (F)	1.12 (F)	1.12 (F)
Airport Blvd to I-405 (EB)	1.07 (F)	1.20 (F)	1.16 (F)	1.16 (F)	1.16 (F)	1.16 (F)	1.16 (F)
4. Lincoln Boulevard							
Venice to Marina Fwy (SB)	1.34 (F[1])	1.18 (E)	1.46 (F[1])	1.46 (F[1])	1.46 (F[1])	1.46 (F[1])	1.46 (F[1])
Marina Fwy to Venice (NB)	.99 (E)	.94 (E)	.99 (E)	.99 (E)	.99 (E)	.99 (E)	.99 (E)
Venice to Sepulveda (SB)	.98 (E)	.96 (E)	1.07 (F)	1.08 (F)	1.08 (F)	1.07 (F)	1.08 (F)

1 Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

2 Volume/capacity ratios equal to or greater than 1.50.

<u>TABLE 23</u> (continued)

<u>Future (1992) Arterials Deficiency Analyses</u>

<u>V/C Ratio (Level of Service)</u>

	1987 ALT IV	1992 ALT V	1992 ALT VI	1992 ALT VII	1992 ALT IV	1992 ALT IX	1992 ALT X
5. <u>Culver Boulevard</u>							
Vista Del Mar to Jefferson (EB)	1.25 (F[1])	.99 (E)	1.03 (F)	1.03 (F)	1.03 (F)	1.03 (F)	1.03 (F)
6. <u>I-405</u>							
Venice to Manhattan Beach (SB)	1.28 (F[1])	1.53 (F[2])	1.47 (F[1])	1.47 (F[1])	1.47 (F[1])	1.48 (F[1])	1.48 (F[1])
Manhattan Beach Blvd to Venice (NB)	1.26 (F[1])	1.38 (F[1])	1.33 (F[1])	1.33 (F[1])	1.33 (F[1])	1.33 (F[1])	1.33 (F[1])
7. <u>Century Boulevard</u>							
I-405 to Airport Blvd (WB)	1.33 (F[1])	1.27 (F[1])	1.37 (F[1])	1.36 (F[1])	1.35 (F[1])	1.36 (F[1])	1.36 (F[1])
I-405 to LAX (WB)	1.16 (F)	1.22 (F)	1.25 (F[1])	1.25 (F[1])	1.25 (F[1])	1.02 (F[1])	1.25 (F[1])
<u>Imperial Highway</u>							
I-405 to Sepulveda (WB)	1.35 (F[1])	1.21 (F)	1.14 (F)	1.13 (F)	1.13 (F)	1.14 (F)	1.13 (F)
Pacific Coast Highway to Sepulveda (EB)	1.10 (F)	.99 (E)	1.03 (F)	1.03 (F)	1.04 (F)	1.03 (F)	1.03 (F)
9. <u>Compton Avenue</u>							
I-405 to Aviation (WB)	1.31 (F[1])	1.57 (F[2])	1.42 (F[1])	1.40 (F[1])	1.41 (F[1])	1.41 (F[1])	1.41 (F[1])

1 Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

2 Volume/capacity ratios equal to or greater than 1.50.

TABLE 23 (continued)

Future (1992) Arterials Deficiency Analyses

V/C Ratio (Level of Service)

	1987 ALT IV	1992 ALT V	1992 ALT VI	1992 ALT VII	1992 ALT IV	1992 ALT IX	1992 ALT X
10. Aviation Boulevard							
Manhattan Beach Blvd to El Segundo (NB)	1.47 (F[1])	1.30 (F[1])	1.20 (F)	1.20 (F)	1.09 (F)	1.20 (F)	1.20 (F)
Manhattan Beach Blvd to Imperial (NB)	1.32 (F[1])	.90 (E)	.98 (E)	.98 (E)	.98 (E)	.98 (E)	.98 (E)
Manchester to Imperial (SB)	1.13 (F)	.99 (E)	1.16 (F)	1.17 (F)	1.16 (F)	1.13 (F)	1.14 (F)
Imperial to Manchester (NB)	1.02 (F)	1.21 (F)	1.02 (F)	1.02 (F)	1.02 (F)	1.03 (F)	1.03 (F)
11. Sepulveda Boulevard							
Venice to Manhattan Beach Blvd (SB)	1.26 (F[1])	1.22 (F)	1.20 (F)	1.20 (F)	1.17 (F)	1.17 (F)	1.16 (F)
Manhattan Beach Blvd to Venice (NB)	.94 (E)	.89 (D)	1.01 (F)	1.01 (F)	.99 (E)	.99 (E)	.99 (E)
12. Vista Del Mar Avenue							
Manhattan Beach Blvd to Imperial (NB)	1.10 (F)	1.24 (F)	1.08 (F)	1.09 (F)	1.09 (F)	1.07 (F)	1.09 (F)
13. Centinela Avenue							
Venice to Jefferson (SB)	.90 (E)	1.09 (F)	1.06 (F)	1.06 (F)	1.06 (F)	1.03 (F)	1.07 (F)
Jefferson to Sepulveda (SB)	.90 (E)	1.12 (F)	1.10 (F)	1.12 (F)	1.11 (F)	1.11 (F)	1.11 (F)

1 Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

2 Volume/capacity ratios equal to or greater than 1.50.

TABLE 23 (continued)

Future (1992) Arterials Deficiency Analyses

V/C Ratio (Level of Service)

	1987 ALT IV	1992 ALT V	1992 ALT VI	1992 ALT VII	1992 ALT IV	1992 ALT IX	1992 ALT X
14. Inglewood Boulevard							
Venice to Jefferson (SB)	1.03 (F)	1.22 (F)	1.15 (F)	1.15 (F)	1.15 (F)	1.15 (F)	1.15 (F)
15. Pershing Drive							
Manchester to Imperial (SB)	1.08 (F)	1.14 (F)	1.02 (F)	1.02 (F)	1.02 (F)	1.02 (F)	1.02 (F)
16. La Cienega Boulevard							
Century to El Segundo (SB)	1.11 (F)	.74 (C)	.77 (C)	.77 (C)	.77 (C)	.77 (C)	.77 (C)
Manchester to Imperial (SB)	.93 (C)	.99 (C)	1.03 (F)	1.03 (F)	1.04 (F)	1.03 (F)	1.03 (F)
I-405 to Imperial (SB)	1.05 (F)	.88 (D)	.96 (E)	.93 (E)	.97 (E)	.97 (E)	.97 (E)
Imperial to Manchester (NB)	.94 (E)	1.23 (F)	1.14 (F)	1.13 (F)	1.14 (F)	1.13 (F)	1.14 (F)
17. Falmouth Avenue							
Culver to Manchester (SB)	1.46 (F[1])	1.80 (F[2])	1.50 (F[2])	1.50 (F[2])	1.50 (F[2])	1.50 (F[2])	1.50 (F[2])

1 Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

2 Volume/capacity ratios equal to or greater than 1.50.

TABLE 23 (continued)

Future (1992) Arterials Deficiency Analyses

V/C Ratio (Level of Service)

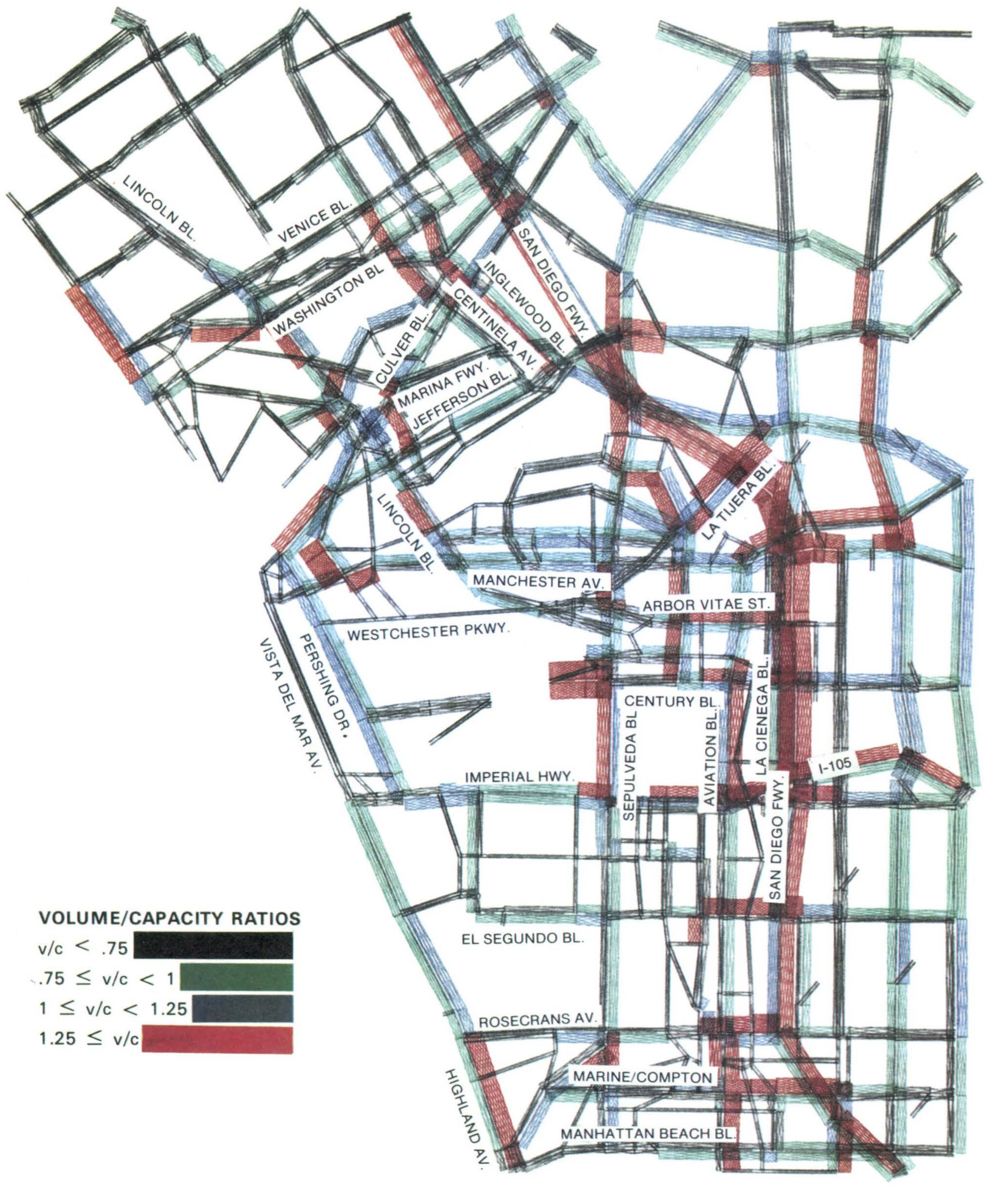
	1987 ALT IV	1992 ALT V	1992 ALT VI	1992 ALT VII	1992 ALT IV	1992 ALT IX	1992 ALT X
18. Admiralty Way							
Mindanao to Culver (SB)	.81 (D)	1.20 (F)	.98 (E)	.96 (E)	.96 (E)	.96 (E)	.96 (E)
19. I-105							
Sepulveda to I-405 (EB)	new	1.33 (F[1])	1.34 (F[1])	1.33 (F[1])	1.33 (F[1])	1.34 (F[1])	1.34 (F[1])
20. Redondo Avenue							
Rosecrans to Marine (SB)	new	.90 (E)	1.08 (F)	1.07 (F)	1.07 (F)	1.07 (F)	1.07 (F)

1 Volume/capacity ratios equal to or greater than 1.25 and less than 1.50.

2 Volume/capacity ratios equal to or greater than 1.50.

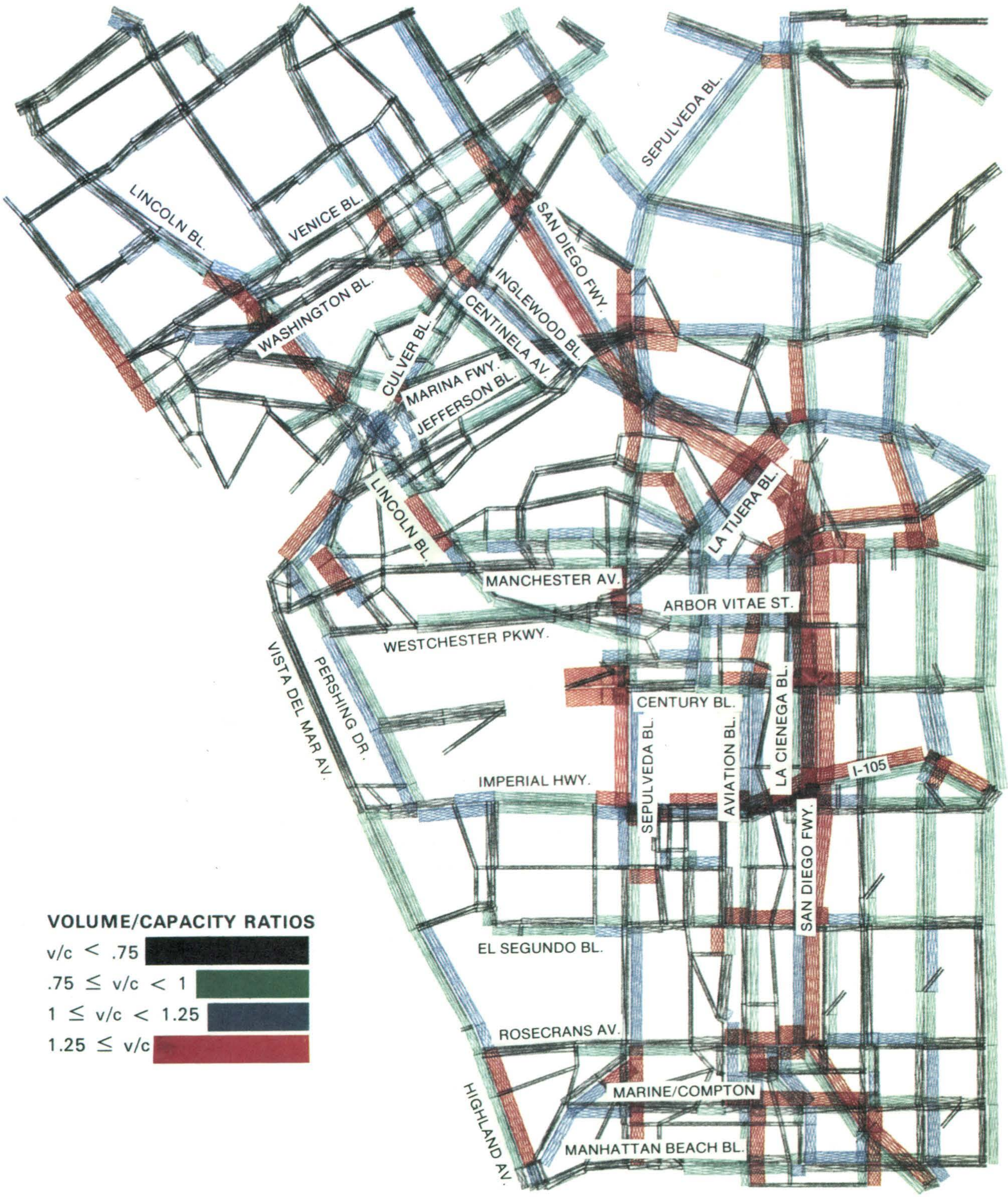
FIGURE 35

LAX AREA TSM/CORRIDOR STUDY



YEAR 1992 ALTERNATIVE 5

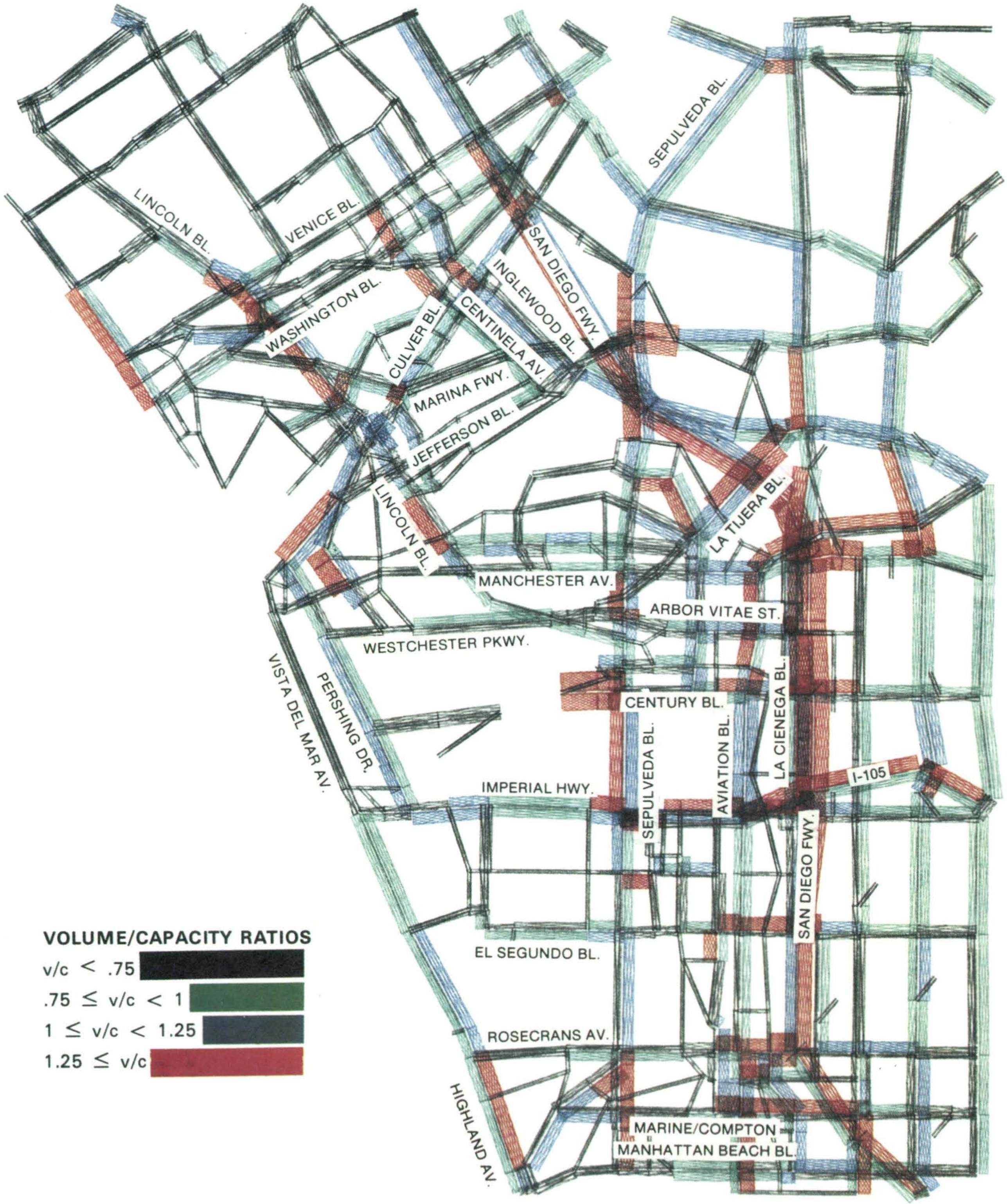
FIGURE 36
LAX AREA TSM/CORRIDOR STUDY



YEAR 1992 ALTERNATIVE 6

FIGURE 37

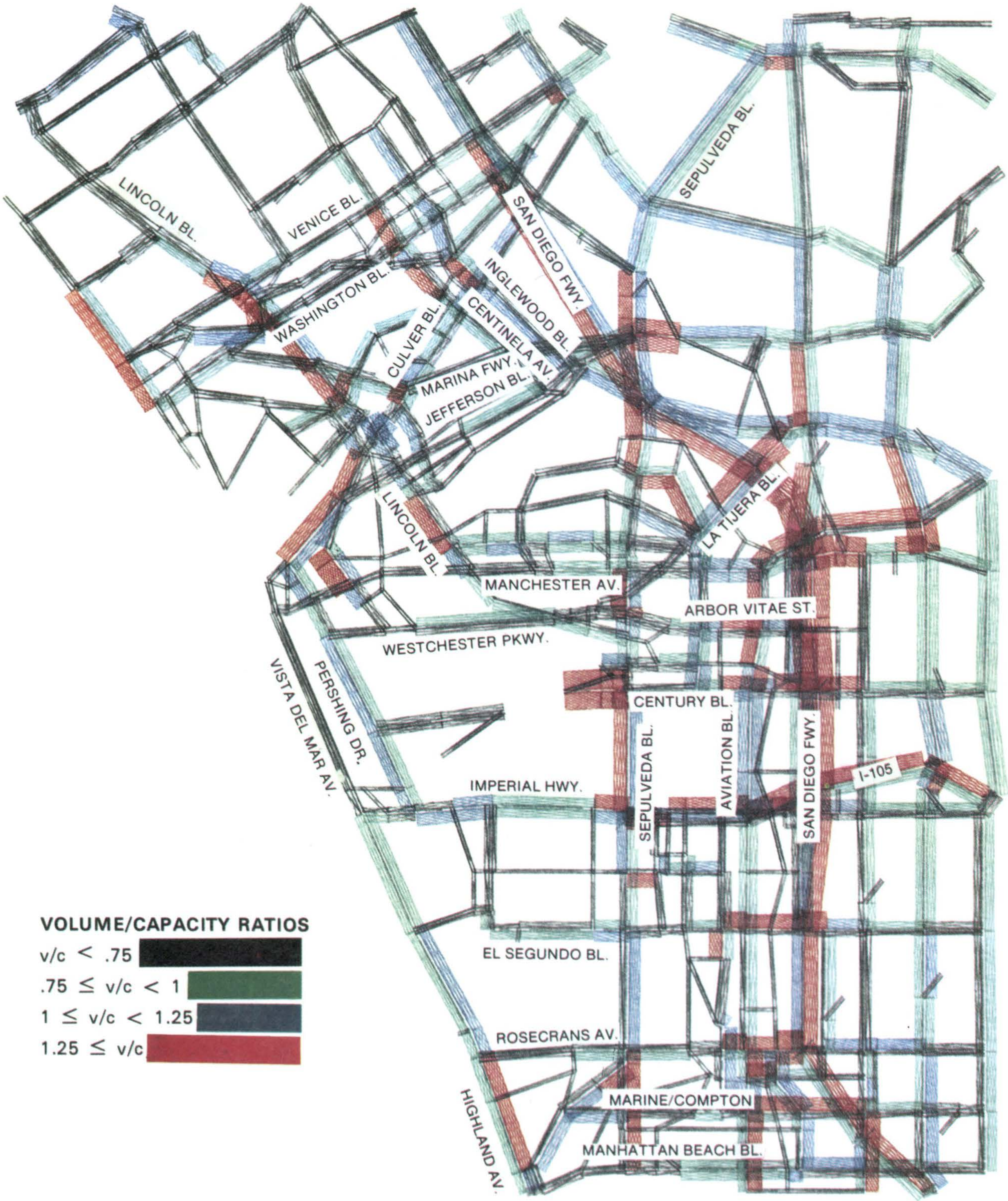
LAX AREA TSM/CORRIDOR STUDY



YEAR 1992 ALTERNATIVE 7

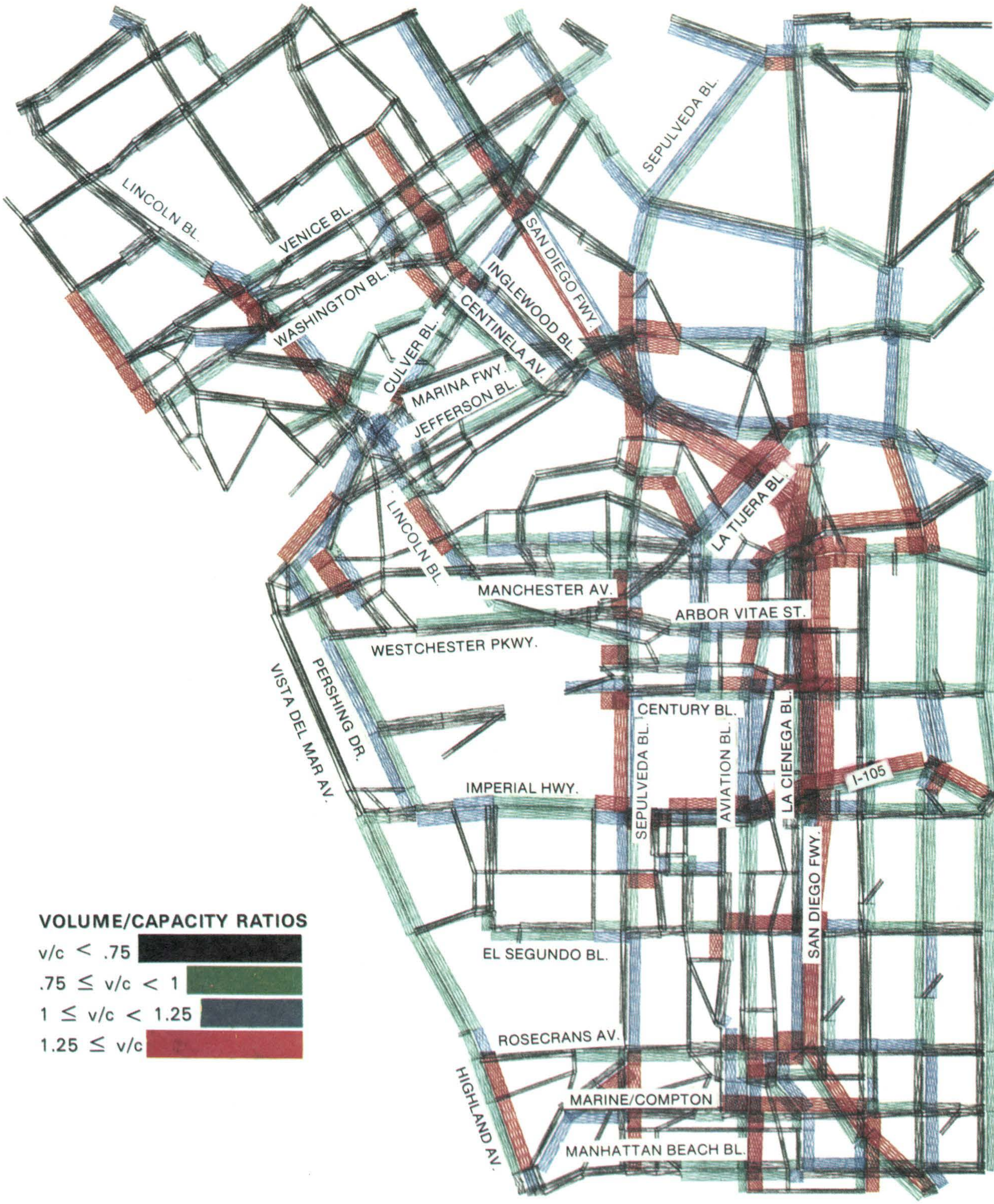
FIGURE 38

LAX AREA TSM/CORRIDOR STUDY



YEAR 1992 ALTERNATIVE 8

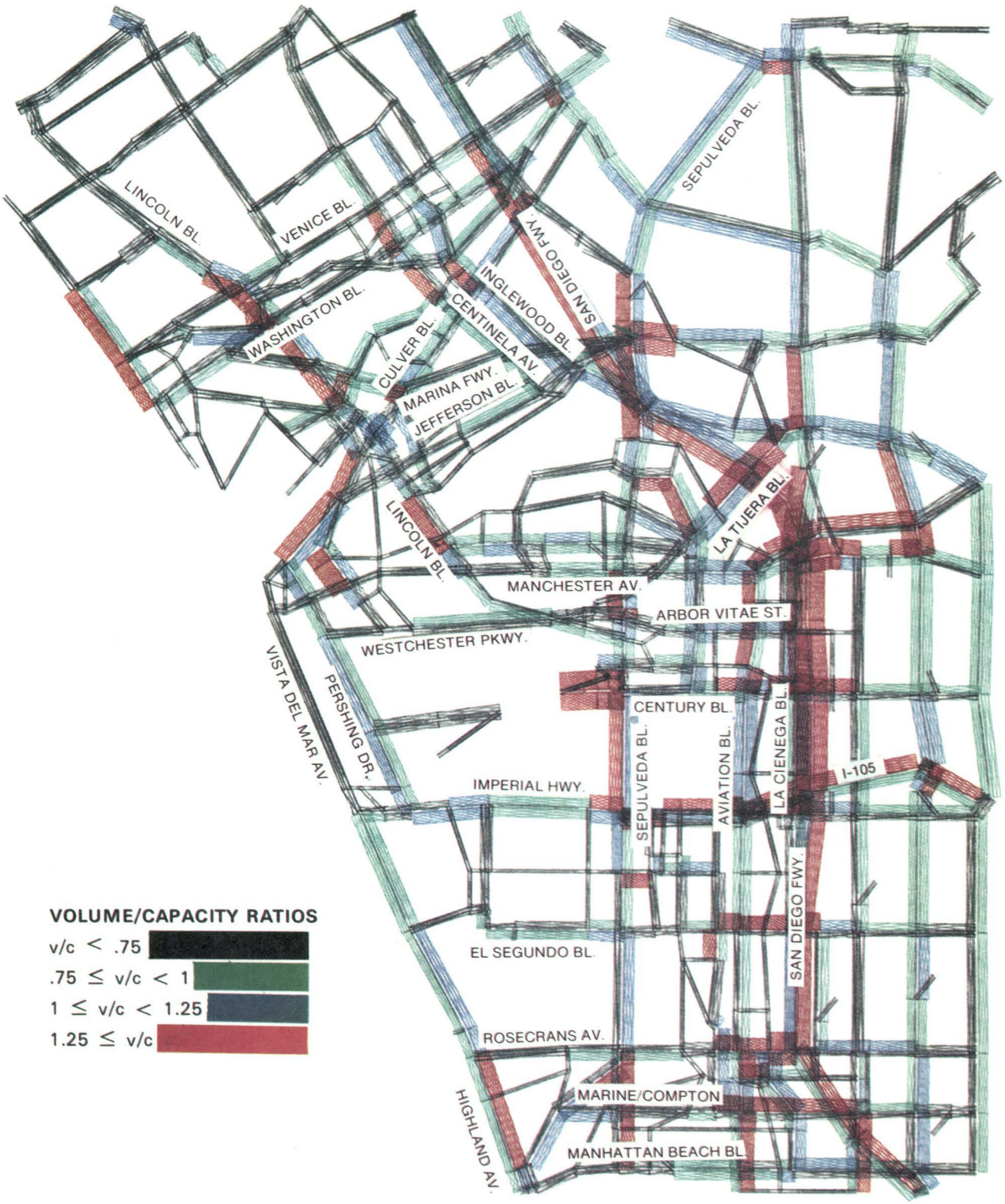
FIGURE 39
LAX AREA TSM/CORRIDOR STUDY



YEAR 1992 ALTERNATIVE 9

FIGURE 40

LAX AREA TSM/CORRIDOR STUDY



YEAR 1992 ALTERNATIVE 10

Implementation of 1992 proposed TSM/Highway improvements (ALT VI) would increase the capacity of the 1992 system while reducing the traffic congestion to the 1987 level. Under this alternative, all arterials either experience an improvement of their level of service or stay at their 1987 level of congestion with the exception of Lincoln Boulevard and Redondo Avenue which experience a further deterioration of their level of service.

As in the case of 1987 bus-transit improvements, the 1992 bus-transit alternative has little effect on the traffic congestion and show small improvements in operational impacts under the 1992 system conditions.

The analysis of rail-transit alternatives reveals a similar result to the bus-transit alternative in terms of level of congestion and capacity improvements in the study area's arterial network. Most arterials will experience a decrease in their morning peak hour volume (Table 24), but again, this decrease is not large enough to have a major impact on the system; this is why the level of service for all the arterials remains unchanged for rail-transit alternatives.

The ineffectiveness of rail-transit alternatives in reducing congestion and improving the mobility of persons in the study area should not necessarily lead to the deletion of a rail-transit alternative from further study as a valuable transit option. The lack of substantial rail-transit ridership could be attributed to the following factors:

a. The majority of trips made to the study area originate from the central and eastern parts of Los Angeles County. The current highway and transit networks do not provide an easy access to the proposed rail-alignment. Therefore, the rail-transit alternative as proposed and will carry mostly those trips which originate in the northern part and just south of the study area, which are not very substantial.

b. The proposed rail-transit is incorporated into the regional network system by connecting with the I-105 Freeway Transitway at the Aviation Terminal. This connection provides for a linkage between downtown Los Angeles and the study area via the north-south Harbor Freeway Transitway and the L. A.-Long Beach LRT. Again, the system is isolated from the south (Orange County) and from western Los Angeles.

c. The projected rail-transit ridership also includes previous bus riders who would readily change modes.

d. SCAG Regional Transportation Modelling System (RTMS) does not predict the transit trips very accurately.

TABLE 24

Future (1992) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 Hours)

	1992 ALT V	1992 ALT VI	Percent Change	1992 ALT VII	1992 ALT VIII	1992 ALT IX	1992 ALT X
1. Rosecrans Boulevard (WB)	2,388	3,666	+54	3,626	3,646	3,632	3,614
I-405 to Aviation (WB)	7,327	5,742	-22	5,675	5,689	5,691	5,690
2. El Segundo Boulevard							
I-405 to Sepulveda (WB)	3,991	3,725	- 7	3,733	3,705	3,722	3,720
I-405 to Douglas (WB)	6,235	5,479	-12	5,520	5,465	5,495	5,488
3. La Tijera Boulevard							
I-405 to Manchester (WB)	2,612	2,677	+ 2	2,680	2,669	2,681	2,667
I-405 to Airport Blvd (WB)	3,437	3,394	-39	3,391	3,372	3,386	3,371
Airport Blvd to I-405 (EB)	2,878	2,784	- 3	2,786	2,871	2,788	2,777
4. Lincoln Boulevard							
Venice to Sepulveda (SB)	3,430	3,856	+12	3,858	3,866	3,854	3,858
Venice to Marina Fwy (SB)	4,252	5,263	+24	5,245	5,251	5,251	5,250
Marina Fwy to Venice (NB)	3,360	3,576	+ 6	3,582	3,573	3,575	3,586
5. Culver Boulevard							
Vista Del Mar to Jefferson (EB)	2,370	2,476	- 5	2,468	2,473	2,464	2,468
6. I-405							
Venice to Manhattan Beach Blvd (SB)	25,012	24,130	- 4	24,022	24,020	24,107	24,012
Manhattan Beach Blvd to Venice (NB)	22,610	21,886	- 3	21,698	21,693	21,791	21,678

TABLE 24 (continued)

Future (1992) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 Hours)

	1992 ALT V	1992 ALT VI	Percent Change	1992 ALT VII	1992 ALT VIII	1992 ALT IX	1992 ALT X
7. Century Boulevard							
I-405 to LAX (WB)	4,479	4,606	+ 3	4,578	4,586	4,580	4,584
I-405 to Airport Blvd (WB)	6,085	6,558	+ 8	6,515	6,499	6,545	6,526
8. Imperial Highway							
I-405 to Sepulveda (WB)	4,354	4,074	- 6	4,052	4,057	4,069	4,041
Pacific Coast Highway to Sepulveda (EB)	2,357	2,481	+ 5	2,480	2,487	2,469	2,478
9. Compton Avenue							
I-405 to Aviation (WB)	3,756	3,391	-34	3,357	3,369	3,372	3,340
10. Aviation Boulevard							
Manhattan Beach Blvd to Imperial (NB)	2,857	2,951	+ 3	2,979	2,984	2,939	2,979
Manchester to Imperial (SB)	2,979	3,438	+15	3,441	3,440	3,424	3,430
Manhattan Beach Blvd to El Segundo (NB)	3,627	3,158	-13	3,148	3,150	3,147	3,146
Imperial to Manchester (NB)	3,716	3,124	-16	3,114	3,108	3,116	3,163
11. Sepulveda Boulevard							
Venice to Manhattan Beach Blvd (SB)	4,688	4,594	- 2	4,588	4,447	4,432	4,431
Manhattan Beach Blvd to Venice (NB)	3,532	4,000	+13	3,991	3,921	3,941	3,928

TABLE 24 (continued)

Future (1992) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 Hours)

	1992 ALT V	1992 ALT VI	Percent Change	1992 ALT VII	1992 ALT VIII	1992 ALT IX	1992 ALT X
12. Vista Del Mar Avenue							
Manhattan Beach Blvd to Imperial (NB)	2,214	2,032	- 8	2,032	2,032	2,000	2,024
13. Centinela Avenue							
Venice to Jefferson (SB)	2,614	2,548	- 3	2,541	2,548	2,455	2,552
Jefferson to Sepulveda (SB)	4,029	3,968	- 2	3,988	3,987	3,952	3,974
14. Inglewood Boulevard							
Venice to Jefferson (SB)	2,299	2,165	- 6	2,163	2,165	2,489	2,164
15. Pershing Drive							
Manchester to Imperial (SB)	4,105	3,657	-11	3,670	3,661	3,665	3,665
16. La Cienega Boulevard							
Century to El Segundo (SB)	1,771	1,855	+ 5	1,844	1,854	1,844	1,850
Manchester to Imperial (SB)	2,380	2,476	+ 4	2,472	2,492	2,455	2,469
I-405 to Imperial (SB)	2,099	2,292	+ 9	2,210	2,326	2,307	2,322
Imperial to Manchester (NB)	2,932	3,124	+ 7	2,722	2,734	2,716	2,724
17. Falmouth Avenue							
Culver to Manchester (SB)	2,954	2,462	-17	2,455	2,460	2,461	2,461

TABLE 24 (continued)

Future (1992) Arterials Deficiency Analyses

Morning Peak Period Volumes (2 Hours)

	1992 ALT V	1992 ALT VI	Percent Change	1992 ALT VII	1992 ALT VIII	1992 ALT IX	1992 ALT X
18. Admiralty Way							
Mindanao to Culver (SB)	2,872	2,359	-18	2,292	2,304	2,299	2,298
19. I-105							
I-405 to Sepulveda (WB)	13,595	13,670	+ 1	12,617	13,650	13,652	13,623
20. Redondo Avenue							
Rosecrans to Marine (SB)	2,805	3,893	+39	3,869	3,862	3,870	3,861

Table 25

Arterial Traffic Volume Increases
Morning Peak Period Volumes (2 Hours)

1980-1992

	1980 ALT I	1987 ALT IV	Percent Change Over 1980	1992 ALT X	Percent Change Over 1980	Percent Change Over 1987
1. Rosecrans Boulevard						
I-405 to Sepulveda (WB)	3,476	4,141	+19	3,614	+ 4	-13
I-405 to Aviation (WB)	4,417	6,227	+41	5,690	+29	- 9
2. El Segundo Boulevard						
I-405 to Sepulveda (WB)	3,562	4,486	+26	3,720	+ 4	-17
I-405 to Douglas (WB)	3,766	6,073	+27	5,488	+15	-10
3. La Tijera Boulevard						
I-405 to Manchester (WB)	2,133	2,737	+28	2,667	+25	- 3
I-405 to Airport Blvd (WB)	2,691	3,427	+27	3,371	+25	- 2
Airport Blvd to I-405 (EB)	2,495	2,572	+ 3	2,777	+11	+ 8
4. Lincoln Boulevard						
Venice to Sepulveda (SB)	2,791	3,583	+28	3,858	+38	+ 8
Venice to Marina Fwy (SB)	3,765	4,836	+28	5,250	+39	+ 9
Marina Fwy to Venice (NB)	3,471	3,551	+ 2	3,586	+ 3	+ 1
5. Culver Boulevard						
Vista Del Mar to Jefferson (EB)	2,775	3,050	+32	2,468	+39	+ 5

Table 25 (continued)

Arterial Traffic Volume Increases
Morning Peak Period Volumes (2 Hours)

1980-1992

	1980 ALT I	1987 ALT IV	Percent Change Over 1980	1992 ALT X	Percent Change Over 1980	Percent Change Over 1987
6. I-405						
Venice to Manhattan Beach Blvd (SB)	16,220	21,840	+35	24,012	+48	+10
Manhattan Beach Blvd to Venice (NB)	16,165	21,320	+32	21,678	+34	+ 2
7. Century Boulevard						
I-405 to LAX (WB)	3,536	4,973	+41	4,584	+30	- 8
I-405 to Airport Blvd (WB)	5,534	6,364	+15	6,526	+18	+ 3
8. Imperial Highway						
I-405 to Sepulveda (WB)	3,876	6,841	+76	4,041	+ 4	-41
Pacific Coast Highway to Sepulveda (EB)	1,753	2,633	+50	2,478	+41	- 6
9. Compton Avenue						
I-405 to Aviation (WB)	1,992	3,223	+62	3,340	+68	+ 4
10. Aviation Boulevard						
Manhattan Beach Blvd to Imperial (NB)	2,763	3,029	+10	2,979	+ 8	- 2
Manhattan Beach Blvd to El Segundo (NB)	2,977	3,516	+18	3,146	+ 6	-11
Manchester to Imperial (SB)	2,756	3,120	+13	3,430	+24	+10
Imperial to Manchester (NB)	2,275	3,014	+32	3,163	+39	+ 5

Table 25 (continued)

Arterial Traffic Volume Increases
Morning Peak Period Volumes (2 Hours)

1980-1992

	1980 ALT I	1987 ALT IV	Percent Change Over 1980	1992 ALT X	Percent Change Over 1980	Percent Change Over 1987
11. Sepulveda Boulevard						
Venice to Manhattan Beach Blvd (SB)	4,412	4,715	+ 7	4,431	0	- 6
Manhattan Beach Blvd to Venice (NB)	3,585	3,612	+ 1	3,928	+10	+ 9
12. Vista Del Mar Avenue						
Manhattan Beach Blvd to Imperial (NB)	1,728	2,077	+20	2,024	+17	- 3
13. Centinela Avenue						
Venice to Jefferson (SB)	1,910	2,197	+15	2,552	+34	+16
Jefferson to Sepulveda (SB)	3,022	3,339	+10	3,974	+32	+19
14. Inglewood Boulevard						
Venice to Jefferson (SB)	1,671	1,921	+15	2,164	+30	+13
15. Pershing Drive						
Manchester to Imperial (SB)	2,884	3,936	+36	3,665	+27	- 7
16. La Cienega Boulevard						
Century to El Segundo (SB)	2,793	2,664	- 5	1,850	-34	-31
Manchester to Imperial (SB)	2,641	2,278	-14	2,469	- 7	+ 8
I-405 to Imperial (SB)	2,939	2,558	-13	2,322	-21	- 9
Imperial to Manchester (NB)	2,276	2,295	+ 1	2,724	+20	+19

Table 25 (continued)

Arterial Traffic Volume Increases
Morning Peak Period Volumes (2 Hours)

1980-1992

	1980 ALT I	1987 ALT IV	Percent Change Over 1980	1992 ALT X	Percent Change Over 1980	Percent Change Over 1987
17. Falmouth Avenue						
Culver to Manchester (SB)	--	2,418	--	2,461	--	+ 2
18. Admiralty Way						
Mindanao to Culver (SB)	--	1,946	--	2,298	--	+18
19. I-105						
I-405 to Sepulveda (WB)	--	--	--	13,623	--	--
20. Redondo Avenue						
Rosecrans to Marine (SB)	--	--	--	3,861	--	--

Table 25 presents existing and future average morning peak period volumes for each arterials and their percentage changes over the existing demand volume. 1987 alternative IV and 1992 alternative X demand volumes were used to compare the best-case alternatives for each year. Both alternatives assumed that all TSM/Highway, bus-transit and rail-transit (for 1992) improvements are in place. Table 25 indicates that 1987 and 1992 average traffic volumes in all the arterials within the study area are expected to increase by 24 percent from 1987 traffic volumes. This may be due to the provision of rail-transit, bus-transit and TSM/Highway improvements. In the absence of these improvements, 1992 average traffic volumes would have increased by 27 percent; this indicates that a 3 percent reduction in average traffic volumes for year 1992 can be obtained if the proposed improvements are implemented.

From the above analysis one concludes that without any major new facility infrastructure, corridors which presently have congestion problem would continue to experience severe congestion in the future.

VI. FINANCE

A. Introduction

The purpose of this chapter is to provide information on the financial aspects of the packages analyzed in this study and to identify those financial and economic issues that need further study. The effort here is limited by the information available at this time. These limits are especially constraining when we examine the available data for rail improvements which are not as detailed as the TSM/Highway improvement. Therefore, many decisions that will ultimately be made should await further studies.

B. Costs of Packages

This chapter deals with Packages V through X, analyzed in this study. They are described as Multimodal Packages in chapter IV (pages 64-68) and were modelled for the year 1992 (model runs 5 through 10, listed in table 10).

Package V is the base 1992 highway and transit system. It contains improvements likely to be in place by 1992 and is our baseline for analysis here. We therefore refer to it as the NO BUILD package. Its cost is assumed to be already part of the baseline and is therefore not dealt with here.

Package VI is the TSM/highway improvements which have so far been the focus of this study. Despite the fact that a great deal of information is available about it, accurate cost estimates are not yet available. For purposes of estimating the cost effectiveness of this package (see below), however, an order of magnitude cost was estimated. This "educated guess" was in the $5-20 million range.[5] We would have stated the costs of all other Packages interms of Package VI if we had a better estimate of the cost involved. In the absence of such an estimate, we will state the costs "in addition to" the cost of Package VI.

Package VII, the "TSM/highway plus Bus" improvements, adds a doubling of private sector bus operations in the area to Package VI. Its total cost, for capital and operations, would be $1.8 million per year. This estimate was arrived at on the basis of unit costs for selected private bus operations already being carried out in the Study Area.

No package for public bus improvements is now contained in this Study. One of the recommendations growing out of the analysis in this chapter is that such a package or packages be developed in the next phase of the Study. It would fill the

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5 All sums are in FY 1983 dollars.

analytical gap now present between the fairly immediate and modest packages above and the rail packages below.

Packages VIII, IX, and X are the three rail improvements. All include Package VII, and therefore Package VI, as well as the rail line that pertains to each of them. In other words, each proposed rail package includes the TSM/highway and private bus components of the other packages.

The annualized cost of Package VIII (Hawthorne Rail) is 26.8 million per year. This includes the $1.8 million per year cost of the bus component (Package VII) as well as the $25 million per year additional investment of the Hawthorne Rail line. The 25 million per year in rail costs is, in turn made up of $7.3 million per year in operations costs and $17.7 million per year in annualized capital costs. This capital figure represents annualized value of $347 million capital cost of the project stretched over 30 years at a 3% real interest rate.

Information has recently come to our attention from the Los Angeles County Transportation Committee (LACTC) staff that they expect operations costs for all three rail packages to be less than our estimates here. If this turns out to be so as the design of the rail alternative becomes more specific, $3-4 million per year could be saved from the operations costs stated here.

Package IX (Redondo Rail) is less expensive than Package VIII, especially in terms of capital costs which total $247 million, or $12.6 million per year in annualized terms. Rail operations would cost an additional $6.2 million per year bringing total rail investment in annualized terms to $18.8 million per year. When the private bus component is added, total package IX costs are $20.6 million per year above Package VII.

Package X combines both rail lines at a total capital cost of $375 million, or $19.1 million per year in annualized terms. Costs of operations jump relatively more, in comparison to the other rail lines, to $10.7 million per year. Total annualized rail investment is therefore $29.8 million per year. Total Package X costs, beyond Package VII, are therefore 31.6 million per year.

C. Financial Resources

Now that we have some idea of the costs of the various Packages, the question is that of identifying potential resources to cover these costs.

The base data for estimating future financial resources are summarized in Technical Appendix D of the Draft Regional Transportation Plan 1984. Reference should be made to that Appendix, as well as to the 1984 RTP Financial Element as questions arise. No one knows how much money will be available in the future, let alone what it will be capable of buying (i.e., its "real" values). These documents show and explain our assumptions about the future of transportation funding in enough detail to be dealth with critically.

Time, as well as amounts of money, is a key consideration in determining potential resources. Our analysis here, therefore, deals with the packages that now seem more immediate -- Packages VI and VII -- separately from those that may be built later or, in any case, probably not before Packages VI and VII.

Financial resources for the actions called for in package VI, TSM and highway improvements, may be provided from the federal, state, and local levels of government as well as the private sector. The ability to use these sources depends upon the nature of each project on a case-by-case basis. <u>These projects must compete with others</u> throughout the local jurisdictions in which they are located and, in some cases, even throughout the state:

1. Federal Resources for Street + Roads and Highways

   The allocation of federal support is by and large controlled by the state through the State Transportation Improvement Program (STIP) process. The federal assistance for highways is allocated using such criteria as cost-effectiveness and geographic apportionment formulae. The following list of federal programs identifies the uses to which each program can be put, the portion of the total project cost that can be covered and the manner in which the funds are allocated by the State.

   Federal Aid Interstate (FAI) is restricted for use in constructing the Interstate Highway System. For the LAX Area TSM/Corridor Study, only I-405 (San Diego Freeway) and I-105 (Century Freeway) are eligible for these funds, which are allocated by the STIP process. Highway widenings and interchanges may be built with these funds. They cover 90% of the costs of such construction, the State supplying the remaining 10%. <u>No such projects are contained in Package VI</u>, although some work intersecting these FAI routes may be eligible.

Federal Aid 4-R (FIR) is available for resurfacing, restoring, rehabilitating, and reconstructing (the 4 "Rs") interstate highway facilities. Restriping, fifth "R", is included in this list. These funds may pay for up to 80% of the project cost. The remaining 20% is provided by the State. They are allocated via the STIP process. Here too, Package VI contains no such projects, although some work in intersecting areas may be eligible.

Federal Aid Primary (FAP) is made available for other principal highways outside of the interstate system, such as Route 90 (Marina Freeway). Both new construction and rehabilitation can be financed with these funds up to 80% of the project costs. The remaining 20% is provided by the State. Allocated by the STIP process, the FAP program provides funding for a wide array of projects. Therefore, it is among the most sought after sources of federal assistance in the State. In addition it is very difficult for projects in counties like Los Angeles, which have FAI routes, to get since counties without FAI routes like Ventura, are more likely to get FAP funds.

Federal Aid Urban (FAU) assistance is subvened to local jurisdictions as part of the Local Assistance Program from the State Highway Account (SHA). FAU designated routes in the LAX Area TSM/Corridor Study include Sepulveda Boulevard and Manchester Avenue. FAU funds can be used for construction, rehabilitation, and widening of such designated routes. Up to 80% of project cost can be paid for out of these funds. The remaining 20% of costs are matched by state or local funds depending upon whether or not it is deemed to have "state-wide significance." Any FAU eligible projects in the Study Area would have to complete with other projects in Los Angeles County.

2. State Funding Resources for Streets + Roads and Highways

As mentioned above, the State provides some of the matching funds for federally funded programs from the SHA. Beyond this, the Transportation Planning and Development Account (TP&D) provides funding for railroad grade separations. The Unified Transportation Fund (UTF) may also be used, but both of these funds are dwindling barring another major energy crisis, and are not likely to provide significant assistance in the near future.

3. Local Resources for Streets + Roads and Highways

Local funding for LAX Area TSM/Corridor Study projects would come out of the streets and roads programs of local jurisdictions. These projects must compete against other projects in each locality for what is considered to be the scarcest resource in the surface transportation system.

Nevertheless, these local jurisdictions have the fiscal authority to pay for streets and roads projects out of funds raised by several fee and taxation mechanisms. Here follows a list of potential resources starting with the most conventional.

Almost half of the 9 cents/gallon fuel tax collected by the state is subvened to local jurisdictions for construction, rehabilitation, and maintenance of their streets and roads network. This source accounts for approximately one-third of the costs of the streets and roads programs in the SCAG region.

Benefit assessment districts are common throughout California for many public facilities and services, including those related to streets and roads, street lighting, road construction and improvements, flood control, and the like. Several approaches to instituting benefit assessment districts are defined in the California Code, most related to legislation passed in 1911, 1913, and 1947. Street frontage is often the base used for assessing each landowner's share of the public expense, but any attribute of land and improvements (except market value) that is related to the benefit conferred by the proposed public works project may be used to base assessments.

Developer exactions for providing public infrastructure are defined in the Subdivision Map Act. These exactions are paid either in currency as a developer fee or in-kind by the developer's providing the facilities directly. Developer agreements have expanded the applicability and flexibility of this method of financing public works.

Collectively, benefit assessments, developer exactions, and developer agreements have provided 15% of the streets and roads program in the SCAG region, about twice the amount of federal assistance through the FAU and FAS (Federal Aid Secondary) programs.

4. Summary

In summary, it appears that the improvements in Package VI must compete on a case-by-case basis with other proposals. FAI funding is probably not available for the projects listed (see page 68) in any more than the most tangential way. FAP funding, while an obvious source for Marina Freeway work, is difficult to get due to intense statewide competition. FAU, local, and private funding seem to be more likely sources for Package VI. FAU funding will depend on relative countywide priorities for that catagory. Local funds will depend on local relative priorities.

Private and value capture sources will depend on the special benefits the projects would confer on private entities.

Resources for the private bus component of Package VII would be available from private employers in the Study Area on the basis of their desire to provide such service. Cost-effectiveness of additional private bus operations would presumeably be foremost in their consideration of such proposals.

Resources for Package VIII, IX, and X are potentially available from sources which fund Public Transportation in general. As such, the rail projects would have to compete with existing and future proposed public transit of all kinds for operating subsidies. In terms of capital funds, the main area of competition would seem to be with other possible Proposition A rail lines. The relative attractiveness of these packages and where they might fit in to an overall Proposition A system are probably the central issues in determining their fundability by LACTC. What follows is a summary of resources for public transit that should put these conclusions in context and also provide a context for any public bus packages that may be developed in the future:

5. Resources for Public Transportation

Financial resources for public transportation also originate from all three levels of government and the private sector. The following funding programs and mechanisms are described in relation to the construction and operation of the rail packages modeled in this study.

a. Federal Resources:

Federal resources are administered through the Urban Mass Transportation Administration (UMTA) in accordance with the Federal Public Transportation Act of 1982. Rail projects in the LAX Area TSM/Corridor Study area could compete regionally (Los Angeles County, Orange County, and the West Valley area of San Bernardino County) for Section 9 operating and capital assistance and nationally for Section 3 assistance for new rail starts. Section 9 money is a block grant of about $160 million per year to the Los Angeles-Long Beach urbanized area. To compete for these funds is to engage in a regional zero-sum game. Section 3 "new rail" money amounts to about $400 million per year nationwide. Claims for it must compete with many new rail starts throughout the nation, many of which are even now experiencing difficulty in securing sufficient federal assistance.

Local jurisdictions must match Section 9 money with 20% of project cost and Section 3 with at least 25% of project cost. The "going rate" for local match of Section 3 funds is 38%.

b. State and Local Resources:

State funds for transit assistance include TDA, TP&D, and Article XIX Highway money. TDA is a 1/4% sales tax on all taxable items. It is apportioned to counties on a county sales basis and to transit operators according to a formula based upon the population of their service area and their vehicle hours of operation. For Los Angeles County, TDA provides $140 million/annually. Most of these funds subsidize operations, but at least 15% must be used for capital and maintenance.

TP&D, as mentioned above, has been shrinking of late due to the softness of gasoline prices. It is also a prime target during periods of state budgetary shortfalls. Under this source, 60% is apportioned by population to each county as State Transit Assistance (STA). About 25% is allocated at the discretion of the California Transportation Commission (CTC) for public transit capital projects. If fully funded, statewide TP&D would amount to about $140 million annually.

Article XIX highway funds for transit guideway construction are distributed through the STIP process Highway maintenance and rehabilitation needs have priority for these funds. The need for funding these priorities is growing, so few new commitments from this resource for transit guideway construction appear likely to materialize in the near future.

Proposition A funding for Los Angeles County is a $250 million per year funding source of public transit assistance. A quarter of this amount, over $60 million annually, is allocated by population to local jurisdictions for the purpose of assisting local transit needs under the local return program. Beginning in 1985, 35% of these funds, or $80 million per year, is earmarked for constructing rail systems within the county. The remaining 40% is to be allocated at the discretion of the Los Angeles County Transportation Commission (LACTC). Proposition A is the most promising source of funding the rail packages of the LAX Area TSM/Corridor Study. In fact, the Marina-Hawthorne rail line is among LACTC's Phase II projects now being analyzed.

At the local level, the local return program of Proposition A and value capture mechanisms are the most promising sources of support. Value capture includes such mechanisms as benefit assessments and developer exactions discussed earlier in this chapter.

D. Cost Effectiveness

Cost-effectiveness analysis measures benefits created by the expenditure of money in certain ways. When examining alternative transportation investments, including the decision not to invest, cost-effectiveness measures can help in evaluating which alternatives are preferable to others. Like all measures, however, cost-effectiveness must be viewed within the context of its assumptions. Here, we have attempted to have those assumptions conform as closely as possible to observed behavior. The value of travel time, for instance, is set at an average of $3.20/hour--a sum equal to 40% of the average wage. Studies of how people make choices involving tradeoffs between time and money indicate that they value their travel time at about 40% of what they earn per hour at their work.

A second factor to keep in mind is that any measure of cost-effectiveness, however sophisticated, is never complete, but rather limited by available data. In our analysis here, for instance, overall travel time differences among transit alternatives were not available. This large factor, used in our comparison of the TSM alternative to the Base Alternative (Table 26), was therefore left out of our comparison of transit alternatives. Data on gasoline saved by more quickly moving traffic was likewise unavailable. What was available to us on a reliable basis was used: the value of travel time savings created by TSM and the number of transit trips created by each incremental transit investment alternative. Reading the "results" within these limits can still be quite helpful in the decision-making process.

A final factor to remember is that cost-effectiveness is a relative term used to describe the relative economy of taking one path rather than another toward a stated goal or set of goals. Given the goal (e.g., minimizing travel time congestion in a given area), investment alternatives can be rank-ordered in terms of their effectiveness. If anything is to be spent on reaching the goal, cost-effectiveness measures can at least help in avoiding spending it in a mistaken way. This does not mean, however, that there are not other goals, even ones related to transportation, for which the same money can be spent. Whether a specific entity of government or a private entity chooses to spend money reaching one goal or another in cost-effective ways has to do with the relative value of competing goals to them. It is, therefore, a policy rather than technical question at that level.

E. Relative Cost-Effectiveness of the Packages

Due to the lack of data on travel time savings, the relative cost-effectiveness of the rail packages cannot be determined. Keeping in mind the limitations outlined above as well as the fact that the packages presented here are not the only ones possible, it appears that the TSM package is clearly cost-effective. The proposed Bus package is cost-effective if those who are expected to fund it, value each additional employee trip at $4.32, or close to double what they are now spending on each trip. Since this is not an outrageously high cost, but clearly higher than what is currently expended, it may be a close question for many private employers and their employees.

TABLE 26 shows that the TSM projects envisioned in the TSM package would increase traffic speeds from 19.3 to 20.6 mph in the study area. This would decrease morning congestion alone by nearly a million person-hours per year in the study area. Evening rush-hour travel time saved would be twice this, since they are twice as long as morning rush hours. The value of travel time savings, at $3.20/hour, would be over $9 million per year in 1982 dollars. The amortized value of that travel time savings would be $182 million in 1982 dollars (@ 3% real rate of interest over 30 years). Since the TSM investment contemplated by this alternative will probably cost nowhere near this amount of $182 million, it is clearly cost-effective on this basis alone.

As was pointed out above, the Bus Package VII costs $4.32 for each additional transit trip it creates. While this is double that currently experienced, it may still be a wise investment for many employers. Transit patronage is increasedby 416,000/year at a cost of $1.8 million/year.

While the relative cost-effectiveness of the rail packages cannot be determined, it is apparent from the modelling results that they would produce very little additional transit patronage for the additional investment they would require if any of them were to be built without the benefit of other rail lines to connect to. Standing alone, the Hawthorne rail line creates only 713,000 more transit trips per year for the additional $25 million per year annualized investment. The Redondo Rail line is even less attractive with 177,000 new transit trips per year for its $18.8 million per year annualized cost. A combination of both lines would cost only $4.8 million per year more than the Hawthorne line alone, but would produce only 36,000 more trips per year than the Hawthorne line alone. We do not know, however, how many more trips would be carried by these lines if they were to interconnect with a wider rail system. This is more than an hypothetical question in view of the likelihood of the early completion of the I-105 transitway and LACTC's plans for a Proposition A system. Finally, there is no assurance that the

Hawthorne rail line would still be preferable to the Redondo line if they were both to be modelled in the context of wider systems.

A determination of the relative cost-effectiveness of Packages VIII, IX, and X awaits modelling them as part of a larger system and obtaining travel time delay and other data from such modelling.

TABLE 26

TSM Package vs. No Build Package

	TSM PACKAGE	NO BUILD PACKAGE
Daily Auto VMT, Arterials	920,294	913,122
Avg. Vehicle Occupancy	1.18	1.18
Avg. Auto Speed (mph)	20.9	19.3
Daily Person Hours	51,959	55,828
Annual Person Hours (000 hrs)	12,990	13,957
Annual A.M. Travel Time Cost ($ 000s, FY82)	41,576	44,663
Annual A.M. + P.M. Time Cost ($ 000s, FY82)	124,702	133,988
Annual Travel Time Savings ($ 000s, FY82)	9,288	Base
Amortized Value of Travel Time* Savings ($ Millions, FY82)	182	Base

* @ 3% real interest rate, 30 year amortization.

VII. CONCLUSION, ISSUES AND IMPACTS

This report, which concludes Phase I of the LAX Area TSM/Corridor Study, presents results of an analysis of: (1) the transportation facilities currently serving the LAX study area, (2) the ability of these facilities to serve current demand, (3) the projected demand which would accrue from implementation of major developments as they are now planned, and (4) the effect various system improvements would have in meeting the highest demand.

This chapter will also formulate some policy questions, the answers to which may mitigate expected traffic impacts associated with the existing land use configuration within the study area, as well as those applicable to new developments now in the planning stages. Furthermore, some of the proposed TSM/Highway improvements which are least controversial and are most cost effective are identified and recommended for implementation. From review of the technical analyses and discussion of policy questions and how they relate to the Regional Transportation Plan, the Policy Advisory Committee would then formulate recommended policies for action.

In August, 1982, when SCAG began this study, local jurisdictions in the study area indicated that they were planning for developments during the next ten years which cumulatively would greatly exceed the employment projections in the Regional Development Guide (SCAG-82). Further, an additional 60,000 jobs had been projected in the study area as a result of federal defense contracts.

Based on these facts, the study's Policy Advisory Committee agreed that analysis should first consider the transportation impacts and short-term mitigation measures for this extraordinary increase in demand upon the study area's transportation facilities. Phase II of the study will analyze demand at low and intermediate levels of development.

The data are not surprising; however, to assess the output accurately the reader should be aware of several factors which have not been accounted for in the modelling. These factors, taken together, could mean that actual future conditions will be significantly better than the numerical results imply. For example, the model cannot accurately quantify the impacts of demand management strategies such as ridesharing incentives, bicycling promotion, parking management and flexible work hours, even though it can predict the number of the home-to-work trips in car and van pools. The model also does not reflect the impacts of proposed transportation engineering measures such as intersection improvements and traffic signal synchronization on the study area's network. Furthermore, public bus system improvements, which constitute an important component of transportation planning, were not studied due to perceived funding constraints; therefore, no increase in public transit service was added to the transit network of the modelling process. The Phase II analysis will be designed to reflect their benefits to mobility in the study area.

A. Technical Findings

This section presents the technical findings of the LAX Area TSM/Corridor Study Phase I. These findings are drawn from the analysis of the traffic congestion problems existing currently and those which can potentially accrue from the implementation of major developments as they are now planned. The findings are:

1. TSM/Highway improvements evaluated in this study will only partially improve circulation and reduce the level of traffic congestion.

2. Future adverse traffic impacts will not be confined to any one area within the study boundaries.

3. Approximately 41 million square feet of new development have been proposed for the study area for the year 2000.

4. Population in the study area is projected to increase 6 percent by 1987, and 10 percent by 1992, while employment is projected to increase 48 and 78 percent respectively. Employment will exceed population by 35 percent in 1987 and by 56 percent in 1992.

5. Home-based-work trip attractions to the study area are estimated to increase 46.6 and 71 percent (over 1980) by 1987 and 1992 respectively.

6. Home-based work trip productions within the study area are estimated to increase 6.4 and 9.5 percent (over 1980) by 1987 and 1992 respectively.

7. Currently, there is little available capacity in the north-south arterials, while east-west arterials experience a somewhat lesser degree of congestion.

8. Under projected traffic volumes and in the absence of any improvements, all arterials will experience either a deterioration in level of service or stay at their current level of service.

9. North-south oriented arterials show an average traffic volume increase of 14 percent and east-west oriented arterials show an average traffic volume increase of 39 percent by 1987 (over the 1980 traffic volumes).

10. North-south oriented arterials show an average traffic volume increase of 20 percent and east-west oriented arterials show an average traffic volume increase of 33 percent by 1992 (over the 1980 traffic volumes).

11. Under the best 1987 and 1992 scenarios, the average traffic volumes in all the arterials will still increase by 27 and 23 percent respectively (over the 1980 average traffic volumes).

12. The proportion of congested miles of major arterials in the study area increases from 25 percent in 1980 to 33 percent in the best 1992 scenario evaluated in this study, an increase of 8 percentage points from 1980.

13. TSM/Highway improvements proposed for 1987 would reduce traffic congestion by providing more capacity and reducing demand, but alone they would not achieve the 1980 level of service.

14. Highway improvements proposed for 1987 will decrease the north-south and east-west congestions by 4 and 6 percent, respectively.

15. Highway improvements proposed for 1992 would increase the system's capacity while reducing the traffic congestion to approximately the 1987 level.

16. Highway improvements proposed for 1992 will decrease the north-south and east-west traffic volumes by 4 and 5 percent respectively.

17. Average traffic volumes for 1987 and 1992 can be reduced by 4 and 3 percent respectively, if all of the proposed highway improvements are implemented throughout the entire study area.

18. Bus-transit improvements proposed for 1987 (subscription buses) show little effect on the traffic congestion and will make small changes in operational impacts (speed and travel time), under the existing and future conditions.

19. The proposed rail-alignments under consideration are only part of a larger system currently under study by Los Angeles County Transportation Commission.

20. The proposed rail-alignment as a stand-alone project cannot easily be accessed by transit riders from outside of the study area and therefore will carry mostly those trips which originate from within and near the study area.

21. The proposed rail-transit alternatives are not very effective in reducing congestion and improving the mobility of persons in the study area's network, unless they are tied to other regional rail systems.

22. Projected rail-transit ridership includes previous bus riders who would readily change modes.

23. The study area shows a higher proportion of shared-ride trips and a lower proportion of transit trips than either Los Angeles County or the region.
24. Ridesharing constitutes 23.7 percent of 1980 home-based-work trip productions.

25. The percentage of the shared-ride mode for home-based work trip productions for 1992 is 24.5, unchanged from 1987.

26. Ridesharing mode alone could reduce demand volumes by 10.8 percent if the 1.3 auto occupancy goal set by the Air Quality Management Plan (AQMP) is reached.

27. Demand management strategies such as prohibition of on-street parking and providing additional lanes by narrowing lane widths could reduce congestion in the study area by about 15 percent if jurisdictions within the study area instituted and implemented them at the same time.

28. A 4 percent reduction in peak hour work trips could be obtained if 20 percent of the employees within the study area would participate in modified work schedules.

29. Traffic engineering improvements (including traffic signal synchronization of major arterials within the study area) could reduce work trip travel time by 7.5% which will result in improved levels of service and reduction in congestion.

B. Policy Issues

The results of the Phase I study present local jurisdictions with some critical policy decisions. Among them must be: the assessment of trade-offs between the revenue benefits of intensive development and the costs of highly capital intensive infrastructure to accommodate such development; the distribution of costs between the public and private sectors; the trade-offs between a high level of development and the need for private sector commitments for demand management strategies (employee ridesharing, modified work schedules, and parking management). Staff has identified these and other policy issue objectives below:

1. Does the area's ability to provide for transportation mobility objectives require establishing maximum development limits?

2. Should local jurisdictions condition approval of future development on the provision of needed transportation network improvements?

3. Should development be phased and should its approval be conditioned upon implementation of TSM improvements proposed by local jurisdiction?

4. Should decentralized development be encouraged if it would improve mobility?

5. Is it feasible to provide financial incentives for employees to live closer to employment centers?

6. Demand management strategies will require employees to change their travel behavior. Will the public and private sectors be willing to institute demand management strategies?

7. Do local jurisdictions want high flow arterials? If so, are they willing to make decisions which might not be popular with merchants located along the arterial?

8. How much more should be done to further car and van pooling, improve transit, and expand bicycle programs?

9. Will public and private sector employers adopt policies to substitute market rate parking fees for current free or low cost parking to discourage single passenger auto commutings?

Depending on answers to the above questions, the jurisdictions could not only mitigate some of the expected traffic impacts associated with existing and future land use configuration within the study area, but they would also indicate the direction of the second phase of the LAX Area TSM/Corridor Study.

C. Recommendations

In view of the above policy questions and considering the adverse traffic impacts associated with the existing and future developments, different arrays of traffic reduction strategies are recommended as follows:

1. Devote staff and resources to developing a cooperative and coordinated process between cities and agencies, as well as between the public and private sectors, to implement the transportation improvements in arterials cutting across city/county boundaries.

2. Coordinate community planning with transportation planning.

3. Support the formation of Transportation Management Association (TMAs) (such as El Segundo Employers Association) in high-density employment centers such as:

   (a) Marina Del Rey Employers Association which should include developments 4, 5, 6, 10, 17, and 24 shown in Table 8, Page 41, and others located north of Manchester Boulevard and south of Venice Boulevard.

   (b) Culver City Employers Association which should include developments 1, 2, 3, and 7 shown in Table 8, Page 41, and others located within the City of Culver.

   (c) LAX Employers Association which should include Developments 8, 9, 11 through 16, 18, and 19 shown in Table 8, Page 41, and others which are not members of other TMAs within the study area. TMAs should promote public/private partnership in implementing TSM programs.

4. Encourage and support measures by local jurisdictions to improve job-housing balance within the study area[6] as indicated in SCAG-82 Development Guide and SCAG RTP System Planning Policy.

5. Encourage the continued development of paratransit (non-fixed route) services:

   (a) Encourage evaluation of paratransit as an alternative to fixed-route transit in area planning studies;

   (b) Encourage cooperative agreements between paratransit operators and public operators;

   (c) Support paratransit ordinances, or revised taxi ordinances, which permit shared-ride taxi service.

6. Develop a financial plan using local, state, and federal funding commitments for TSM/Highway, bus transit, and rail-transit improvement.

7. Support implementation of an interconnected system of regulated signals at high volume intersections in order to achieve some of the benefits of highflow arterials.

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6 An area is defined to be "balanced" if the ratio of employment to population is between 0.38 and 0.55. An area is "housing-rich" if the above ratio is less than 0.38 and "job-rich" if the ratio is above .55. The ratio for the study area in 1980 is 0.96.

8. Support improving the geometrics of high-volume intersections where appropriate by either widening the intersections, adding left or right-turn lanes, or imposing left turn prohibitions during peak period. Any or all of these improvements are designed to improve the flow of traffic.

9. Support implementation of bus turnouts or loading bays on major arterials where physically possible in order to increase traffic flow and circulation.

10. Support stricter enforcement of on-street parking codes to increase traffic flow and circulation.

11. Support the increased use of telecommunications to reduce work trips.

12. Support the implementation of park-and-ride lots within the study area in order to facilitate the use of bus transit and ridesharing.

13. Increase the enforcement of bicycling and driving laws in order to provide a safer climate for bicycle use.

14. Increase bicycle facilities, such as racks, lockers and/or showers at both places of employment and public transportation facilities.

15. Recognize the need for more coordination among jurisdictions within the study area in bicycle planning and undertake marketing programs to make the public aware of the bicycle as a viable means of transportation.

16. Support parking management ordinances authorizing reduced on-site parking and development of remote off-site parking for commercial and industrial uses meeting certain requirements.

17. Support the addition of transit guideway and carpool lanes on major arterials and freeways serving the study area where physically possible.

18. Support ridesharing ordinances requiring employers to provide incentives for employees who commute to work by shareing rides.

    a. <u>Employers with ten or more employees should provide the following incentives</u>:

        (1) Posting in a conspicuous place or places current schedules, and rates for all bus routes to the common work location.

(2) Posting the location of bicycle routes within at least a five mile radius of the common work site.

(3) Posting flyers and information encouraging ridesharing and providing sources of ride-matching services.

(4) Disseminating to all new employees information encouraging ridesharing and sources of ride-matching services.

b. Employers with 50 or more employees at a common work location shall facilitate ridesharing by:

(1) Designating an employee or other appropriate person to publicize to the employees available public transit services, to assist them in forming carpools or vanpools, and to perform an annual employee transportation survey to determine how employees are traveling to work.

(2) Establish preferential parking facilities for employee carpools and vanpools.

(3) Provide secure bicycle parking facilities for any employee requesting them, when bicycling is the employee's primary mode of commuting.

c. New employers generating 200 or more employees at a common location or existing employers with 200 or more employees at a common location (who are expanding their employment by 20 percent over their baseline employment, and who are applying for a conditional use permit, and/or zoning change). Every applicant meeting these criteria shall prepare and submit to jurisdication in charge, along with any other required information, an auditable ridesharing plan that includes the following:

(1) Description: A brief description of the business activity, business hours, peak hours of traffic generation.

(2) Commuting Characteristics: An estimate (based on a survey) of the commuting characteristics of employees anticipated at the common location.

(3) Program: Description of a program designed to achieve 1.5 AVR (Average Vehicle Ridership) including transit ridership.

The measures selected for the programs shall be selected by the applicant and may include, but are not limited to, the following:

a. Payment of subsidies or provision of other incentives to carpoolers and vanpoolers;

b. Payment of parking charges or vanpool operation expenses for ridesharers;

c. Payment of subsidies or provision of fares for the use of transit or transportation by other than single-occupant motor vehicle;

d. Provision of bicycle lockers, transit shelters, shuttle buses, or other items designed to enhance the use of other than a single-occupant motor vehicle;

e. Shower and personal locker facilities for regular bicycle commuters;

f. A vanpool program consisting of an offer to acquire a van or vans by purchase, lease, or other means; and to make them available to any group of at least eight employees who agree to vanpool as their principal method of commuting for a period of time agreed upon by the group and the employer; and to obtain insurance;

g. Provisions for shifting vehicle trips from peak hours to nonpeak hours.

h. Any other program the applicant may devise.

19. Study further the need for a rail transit system which is tied to the regional system in the corridor serving the study area.

20. Support the development of a unified information and advertising program for transit services within the study area. Considerable emphasis should be placed on coordinated transfers and the ability of the improved transit service to provide more convenient, faster trips between a greater number of locations within the study area.

21. Support the establishment of a single telephone number for transit information on all available services within the study area.

22. Support improved transit to the airport from all parts of its service area within the region.

D. Implementation

One of the primary purposes of the LAX Area TSM/Corridor Study Phase I was to assist the local jurisdictions in defining a coordinated goal for transportation development both for near term and future. In keeping with that objective, projects which demonstrate cost effectiveness and provide the maximum transportation benefits for a modest investment are identified and recommended for immediate implementation. These projects respond to existing capacity deficiencies and if implemented, could significantly reduce traffic congestion. All of the recommendations for immediate action involve solutions which could be implemented within the next three years. Designation of both immediate action projects and short-range projects are based on the evaluation and judgment of the staff and can be modified by the affected agencies.

1. Immediate Action Projects:

The following traffic engineering improvements are recommended for immediate implementation in addition to those recommended in the previous section (the status of these projects are identified and shown in parenthesis).

1. Add two lanes plus a left-turn lane in each direction on Will Rogers Street at Sepulveda Boulevard (Project in 83 STIP)

2. Add an northbound to westbound left-turn lane (making 3) to Sepulveda Boulevard at Lincoln Boulevard (Approved);

3. Add additional northbound lane on Sepulveda Boulevard between 96th Street and Lincoln Boulevard (Project is supported by Caltrans and is under study);

4. Provide two through lanes one optional through or right turn, one right-turn lane, and one left-turn lane for eastbound Centinela Avenue at Sepulveda Boulevard (Approved and Funded);

5. Remove medians and restripe to provide dual left turn lanes in both directions on Sepulveda Boulevard and change northbound right-turn-only lane to a continuous through lane; or (Project is supported by Caltrans);

6. Provide dual left-turn lanes for southbound Sepulveda Boulevard at southbound on-ramp to I-405 (Project is ready for construction);

7. Restripe Maple Avenue at Sepulveda Boulevard to provide a separate left turn lane on the eastbound approach (Funded, Private);

8. Prohibit morning peak hour parking on Sepulveda Boulevard northbound between 22nd Street and Marine Avenue (Approved);

9. Provide dual left-turn lanes on Sepulveda Boulevard at Grand Avenue, El Segundo Boulevard, Rosecrans Avenue, Marine Avenue, Manhattan Beach Boulevard, and change signal phasing accordingly (Project is included in the Caltrans candidate list); or

10. Provide a reversible mixed flow or high-occupancy vehicle (HOV) lane between Imperial Highway and Artesia Boulevard on Sepulveda Boulevard (Project is included in the Caltrans candidate list and is under study);

11. Provide one through, one through-or-right, two left turn lanes westbound Centinela Avenue at Sepulveda Boulevard by restriping (Project is ready for construction);

12. Provide double left-turn lanes for eastbound, westbound, and southbound approaches at Rosecrans Avenue and Sepulveda Boulevard (Programmed);

13. Add a separate right-turn lane on the southbound approach on Sepulveda Boulevard at El Segundo Boulevard (Project is supported by Caltrans);

14. Provide dual left-turn lanes northbound and southbound on Sepulveda Boulevard at 96th Street (Funded, project is ready for construction);

15. Restrict parking on Sepulveda Boulevard from Lincoln Boulevard to Manhattan Beach Boulevard (6:30-9:00 a.m., 3:00-6:30 p.m.) in direction of peak hour traffic (Project is supported by Caltrans);

16. Provide dual left-turn lanes for eastbound Jefferson Boulevard at Sepulveda Boulevard by restriping and prohibiting parking on both sides (Project has Caltrans supports);

17. Restripe Sepulveda Boulevard from six to eight lanes from Imperial Highway to El Segundo Boulevard (Done or Begun);

18. Restrict parking on Lincoln Boulevard from Venice Boulevard to Sepulveda Boulevard and provide off-site parkings for merchants located along Lincoln Boulevard (6:30-9:00 a.m., 3:00-6:30 p.m.) (Supported by Caltrans);

19. Add a second westbound left-turn lane on Washington Boulevard at Lincoln Boulevard by redesignating the left-most through lane as optional through/left turn (Supported by Caltrans);

20. Change the inside left-turn lane to through, and change the optional right-turn or through lane to right-turn-only on Lincoln Boulevard northbound at Washington Boulevard (Supported by Caltrans);

21. Provide a reversible lane on Imperial Highway from Hughes Way to La Cienega Boulevard (only until I-105 is built) (Supported by Caltrans); or

22. Provide dual left turn lanes on Imperial Highway at Sepulveda Boulevard, Douglas Street, and Nash Street (Supported by Caltrans);

23. Add a left-turn lane southbound on Vista del Mar Avenue at Imperial Highway (Status Unknown);

24. Lengthen the left-turn pocket on east approach from 250' to 540' on Rosecrans Avenue at Aviation Boulevard (Status Unknown);

25. Lengthen left-turn pocket on the west approach from 200' to 400' on Rosecrans Avenue at Aviation Boulevard (Status Unknown);

26. Relocate the northbound bus stop on Aviation Boulevard at Rosecrans Avenue from nearside to farside (Status Unknown);

27. Make south approach curb lane on Aviation Boulevard at Rosecrans Avenue, "Right Turn Only--Buses Exempt" (Status Unknown);

28. Widen and restripe east approach to make two left turn lanes, three through lanes, and one right-turn-only lane on Rosecrans Avenue at Aviation Boulevard (Funded);

29. Provide a pedestrian grade separation at El Segundo Boulevard/Aviation Boulevard (Supported by Caltrans);

30. Restrict parking on Aviation Boulevard (6:30-9:00 a.m., 3:00-6:30 p.m.). Specific limits should be imposed by jurisdictions (Supported by Caltrans);

31. Add a lane in each direction to Aviation Boulevard at Rosecrans Avenue by restriping and taking the median (Funded, supported by Caltrans);

32. Provide a new signal at El Segundo Boulevard and Illinois Avenue, add a right-turn-only lane (13') to westbound El Segundo Boulevard for 460' before Illinois Avenue (Funded);

33. Widen and restripe to provide a separate left-turn lane on El Segundo Boulevard westbound at Chevron entrance/Maryland Street (Funded, supported by Caltrans);

34. Restripe and relocate the north-side median to provide dual left-turn lanes, two southbound and northbound through lanes and a southbound right-turn lane for Douglas Street at El Segundo Boulevard. Restripe the south leg of Douglas Street at El Segundo Boulevard to provide dual left-turn lanes, a northbound through lane, one optional northbound through/right turn lane and two southbound through lanes if Douglas Street stays two-way (supported by Caltrans);

35. Restrict peak-hour parking on Jefferson Boulevard between Inglewood Boulevard and Centinela Avenue on the north side to achieve six-lane full capacity (status unknown, supported by Caltrans);

36. Provide dual left-turn lanes from Jefferson Boulevard onto the northbound San Diego Freeway on-ramp (supported by Caltrans);

37. Provide a four-lane section plus turning lanes on Culver Boulevard from Marina Freeway to Sepulveda Boulevard (requires peak-hour parking restrictions on some sections), (Approved);

38. Widen Grand Avenue at Vista del Mar Avenue at each leg to provide westbound left turn plus right-turn-only lanes and an optional through/right-turn lane (Status Unknown);

39. Restripe I-405 to add a lane (either mixed flow or HOV) each direction from I-10 to the Harbor Freeway. (Approved);

40. Add a right-turn lane and change the optional right/though lane to through-only on southbound Lincoln Boulevard at Manchester Avenue. Eastbound on Manchester Avenue at Lincoln Boulevard, add a second left-turn lane and add two right-turn lanes and change the optional through/right lane to through only westbound on Manchester Avenue at Lincoln Boulevard. (Approved by Caltrans);

41. Provide roadway separation over Sepulveda Boulevard at 96th Street (Funded);

42. Convert signal system within City of Los Angeles portion of Study Area to computer control similar to ATSAC System installed in Coliseum area prior to the Olympics. This type of system can increase the traffic-carrying capacity of arterial streets by at least 10 percent by means of more immediate response to changing traffic conditions and signal malfunctions. The system would provide for constant monitoring of traffic in the area. (Funding status uncertain.)

43. Acquire right-of-way and upgrade Venice Boulevard (Rt. 187) to state standards from Pacific Avenue to 0.1 mile west of Lincoln Boulevard. (Approved by Caltrans);

44. Construct full Interchange on I-405 at Arbor Vitae (combine or weave with existing movements). (Approved by Caltrans);

45. Widen Route 1 Sepulveda Boulevard at Manhattan overhead (at Valley Blvd.) (widen NB roadway and railroad overhead), (approved by Caltrans);

2. Short Range Projects:

Short-Range Projects are those projects which are proposed for the 1992 time period. In general, they respond to conditions which are projected to occur should population and employment continue to grow as forecast. They should, therefore, be seen as options for the future which will require continuing reevaluation to correlate actual with projected conditions. These projects are as follows:

1. Add one through-lane each direction on Sepulveda Boulevard from El Segundo Boulevard to Valley Drive (making 8 lanes) by widening (project is included in Caltrans Candidates list);

2. Add one through-lane each direction on Sepulveda Boulevard from Playa Street to Sawtelle Boulevard (making 6 lanes) by widening, parking prohibition (west side only), and restriping (supported by Caltrans);

3. Provide a consistent 6-lane capacity on Lincoln Boulevard from Venice Boulevard to Sepulveda Boulevard, plus additional turning lanes. This requires minor widening from Fiji Way to Jefferson Boulevard (Summa property), peak-hour parking re-

strictions from 83rd Street to Manchester Avenue, and the addition of one through-lane in each direction from Manchester Avenue to Sepulveda Boulevard (supported by Caltrans);

4. Construct through street between Imperial highway and Grand Avenue along the Continental Boulevard/Lairport Street/Selby Corridor (Approved by Caltrans);

5. Add a through-lane in each direction on Aviation Boulevard from Imperial Highway to north of El Segundo Boulevard to provide 6-lane capacity, plus separate left-turn lanes by widening. (Approved, But L. A. County has no plan to implement this improvement in the near future);

6. Add a through-lane in each direction on Aviation Boulevard from south of El Segundo Boulevard to Rosecrans Avenue to provide 6-lane capacity and also provide a 2-way continuous left-turn lane (Approved and supported by Caltrans);

7. Connect Douglas Street from Alaska Street to Park Place over the railroad tracks to provide a continuous 6-lane capacity from Imperial Highway to Rosecrans Avenue (supported by Caltrans);

8. Provide through 6-lane capacity on Redondo Avenue from Rosecrans Avenue to Marine Avenue (Approved);

9. Widen and extend Hindry Avenue southeast to meet Florence Avenue at Compton Avenue, with 4 through-lanes plus parking. Widen to 4-lanes and extend 147th Street west to Aviation Boulevard (under ATSF tracks), and east (with a jog at Hindry Avenue) under I-405 to Ocean Gate in the existing railroad right-of-way (Status Unknown); or

10. Construct a new on-off ramp from Compton Boulevard to north and southbound I-405 to provide a ramp connection to the freeway (Status Unknown);

11. Connect Marina Freeway to Washington Street via a 4-lane local street in the abandoned railroad right-of-way (Approved but not programmed);

12. Add one eastbound lane on El Segundo Boulevard from Aviation Boulevard to the I-405 southbound on-ramp (Done or Begun);

13. Add two new streets with signals: Riggs Place and Nancy Place (Spicer Property) with provision for left turn from Riggs place to Sepulveda Boulevard (Funded);

14. Widen Sepulveda Boulevard from Grand Avenue to Marine Avenue (from 76 to 117 feet) and provide double left turn lanes at Rosecrans, Hughes Way/Coke Road, and El Segundo Boulevard (Approved, Hughes way area is done);

15. Widen Lincoln Boulevard from south of Jefferson Boulevard to near Fiji Way (Summa property), by paving the shoulders (Approved by Caltrans);

16. Widen Vista del Mar Avenue for approximately 500' north and south of Grand Avenue to allow two through-lanes plus a left turn lane in each direction at the intersection (Status Unknown);

17. Improve Jefferson Boulevard from Lincoln Boulevard to Culver Boulevard to change the existing 4-lane section to urban, divided-roadway standards (Approved);

18. Realign and widen Culver Boulevard from Falmouth Avenue to the Marina Freeway from 4-lanes to a 6-lane divided section with controlled access to adjacent land uses (Approved):

19. Extend Falmouth Avenue from Culver Boulevard to (new) Westchester Parkway to provide a 4-lane capacity (Approved but not programmed);

20. Extend Admiralty Way from Fiji Way to Culver Boulevard to provide a 4-lane divided roadway (Approved);

21. Extend Bay Street from Culver Boulevard to Hughes Way (including a bridge over Ballona Creek) to provide a 4-lane roadway (Approved but not programmed);

22. Extend Centinela Avenue from Jefferson Boulevard to Hughes Way to provide a 4-lane roadway south, then east to region Hughes Way (Approved);

23. Improve and widen Hughes Way from Lincoln Boulevard to (extended) Centinela Avenue to provide 4-lane capacity (Approved);

24. Construct a new 4-lane roadway, "Westchester Parkway", from Pershing Drive to Sepulveda Boulevard intersecting Sepulveda Boulevard at Will Rogers (Programmed);

25. Extend La Tijera Boulevard from 88th Street to Westchester Parkway as a 4-to-6 lane roadway, and prohibit left turns from northbound (new) La Tijera

Boulevard to westbound 88th Street prohibited (Programmed);

26. Construct a new on-ramp from eastbound Marina Freeway to southbound San Diego Freeway to provide a direct ramp connection (Funded, Public);

27. Add a second left-turn lane, a right-turn lane, and change the optional through/right lane to through only, at the northbound on Lincoln Boulevard and eastbound Jefferson Boulevard intersection. Westbound on Jefferson Boulevard at Lincoln Boulevard, add a right-turn lane, a through lane, and a left-turn lane and change the two optional lanes to through only. These improvements will require Jefferson Boulevard at each approach to Lincoln Boulevard widening (Status Unknown).

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APPENDIX A

Highway System

The following is a brief description of the major and minor facilities included in the basic 1980 highway network for the LAX Area/TSM Corridor Study:

EAST/WEST FACILITIES

The major east/west streets serving the study area are Venice Boulevard, Washington Street, Washington Place, Washington Boulevard, Short Avenue, Marina Freeway, Culver Boulevard, Jefferson Boulevard, Manchester Avenue, Florence Avenue, Arbor Vitae Street, 96th Street, Century Boulevard, Imperial Highway, Mariposa Avenue, Grand Avenue, El Segundo Boulevard, Rosecrans Avenue, Valley Drive/Ardmore Avenue, Marine Avenue, Compton Boulevard, and Manhattan Beach Boulevard. In addition, the following minor streets were included on the basis of their importance, location, and traffic levels: Van Buren Avenue/Zanja Street, Mindanao Way, 77th Street, 80th Street, 83rd Street, and World Way.

Venice Boulevard

Venice Boulevard is a variable width intercity roadway that runs from Pacific Avenue in Venice to Figueroa Street near downtown Los Angeles. It presents a two through-lane configuration between Pacific Avenue and Lincoln Boulevard, and three lanes each direction there- after. There are separate left-turn lanes at the major intersections, including dual left-turns westbound at Lincoln Boulevard.

Washington Street

This major street runs from Pacific Avenue to its merging with Washington Boulevard in Marina del Rey. It is a two through-lane facility with parking permitted on both sides and left-turn provisions in the median.

Washington Boulevard/Washington Place

Washington Boulevard is a variable width intercity roadway within the study area with one-lane each way between Venice Boulevard and its merging with Washington Street, and two through-lanes thereafter. There are left-turn lanes at the major intersections, and parking is permitted except at the intersection approach lanes. Approximately one mile northeast of Lincoln Boulevard, Washington Boulevard splits into Washington Place and Washington Boulevard, running parallel with the same characteristics and meeting again east of Sepulveda Boulevard.

Culver Boulevard

Culver Boulevard is a major county highway that serves the different beach communities south of Marina del Rey, providing a connection with the coastal corridor formed by Pershing Drive and Vista del Mar Avenue to the I-405 Freeway. It has a two through-lane configuration all along with on-street parking permitted at different points, through the Playa del Rey business district and east of its intersection with the Marina Freeway.

Marina Freeway

The Marina Freeway (State Route 90) originates at Lincoln Boulevard east of Marina del Rey, extending 3.5 miles eastward to Slauson Avenue, beyond the I-405 Freeway. Between Lincoln Boulevard and Culver Boulevard it is an at-grade roadway with two through separated lanes each way. East of Culver Boulevard this facility is elevated with four lanes each direction and grade-separated interchanges at Centinela Avenue and I-405.

Jefferson Boulevard

Jefferson Boulevard is a major county highway that connects the Marina del Rey area with other inland cities east of the I-405 Freeway. It is also considered as an access to the Beach Cities coastal corridor to the south. Within the study area it begins at its connection with Culver Boulevard, extending to the I-405 Freeway. Between Culver Boulevard and Lincoln Boulevard it is a four-lane undivided roadway, turning into a six-lane divided facility from Lincoln Boulevard to Centinela Avenue with parking prohibited at both sides of the street and left-turn lanes at the major intersections. East of Centinela Avenue on-street parking reduces effective pavement width to two through-lanes each way again.

Manchester Avenue

Manchester Avenue is a major east-west highway that begins at its intersection with Pershing Drive, north of the Los Angeles Airport. This facility then extends eastward to serve a number of cities within the Los Angeles metropolitan area. Within the study area it is bounded to the east by the I-405 Freeway. Over its entire length it is a fully improved facility with two through-lanes each way and on-street parking permitted on both sides.

Florence Avenue

Florence Avenue originates at the intersection of Manchester Avenue and Aviation Boulevard around the Los Angeles Airport. Like Manchester Avenue, it is also a major east-west undivided four-lane highway with parking provisions on each side of the street.

Arbor Vitae Street

Arbor Vitae Street is a newly improved and extended facility that runs eastward within the study area from its intersection with Sepulveda Boulevard to the I-405 Freeway. Between Sepulveda Boulevard and Airport Boulevard it is a six-lane undivided facility with parking restricted at all times. East of Airport Boulevard the arterial narrows to two through-lanes each direction due to on-street parking.

Century Boulevard

Century Boulevard is a major intercity highway that serves the Los Angeles Airport and surrounding area and provides access to a number of communities east of the I-405 Freeway. Within the study area (LAX to I-405) it is an eight-lane divided facility with left-turn lanes at major intersections and prohibited parking in each direction.

Imperial Highway

Imperial Highway is a major access arterial for the Los Angeles Airport and El Segundo industrial areas. Within the study area it extends from Vista del Mar Avenue to the I-405 Freeway as a six-lane configuration, with a wide raised median between Vista del Mar Avenue and Sepulveda Boulevard, and a painted median thereafter. Left-turn lanes are provided at the major intersections, and parking restrictions ensure the full use of the facility's capacity.

Grand Avenue

This local facility connects the El Segundo residential area with the beaches. It is a four-lane undivided arterial with parking prohibitions at certain points along its way and during peak periods.

El Segundo Boulevard

El Segundo Boulevard is a major county highway which provides the main access to the City of El Segundo. Its limits within the study area are Main Street and the I-405 Freeway. From Main Street to Sepulveda Boulevard it is a four-lane undivided facility, widening to a six-lane undivided arterial east of Sepulveda Boulevard with parking prohibited along both curb lanes at all times.

Rosecrans Avenue

Rosecrans Avenue is a major east-west facility extending from Vista del Mar Avenue/Highland Avenue in Manhattan Beach to a number of cities before reaching the Orange County line. Within the study area it is bounded by the I-405 Freeway to the east. It is a variable width (2-3 lanes each way) divided highway with prohibited parking at different points.

Manhattan Beach Boulevard

Manhattan Beach Boulevard is a major arterial that begins at Highland Avenue in Manhattan Beach and extends east of the I-405 Freeway. Within the study limits it is a variable width facility between Highland Avenue and Pacific Avenue (1-2 lanes each way), widening to a four-lane undivided arterial from Pacific Avenue to the I-405 Freeway.

Van Buren Avenue/Zanja Street

Van Buren Avenue and Zanja Street form a continuous minor arterial that runs parallel to Washington Boulevard, diverting some of the traffic from both Washington Boulevard and Washington Place. Over its entire length, this is a two through-lane facility with parking permitted at different points.

Mindanao Way/Short Avenue

Mindanao Way has its origin inside the Marina del Rey area, extending eastward to Lincoln Boulevard where it becomes Short Avenue until its meeting with Centinela Avenue. Inside the Marina it is a two-lane divided facility with parking prohibited at all times. East of Lincoln Boulevard the facility follows a four-lane undivided configuration with parking permitted at various points along the way.

76th/77th, 79th/80th, and 83rd Streets

These are minor residential streets included within the study limits as traffic generators for those major arterials north of the Los Angeles airport area. 76th Street originates at the north extension of Airport Boulevard and extends as 77th Street to McConnell Avenue, west of Sepulveda Boulevard. 79th Street begins at La Tijera Boulevard and continues as 80th Street to McConnell Avenue. Finally, 83rd Street runs from Lincoln Boulevard to La Tijera Boulevard. All three facilities are one-through-lane each way with parking permitted along both sides.

96th Street

96th Street is a local arterial within the Los Angeles airport area. Through its connection to Sky Way it channels a good part of the traffic to and from the airport. It is a four-through-lane facility along its short length.

World Way

This small street provides an important access to the Los Angeles Airport, accommodating traffic from Sepulveda Boulevard and 96th Street. It is a two-lane undivided facility with parking strictly prohibited at all times.

Mariposa Avenue

Originating within the El Segundo residential area west of Sepulveda Boulevard, this street also provides accommodation for the local traffic generated in the industrial zone around Nash and Douglas Streets. Between Sepulveda Boulevard and Douglas Street it is a four-lane undivided facility.

Valley Drive/Ardmore Avenue

These form a pair of local streets in Manhattan Beach providing access for most of the residential users in the city. Both run parallel to the existing AT&SF railroad alignment from Sepulveda Boulevard to Manhattan Beach Boulevard, on a variable width (1-2 through lanes each way) configuration.

NORTH/SOUTH FACILITIES

The major north/south arterials included within the study area are Pacific Avenue, Lincoln Boulevard, Centinela Avenue, Inglewood Boulevard, Sepulveda Boulevard, Vista del Mar Avenue/Highland Avenue, Pershing Drive, La Tijera Boulevard, Airport Boulevard, Aviation Boulevard, La Cienega Boulevard, I-405 Freeway, Main Street, and Inglewood Avenue. The minor streets are: Via Marina, Admiralty Way, Nash Street, Douglas Street, Freeman Avenue, and Inglewood Avenue.

Pacific Avenue

Pacific Avenue is a major street for the traffic along the beaches around Santa Monica and Venice. Within the study area it extends from Venice Boulevard to approximately one mile south of Washington Street. It is a two-lane facility with parking permitted in both curb lanes.

Lincoln Boulevard

Lincoln Boulevard (Route 1) is a major county highway that extends from the City of Santa Monica to its merging with Sepulveda Boulevard near the Los Angeles Airport. Within the study area it is bounded by Venice Boulevard at the north; it maintains mostly a six-lane configuration over its entire length, with the exception of certain sections where parking is permitted.

Centinela Avenue

Centinela Avenue runs within the study limits from Venice Boulevard to its intersection with Sepulveda Boulevard and the I-405 Freeway. It is a two-through-lane undivided facility with on-street parking between Venice Boulevard to Jefferson Boulevard, widening to three lanes each way (parking prohibited) from Jefferson Boulevard to Sepulveda Boulevard.

Inglewood Boulevard

Parallel to Centinela Boulevard, Inglewood Boulevard extends from Venice Boulevard to Jefferson Boulevard with a similar configuration.

Sepulveda Boulevard

A major through county arterial, Sepulveda Boulevard interconnects the whole study area from north to south, providing a continuous support access for the different existing west/east major arterials. From the northern boundary to its merging with Lincoln Boulevard, it is an undivided six-lane facility with parking prohibited at peak hours and left-turn lanes provided at intersections. From Lincoln Boulevard to Century Boulevard it widens to accommodate five lanes southbound and four lanes northbound with the same parking restrictions. South of Century Boulevard it narrows again to three-lanes each way until it reaches Imperial Highway. From Imperial Highway the facility widens again to four-lanes each way. Finally, south of El Segundo Boulevard, Sepulveda Boulevard continues as a six-lane highway through the southern study area boundary, at Manhattan Beach Boulevard.

Vista del Mar Avenue/Highland Avenue

A part of the south coastal corridor, Vista del Mar Avenue and Highland Avenue provide access for the different beach communities along their way. Originating at its connection with Culver Boulevard, within the Playa del Rey business district, Vista del Mar Avenue runs south following a four-lane configuration with parking permitted at different points. Within Manhattan Beach the facility continues as Highland Avenue through the business district, following a two-lane configuration with on-street parking permitted at both sides.

Pershing Drive

Pershing Drive is a major county highway arterial providing a connection between Manchester Avenue and Imperial Highway, west of the Los Angeles airport. Beginning with a four-lane configuration between Culver Boulevard and Manchester Avenue, it widens to 3-4 lanes each direction from Manchester Avenue to Imperial Highway.

La Tijera Boulevard

La Tijera Boulevard is a major facility serving the study area to accommodate in and outbound traffic in combination with the I-405 Freeway and other major north/south arterials. It is a diagonal (southwest to northeast) four-lane facility over its entire length within the study area, from Sepulveda Boulevard to the I-405 Freeway.

Airport Boulevard

Airport Boulevard provides a major access for local and regional traffic. It extends from Century Boulevard to its connection with 76th Street, north of La Tijera Boulevard, maintaining a four-lane configuration through its entire length.

Aviation Boulevard

Aviation Boulevard is a major intercity roadway providing an important north/south access for the study area. It originates at Manchester Avenue, extending southward to Manhattan Beach Boulevard. From Manchester Avenue to Century Boulevard it is a four-lane undivided facility with on-street parking permitted at some points within this industrial zone. The arterial then widens to six lanes/no parking between Century Boulevard and Imperial Highway. South of Imperial Highway, the facility continues as four lanes until its intersection with Manhattan Beach Boulevard.

La Cienega Boulevard

La Cienega Boulevard is a major intercity arterial that runs parallel to the I-405 Freeway within the study limits. It extends southward from its intersection with the I-405 Freeway to El Segundo Boulevard, following a four-lane configuration with on-street parking permitted in each direction.

Interstate 405 (San Diego Freeway)

The I-405 Freeway defines the east boundary of the study area. It is a major regional facility serving as a primary access for the Western Metropolitan Los Angeles area. Within the study area, it is four lanes each way, with 13 on/off ramp locations between Venice and Manhattan Beach Boulevards.

Main Street

Main Street provides direct access to El Segundo's business district from both Imperial Highway and El Segundo Boulevard. It is a six-lane facility with parking permitted at both curb lanes.

Inglewood Avenue

A small section of this facility crosses the southeast corner of the study area. Over this length it is a four-lane arterial with parking permitted on both sides.

Admiralty Way

Admiralty Way serves as an important linkage for most of the traffic in the Marina del Rey area. It is a four-lane divided facility with parking prohibited at all times.

Via Marina

This is a small nonthrough street connecting with Washington Street on the west side of the Marina area. It is a variable width (1-2 through lanes) facility.

Nash Street

Nash Street is a local street serving the industrial/commercial users between Imperial Highway and El Segundo Boulevard, east of Sepulveda Boulevard. It is a variable width facility as follows: Imperial Highway to south of Mariposa Avenue, four-lanes divided; south of Mariposa Avenue to Grand Avenue, two-lanes undivided; Grand Avenue to El Segundo Boulevard, four-lanes divided.

Douglas Street

Douglas Street, similarly to Nash Street, serves the various uses east of Sepulveda Boulevard. It extends from Imperial Highway to the AT&SF Railroad tracks south of Alaska Avenue, continuing on the south side of the railroad to Rosecrans Avenue, and becoming Redondo Avenue (a private road) south of Rosecrans. The facility follows a variable width configuration: Imperial Highway to El Segundo Boulevard, six-lane divided; south of El Segundo Boulevard to Utah Avenue, four-lane divided; south of Utah, four-lane undivided.

Freeman Avenue

Freeman Avenue is a local residential street within the City of Manhattan Beach. It is a four-lane facility extending between Marine Avenue and Manhattan Beach Boulevard with parking permitted on both sides.

APPENDIX B

REGIONAL TRANSPORTATION MODELING SYSTEM

Description and Assumptions of Travel Demand Models

February 1984

Southern California Association of Governments
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TABLE OF CONTENTS

1.0 INTRODUCTION

This report provides an overview of SCAG's Regional Transportation Modeling System. It is addressed primarily to the planner who is involved in the evaluation of alternative transportation systems, and to the public officials who must consider these evaluations in making major decisions regarding transportation investments, policies, or programs. The body of this report deals primarily with a description of the transportation modeling system and its application to travel demand forecasting and to analysis of closely related impacts. This Section reviews travel demand forecasting in the context of the urban transportation planning process.

1.1 The Urban Transportation Planning Process

Exhibit 1-1 shows the role played by travel demand forecasting and modeling in the context of the urban transportation planning process. This process, promulgated by the U.S. Department of Transportation, has evolved to a generally accepted and widely applied practice. In this process, planners develop information about the benefits and impacts of implementing alternative transportation improvements. This information is used to help decision-makers (elected officials or their representatives) in their selection of transportation policies and programs to implement. Thus, the planning process lends to development and adoption of the Regional Development Guide Plan, the Regional Transportation Plan, the Transportation Improvement Program, and the Air Quality Management Plan.

The urban transportation planning process usually develops through several phases as indicated in Exhibit 1-1. SCAG is now in the "continuing" process, as are most MPO's. Collection of data was largely done in the 1967 and 1976 home interview surveys (References 10-1,10-2), conducted by Caltrans, in conjunction with the association. Socioeconomic and land use inventories were also collected and maintained. Base year survey and inventory data were used to develop and calibrate the transportation models, most notably the trip generation, trip distribution, and mode choice models (references 10-3,10-4,10-5,10-6). Then alternative transportation systems were formulated and evaluated, a process which led to the development and adoption of the Regional Transportation Plan, now being implemented by the Regional Transportation Improvement Program.

The continuing process (the stage most urban areas are in now), consists of monitoring changes in land use and growth that could make it necessary to modify the transportation plan; updating the data that serve as a base for planning; developing and adopting new growth forecasts; updating the methods and models used in transportation planning; and reporting on activities and findings.

The "Travel Forecast Summary (reference 10-7)" will periodically summarize the significant regional transportation modeling assumptions, input, and model outputs of various transportation studies performed by SCAG for sharing information, analyses and findings between planners and researchers.

Travel demand forecasting models are applied in four places in the urban transportation planning process: in the long-range and transportation system management (TSM) elements of the Regional Transportation Plan; in the plan refinement phase; and in the continuing process. In any case, the transportation models are usually applied in a similar manner.

1.2 Structure of the Transportation Modeling System

SCAG's Regional Transportation Modeling System consists of a set of steps from trip generation, trip distribution, mode split, and trip assignment as shown in Exhibit 1 - 2. These four stages comprise the traditional travel demand forecasting process; they are described more fully in the body of this appendix. This section provides a brief overview of the models.

The regional travel forecasting system is a set of quantitative procedures, made operational in a package of computer programs, which predict certain behaviors of trip-makers and the air quality impacts of travel flow patterns. In general, travel demand forecasting attempts to quantify the amount of travel on the transportation system. Demand for transportation arises from the separation of urban activities. The supply of transportation is represented by the service characteristics of highway and transit networks.

At present, SCAG's study area includes all of Los Angeles, Orange, and Ventura counties, and the westernmost, more intensively developed portions of Riverside and San Bernardino counties. This study area is divided into 46 Regional Statistical Areas (RSA's) for the purposes of Development Guide Planning. For travel modeling purposes, however, the RSA's are divided into 1,285 analysis zones (AZ's), each composed of a single census tract, two or more small census tracts, or a portion of a very large census tract. The study area with analysis zones is shown in Figure 7 of the main report.

Three major types of data are required as input to the forecasting system:

(1) Socioeconomic data at the analysis zone level;
(2) Detailed descriptions of transportation systems;
(3) Emissions factors for the vehicle fleets in the analysis.

A complex set of interrelated models use these inputs, plus a number of relationships between socioeconomic data, transportation systems, and travel based on past behavior, to forecast travel patterns. In general terms, these models are applied in the following sequence:

(1) Socioeconomic data for the analysis year is disaggregated from the RSA level to the 1,285 analysis zone level, using a combination of trend analysis, negotiations, and informed professional judgment;

(2) The number of weekday trips generated by households in each zone is predicted as a function of housing type, population, and median income; in this stage, the relative number of trips attracted to each zone is predicted as a function of zonal population, retail employment, and nonretail employment;

(3) Trip distribution determines where these trips will go. The number of trips between a zone pair is predicted using the "gravity" model form; these trips are functions of zonal attractions and travel times between the zones;

(4) The choice of mode (transit or auto with 1, 2, or 3 or more occupants) for work trips, between each zone pair, is predicted as a function of the travel cost and time of each mode, and of the zonal characteristics such as employment density, parking cost, income, auto ownership, household size, number of licensed drivers, and number of workers. Mode choice predicts how the consumer of transportation will choose his mode of travel from among those available;

(5) The number of vehicle trips passing through each external station are estimated;

(6) Trip assignment predicts the routes that the trips will take resulting in traffic forecasts for the highway system and ridership forecasts for the transit system. Vehicle trips are assigned to the highway network with iterative capacity restraint methods for peak periods, and with multipath assignment techniques for the off-peak period;

(7) Transit trips are assigned to the transit network;

(8) Vehicle emissions are computed for each highway link and summed by geographic area.

As it would be carried out for a complete forecast of regional travel, SCAG's Regional Transportation Modeling System has many applications involving more than 100 separate executions of computer programs. More recently, many of the programs in the UTPS (Urban Transportation Planning System) package distributed by two federal agencies (UMTA and FHWA) have been incorporated, and several special programs have been developed by SCAG in conjunction with SAS (Statistical Analysis System).

1.3 Model Applications

The SCAG Regional Transportation Modeling System can be used to study a range of regional land use and transportation alternatives. Given the system's input variables and internal relationships, it can be used to address each of the following types of issues and alternatives:

(1) How will travel patterns and vehicle emission levels change in response to changes in the distribution of land use development, population growth, employment levels, and demographic characteristics such as income levels and household sizes?

(2) How will changes in the operation of highway facilities affect the congestion levels on transportation systems?

(3) How much will new highway facilities reduce travel times?

(4) How will changes in transit services affect the number of transit users?

(5) What will be the impacts of transportation improvements, or of the lack of improvements, on special groups or segments of society?

(6) Alternatives analysis - comparative benefits of alternative transit systems or projects;

(7) Identify future problems;

(8) Predict future air quality;

(9) Transportation policy planning and analysis.

Thus, the regional modeling system has many applications for regional planning in general, and for transportation planning in particular.

2.0 SOCIOECONOMIC DATA

Demand for transportation arises from urban activities. All the urban activities that an individual or household demands depend upon its socioeconomic characteristics. For example, the activity of a household would depend on the size of the household, its combined income, the number of people employed, and so forth. Consequently, the prediction of travel demand requires a description of future urban activities. Model input data calls for the expression of urban activities in terms of population, housing, employment, and median household income.

Forecasting future urban systems that the transportation system is to be designed to serve requires an estimation of the intensities and spatial distributions of population, employment, social activity and land use. Socio-economic data for a future year is derived from the region's growth forecast policy, a product of SCAG's ongoing Development Guide Program. This program has been in operation since 1970, providing a framework for coordinating local and regional decisions regarding growth. Since 1972, SCAG has adopted a new growth forecast policy approximately every three years. The current growth forecast policy, called the "SCAG-82 Growth Forecast Policy" (Ref. 10-8), was adopted by the SCAG Executive Committee in October 1982. It is the culmination of extensive analysis and discussion by SCAG committees, local governments, and other affected/interested parties and agencies.

SCAG-82 presents forecasts of population, housing, employment, and land-use for the years 1985, 1990, 1995, and 2000. The adopted growth forecast policy reflects regional and local growth policies, and is intended to represent the best judgment of association membership in terms of a likely and viable direction for the region. It is accompanied by supporting assumptions regarding future growth, and policies to control and direct growth. The geographic unit for which data are compiled is the Regional Statistical Area (RSA). The data are disaggregated to the 1285 analysis zones for input to the trip generation models, the first step in the travel forecasting process.

3.0 TRIP GENERATION

Trip generation plays a role in many phases of transportation planning and traffic engineering related activities. The trip generation model estimates the number of person trips generated by the residents of each analysis zone, on an average weekday. It does not consider their other characteristics such as direction, length, or duration. Five trip types are utilized: (1) home-other, (2) other-other, (3) other-work, (4) home-work, and (5) home-shop.

The trip generation models were derived through multiple linear regression methods using base year data for the estimation of trip making units. the trip making units were defined as (1) housing units with no vehicles, (2) housing units with one vehicle, and (3) vehicles belonging to housing units categorized as owning two or more vehicles.

One basic assumption of the trip generation procedure is that the number of trip making units in each of three categories can be estimated as a function of zonal median household income, proportion of single housing units to total housing units, and population per housing unit.

Three relationships are developed.

(1) $Ln(V) = A0 + A1(S) + A2(1/P) + A3(1/I) + A4(1/I)*(1/I)$

$$Z = B0 + B1(S) + B2Ln(P) + B3(1/I) + B4(1/I)*(1/I) \quad (2)$$

$$Ln(R) = C0 + C1(S) + C2(1/P) + C3(1/I) + C4(1/I)*(1/I) \quad (3)$$

where V = Vehicles per occupied housing units
S = Ratio of single housing units to total units
P = Ratio of population to total housing units
I = Median household income in $1000's (1967 dollars)
Z = Ratio of zero vehicle housing units to total housing units
R = Ratio of one to two or more vehicle housing units
A,B,C = Coefficients
Ln = The natural logarithm function

As shown in Exhibit 3-1,3-2, and 3-3 the regression coefficients vary between counties. For the subregional study, appropriate coefficient to the study area should be derived. The trip making units estimated by applying the above three equations, will be allocated to three (zero,one,and two or more) level of vehicle ownerships and two(single and multiple) housing unit types. The method used to accomplish this allocation is a cross-classification technique, which obtains from base-year survey data. The result is a 2X3 contingency table showing trip making units for each zone.

Each trip making unit in the table is converted into person trips by applying trip generation rates. These rates were developed from survey data by cross-classification techniques, and are the number of person trips generated by a particular kind of housing unit having a given level of vehicle ownership, for one trip purpose. As there are five trip types, and a set of trip generation rates for each type, the result of this operation is a set of five 2 x 3 person trip tables for each zone. It should be noted that the trip rates are unvarying within a county, but do vary from county to county.

All of the person trips are generated at the home zone. However, other-other and other-work trips are nonhome-based. Consequently, it is necessary to reallocate these trips to zones of production.

The trip generations for non home-based trips are reallocated among the zones according to their relative factors for producing trips of these types. These factors are functions of zonal population and employment. Person trip reallocation equations expressing these relationships are presented in Exhibit 3-4. Separate reallocations are made for the different counties and for the two nonhome-based trip types.

Each trip is conceived as being "produced" in one zone and "attracted" in another. Attractivity is considered an indicator of intensity of the type of activity, which is a weighted combination of variables such as population and employment. The statistically developed regression equations for attraction factor, for each trip purpose are presented in Exhibit 3-5. The resulting attraction factors are used in trip distribution.

4.0 NETWORK DEVELOPMENT

In any transportation study in which we forecast the demand for travel, a representative description of the transportation system is required.

Network representations, both highway and transit, serve three purposes. First, they provide the zone-to-zone impedances, or travel times, needed for the trip distribution stage of the travel forecasting process. Second, they provide the relative time or cost of travel between zones by alternative modes available to trip makers to enable a mode split analysis on every zonal interchange. Finally, the networks are needed to find the most appropriate routes and to assign to those routes, the vehicle trips or transit person trips resulting from mode split.

4.1 Highway Networks

Three basic highway networks are prepared. One is a so-called "standard" highway network, upon which all vehicles may operate. This network furnishes the travel times for the gravity model. A standard highway network is constructed for the base year as well as for the future year. The latter network includes the major improvements in the highway system that are planned or under study. Because the AMV/CSI coupled mode choice model (see S 5.) captures the interaction of shared rides with transit, two other highway networks are required: a network for two-person occupancy vehicles; and a network for three-or-more-person occupancy vehicles.

4.1.1 Standard Highway Network

An inventory of the existing street and highway system usually provides the information needed for defining the street and highway system to the computer. Not all streets and roads are included; it would be prohibitively expensive to do so (computational costs, in general, increase exponentially as the number of links in the network). The kind of road to be included in the representative networks depends upon the hierarchy of planning levels at which the study is being conducted. The facilities selected for designation in a regional study should represent the strategic network for the area. Thus, the SCAG regional highway network includes all of the state highways and freeways, expressways, major arterials, most secondary arterials, and connector or through streets where necessary. Wherever there is a significant volume of traffic, those links should be included. In addition to volumes, zone size and area are also considerations. For example, within the Los Angeles CBD, almost every major street is represented.

After selection of streets and roads, the network is defined by links and nodes. Nodes usually represent a junction at the intersection of two roads. To identify a link for computer analysis, nodes are assigned numbers. Other characteristics of a link that are included in the "historical record," the computer file representing the network, include the free-flow speed or time between nodes, the link distance, facility type, the area type, and the capacity or number of lanes. Internally, the network building program determines a practical capacity.

Zone centroids have to be identified and connected to the network. A zone centroid represents the point of origin or destination of all trips generated or attracted to the zone. Therefore, the centroid should be located at the center of activity of that zone, or, to put it another way, at the center of gravity of all trips from that zone. Usually, the position of the centroids is determined early in a transportation study, and are not changed except for long-range forecasts wherein major land use changes are anticipated. After locating the position of the centroid, it is then connected to the coded network at selected nodes. These links are termed "centroid connectors." Access and terminal times and distances are assigned to each centroid connector. The specification of centroid connectors requires some care and attention, because they can influence the choice of route to and from that zone.

The standard network is intended to represent driving conditions experienced by the majority of vehicles, but by single occupancy vehicles in particular. The only place where a lone driver is singled out is at a ramp-metered control lane, where vehicles with a single occupant are allowed to enter a freeway one at a time. The delay time is a function of the existing flow conditions on the freeway, which varies by area. To represent these conditions, in the highway network, ramp meter control lanes are simulated by links 0.15 miles long, which are assigned speeds of between 2 and 8 mph, depending on the degree of congestion or delay expected. These links connect the arterial highway system to a freeway interchange node, wherever they have been installed, or are planned to be installed in the future.

For a region as large as SCAG's, 9,000 square miles, it is not feasible to try to obtain the speed or travel time on every link in the network. Typical values of speed or time are obtained for the major links in the network. Also, speeds are obtained on typical facilities in selected areas, because travel time varies with the density of development as well as with time of day. This makes it possible to apply a blanket value of speed to all links of a particular type in a specified area. Exhibit 3-1 shows the results of such a study by the LARTS group.

4.1.2 Shared Ride Network

This highway network applies to two-person occupancy. Such vehicles receive special treatment at ramp-meter control ramps where a bypass lane exists. They are allowed direct access to the freeway. This network is created from the standard network by simply changing the speed of the ramp-meter control link to 20 mph, wherever a bypass lane exists or is proposed.

4.1.3 Carpool Network

This network applies to three-or-more-person occupancy. Present policy is to allow carpools to use HOV lanes along with buses.

4.2 Transit Networks

Transit networks are related to highway networks, but differ from them fundamentally in that fixed route services limit the freedom of choice and time for making a trip.

Links and nodes are defined in similar fashion to highway links and nodes. Transit links are also identified by node numbers, A-node and B-node, and assigned a speed or link time and a length. There the similarity ends.

A transit network is built up by the description of individual transit lines, each line being described by a sequence of node numbers defining the route and given the headway in the am-peak period. Nodes become points of transfer between transit lines when both contain the same node number in their descriptions. In the case of existing bus routes, the route and headway are taken from actual schedules furnished by the transit operators. In UNET (transit network building program) parlance, each transit line in the system is represented in the network by a "line" card. Because each line card is assigned only one set of headways -- a.m., p.m., midday and night -- a separate line card must be punched for each variant in a route such as a "cutback", or express, or limited service.

UNET allows individual transit lines to be grouped by "mode" number; 5 groupings are available (4, 5, 6, 7, 8). Modes are used in the computer description of the transit networks for several reasons: (1) To apply separate fare policies; (2) to make it easier to excerpt performance characteristics, e.g., of LRT lines; (3) to allow the separate analysis of major transit operators in the region; and, (4) to identify a corridor or major market area.

In addition to line cards, "link" cards are needed to describe the transit network. Links are described or characterized by mode. There are three access links (modes 1, 2, 3). The eight modes are listed below.

Mode 1 = "sidewalk" link; transfer between transit lines; walk from park-ride lot to transit stop;

Mode 2 = auto connector link; represents auto access to transit system from zone centroid;

Mode 3 = walk link; represents walk access to transit system from zone centroid.

Mode 4 = SCRTD local bus service;

Mode 5 = SCRTD express bus service;

Mode 6 = OCTD local bus service;

Mode 7 = OCTD express bus service;

Mode 8 = rail transit service.

The remaining modes -- 4, 5, 6, 7, 8 -- describe links that are in one of the transit line groupings described above. Characteristics applied to links belonging to transit lines include link speed, link time, link distance and 1-way or 2-way.

The time or speed between nodes of a link in the transit network is also handled differently. For bus routes, the running time or speed can be estimated from the published schedules, or it can be related to operational highway speeds, being taken as something less than the traffic speed. In the case of new rail alternatives, the link times between nodes are most often calculated as a function of the vehicle's acceleration and deceleration characteristics, cruise speed and station dwell time.

In general, the existing or base-year transit network is developed first. To construct a transit system alternative, proposed routes are added to the base network and made an integral part of it by adjusting routes and inserting transfer nodes at logical places in the base network.

5.0 TRIP DISTRIBUTION

Trip distribution is the central component of most transportation modeling systems and has received much research attention. The current state-of-the-art in the application of trip distribution models has evolved from two primary sources: the original Bureau of Public Roads studies and the work of Wilson (1967).

SCAG employs the most widely used technique for trip distribution, the gravity model. This model is based on the concept of Isaac Newton's Universal Law of Gravitation, which states that the attractive force between two bodies is proportional to the product of their masses and inversely proportional to the square of the distance between them. In similar fashion, the trip distribution model expresses the relationship between the zone-to-zone trip interchanges and the production, attraction, and network path value data developed in previously described phases. Expressed mathematically, the gravity model is given by:

$$T_{ij} = \frac{P_i F_{ij} A_j}{\sum_j F_{ij} A_j}$$

where T_{ij} = number of trips produced from zone i and attracted to zone j

P_i = total number of trips produced from zone i

A_j = attraction factors or attractivity of zone j

F_{ij} = the friction factors between zone i and zone j

The friction factors were derived empirically, using survey data, in the process of gravity model calibration. There is a set of friction factors for each trip type, reflecting the fact that each trip purpose has a different travel time distribution. These friction factors are shown on Exhibit 5-1.

The definition of a production is the home end of a home-based trip or the origin of a nonhome-based trip. Similarly, an attraction has been defined as the nonhome end of a home-based trip, and the destination end of a nonhome-based trip.

It has been found that the use of productions and attractions in the gravity model gives a better fit with observed data than simply using origins and destinations.

Therefore, the trip distribution process produced a nondirectional person trip table for the home-based trips, and directional origin-to-destination trip matrices for nonhome-based trip. Should directional matrices be required these can be calculated using the ratio of the production-to-attraction movement to the origin-to-destination movement from the survey trip matrices.

6.0 MODE CHOICE

The mode split models are implemented after the trip distribution phase. The purpose of mode choice model analysis is in general to determine the person trips made by public transit as opposed to those made by private vehicle.

The mode choice model is a demand function based on time expressed in terms of marginal utility. Marginal utility is defined as the difference in disutility between transit and auto modes. The marginal utility function is given as

$$U = (Tr - Ar) + 2.5(Tx - Ax) + (Tc - Ac)/(0.25I)$$

where
- U = marginal utility
- Tr = transit running time
- Ar = auto running time
- Tx = transit excess (access and waiting) time
- Ax = auto excess (access and terminal) time
- Tc = transit fare cost
- Ac = auto operating cost
- I = zonal median household income

Running time is defined as "on-board" time for transit and as highway network travel time for auto. Operating costs include transit fares, auto travel cost and auto parking fees. Excess time is assumed to weight psychologically more heavily than running time. It is accordingly weighted by a factor of 2.5 in comparison to running time.

The conversion of money expressed to time-expressed costs is accomplished by dividing travel cost(cents) by the trip-maker's perceived value of time.

The perceived value of one minute of time has been shown statistically to be one-quarter the zonal median household income, expressed in cents per minutes.

Three separate demand functions which relate mode choice to marginal utility have been derived empirically from survey data: one for high household incomes (over $12,500 per year); one for medium household income (from $7,000 to $12,000 per year);and one for low household income (under $7,000 per year). Income must be expressed in 1967 dollars. These functions are graphed in Exhibit 6-1.

The demand functions have been determined only for home-work trips, which account for over 45 percent of all transit trips reported in the 1967 home-interview survey. Data from the survey were insufficient for determining demand functions for the other trip types. However, the survey shows that there are about 0.09 other-work and 1.10 nonwork transit trips for every home-work transit trip. After transit home-work trips are determined as described above, the numbers of other-work and nonwork transit trips are estimated by applying the factors 0.09 and 1.10 to the home-work transit trips. This is done to obtain the net number of person trips that will make the trip by private vehicle.

Vehicle trips are divided into drive-alone, two persons per vehicle and three-or-more persons per vehicle by a submodal choice model coupled to the mode choice model described above. The submodal choice model consists of a multinomial logit model developed by CSI for SCAG/CALTRANS that considers three modes: drive-alone, shared-ride, and transit. The shared-ride mode is further divided into two and three-plus occupancy by a logit model developed by Barton-Aschman Associates. The process of submodal split is only a modification of the binary mode choice results described above, but it does allow an estimate to be made of ridesharing and of its interaction with transit ridership.

The outputs of the mode-choice phase are several tables of transit and vehicle trips, including home-work transit trips, home-work and other-work vehicle trips, nonwork vehicle trips, and carpool trips, for assignment to the highway and transit networks.

7.0 TRIP ASSIGNMENT

Trip assignment is the process by which the trips are assigned to specific routes in either the transit or highway networks. This process results in passenger loadings on each line of the transit network, and in traffic volumes and speeds in each link of the highway network. Operational statistics and system performance measures also become available from the trip assignment phase: VMT, passenger-miles, passenger-hours, boardings per transit lines, ridership by mode, linked and unlinked trips, etc.. Certain quantities can be derived from these performance measures, given other inputs: capacity required on rail lines, transit market areas, etc..

Uses of trip assignment include:

-- developing and testing alternative transportation systems or projects;

-- indicating potential areas of congestion;

-- establishing short-range priorities for implementing transportation facilities;

-- evaluating environmental impacts of transportation proposals;

-- analyzing alternative locations for facilities;

-- providing the necessary input and feedback for other planning tasks;

-- providing design volumes for facility sizing.

Vehicle-trip and transit-trip data developed in the mode choice analysis are assigned to the highway and transit networks, respectively.

7.1 Highway Trip Assignment

Highway trip assignment is accomplished by assigning to a path or family of paths the vehicle trips that occur between zonal pairs. After the trips between all zonal pairs have been assigned appropriate paths, the total number of trips assigned to individual links on all the paths are accumulated. The result is a representation of how traffic would distribute itself over a particular network during time-of-day, which the vehicle trip table encompasses.

24-hour total vehicle trips are divided into 3 period trip tables in origin and destination format.

(1) A.M. peak (6:30 - 8:30 a.m.)
(2) P.M. peak (3:00 - 6:00 p.m.)
(3) Off peak period.

Capacity restrained techniques are performed with several iterations for AM-peak and PM peak period trips. In the first iteration, trips are assigned stochastically using the free flow speeds from the UROAD look-up table. The link speeds are revised after each iteration with the following formula (usually referred to as the "BPR" formula).

$$T = T_o + 0.15\ T_o\ (V/C)^4$$

where T = estimated link time at volume V
T_o = Free-flow link time
V = link volume
C = link capacity

The probabilistic multipath assignment technique is applied for the off-peak period trip.

The program UROAD is a comprehensive and flexible highway assignment and produces reports on assigned link volume, volume/capacity ratio, vehicle miles traveled(VMT), speed, and delay.

7.2 Transit Trip Assignment

In transit assignment, trips between two zones are assigned to a path through the network. The path is selected from among the many possible paths on the basis of a minimum impedance criterion based on the assumption that the trip-maker always takes the shortest route available. Impedance is simply the total time in minutes that it takes to traverse a given path from the origin zone to the destination zone; it includes the times transit passengers spent waiting, walking, and riding the various modes. The transit path-finding algorithm (program ULOAD) assumes that:

1. Link characteristics are unaffected by the passenger loading; in other words, the time to traverse a transit link is constant.

2. The time spent waiting to transfer is one-half the headway of the line the passenger is transferring to. This assumption holds for all transfers subsequent to the first boarding. For first boardings, the waiting time is one-half the headway when the headway is less than 14 minutes; thereafter, waiting time becomes a smaller fraction of headway as headway increases.

Output from the transit assignment procedure includes:

1. Volumes on walk and auto connector links;

2. a summary of mode-to-mode transfer volumes;

3. total work trips assigned;

4. passenger loads, by line, between stops;

5. passengers off and on at each stop;

6. summaries of passenger-miles, passenger-hours, and peak loads.

8.0 VEHICLE EMISSIONS

To assess the air quality impacts of any proposed change in land use, in the highway network, in the transit system, in a transportation control measure, or in any element that influences the use of on-road vehicles, the State of California developed the Direct Travel Impact Model (DTIM). This model, programmed to operate on the output of the regional transportation model, or, more specifically, on the outcome of the highway assignment process, converts vehicle miles of travel on the highway system to vehicle emissions.

Although this report describes only the on-road emissions aspects of DTIM, the reader should be aware that the DTIM model was designed to take as input, other than the on-road emissions, stationary point and area source emissions plus off-road vehicle emissions, and produce total emissions (weekday) in 5km-by-5km grid cells covering the study area. DTIM also processes meteorological and climatological data, along with the emissions data, to prepare all of the input data required to run the "photochemical" model, which forecasts air pollution levels. That model is not currently part of the regional transportation model. In almost all cases, however, the impacts on air quality by a transportation alternative may be assessed by using DTIM to compare on-road emissions produced by that alternative to base-year emissions.

9. EXHIBITS

EXHIBIT 1-1

MODELING AND TRANSPORTATION PLANNING

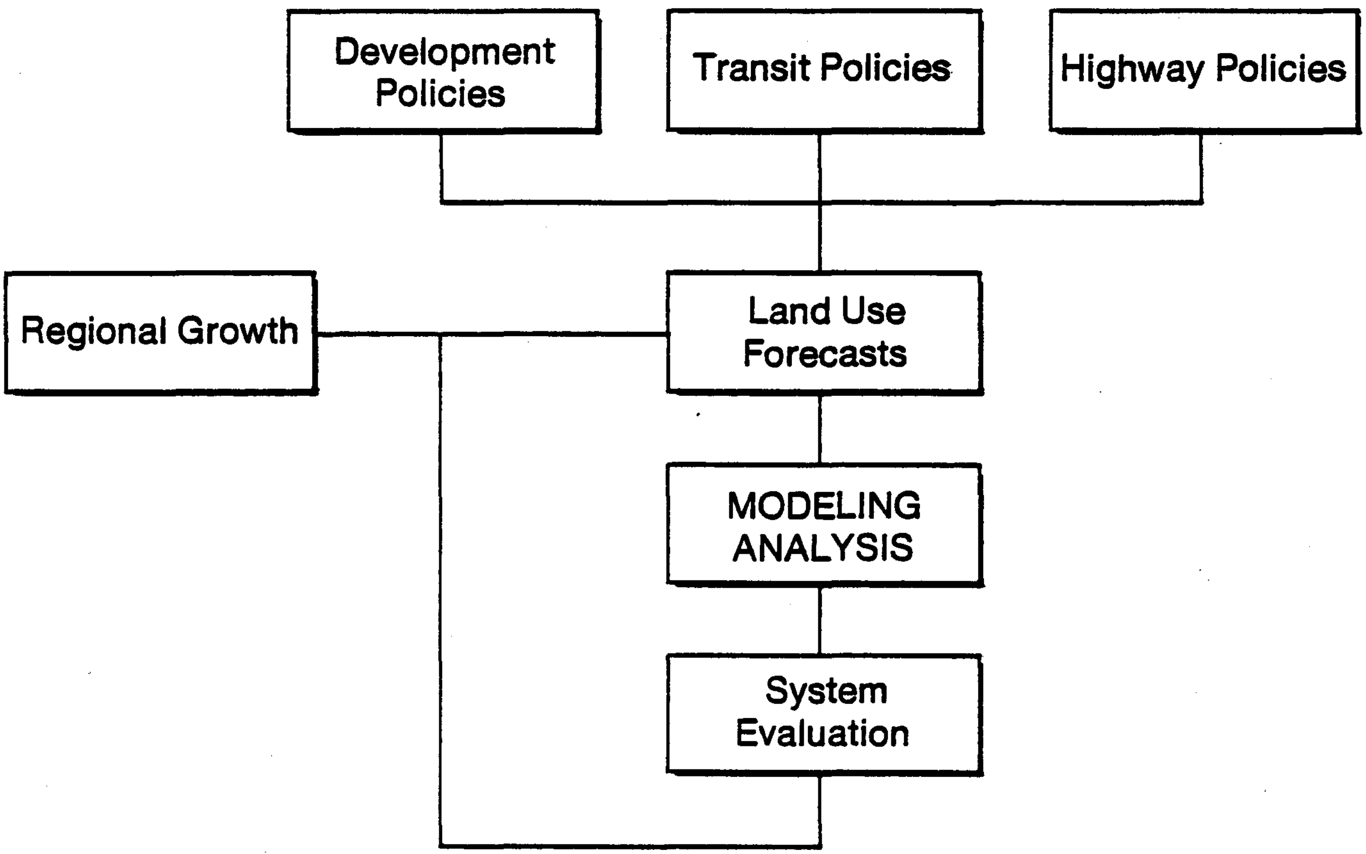


EXHIBIT 1-2

SCAG'S REGIONAL TRANSPORTATION MODELING SYSTEM

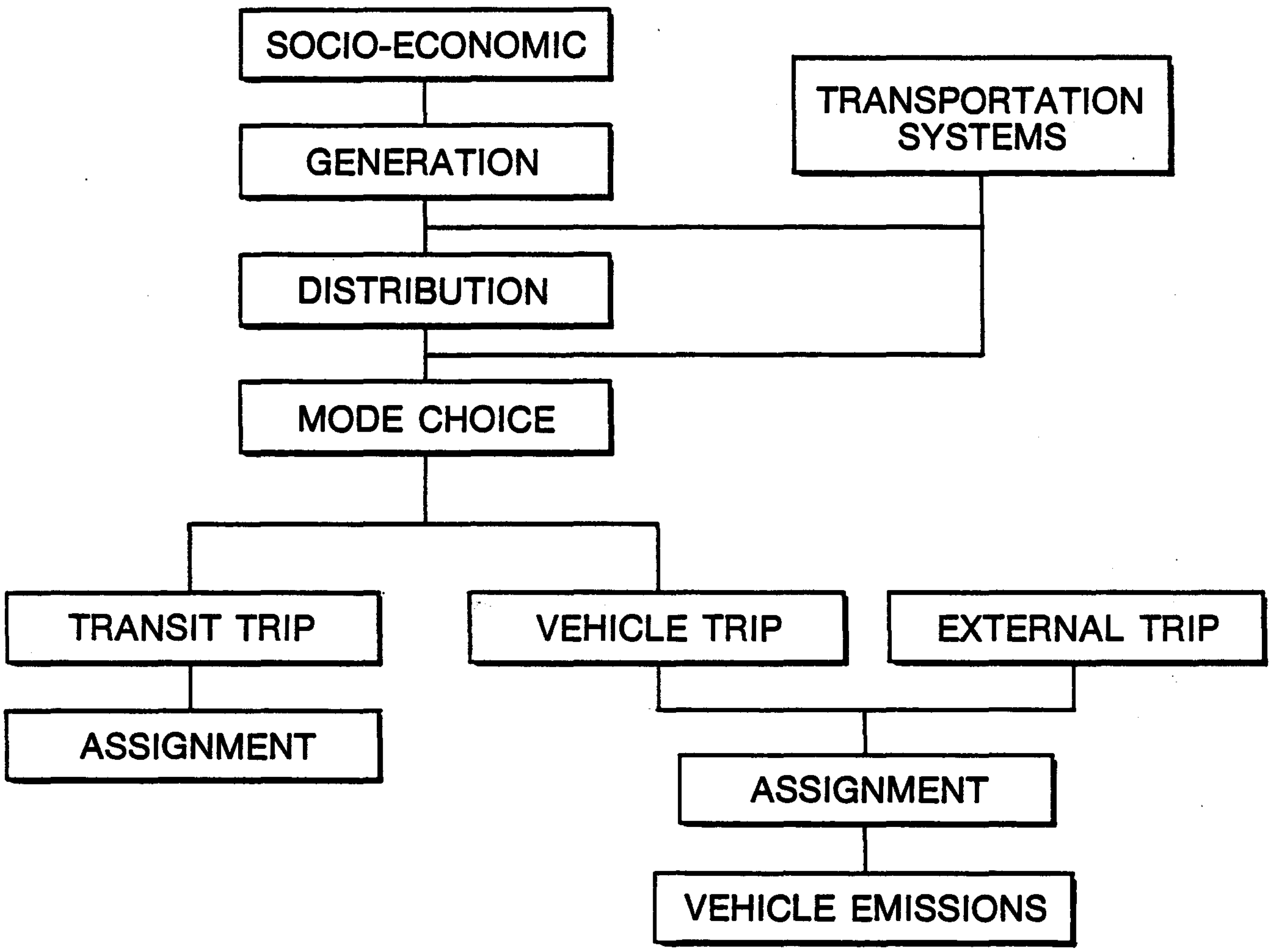


EXHIBIT 1-3
STUDY AREA

LAX AREA/TSM CORRIDOR STUDY MAP

EXHIBIT 3-1

TRIP GENERATION MODEL (1)

$$\text{Log}_e(V) = A_0 + A_1(S) + A_2\left(\frac{1}{P}\right) + A_3\left(\frac{1}{I}\right) + A_4\left(\frac{1}{I^2}\right)$$

where: V = vehicles per occupied housing unit
S = ratio of single housing units to total units
P = ratio of population to total units
I = median household income in $1000's
$A_0 - A_4$ = regression coefficients*:

County	A_0	A_1	A_2	A_3	A_4
Los Angeles	0.48	0.57	-0.14	-3.52	1.34
Orange	0.93	0.34	-1.21	-2.91	3.98
Riverside	1.07	0.22	-1.86	-1.73	3.28
San Bernardino	0.93	0.55	-1.91	-3.32	4.51
Ventura	0.22	0.50	-0.58	-2.20	0.75

* From LARTS tabulations 400603 through 400607 and 1976 Urban-Rural Survey.

EXHIBIT 3-2

TRIP GENERATION MODEL (2)

$$Z = B_0 + B_1 (S) + B_2 \operatorname{Log}_e (P) + B_3 \left(\frac{1}{I}\right) + B_4 \left(\frac{1}{I^2}\right)$$

where: Z = ratio of zero vehicle to total housing units
S = ratio of single housing units to total units
P = ratio of population to total units
I = median household income in $1000's
$B_0 - B_4$ = regression coefficients*:

County	B_0	B_1	B_2	B_3	B_4
Los Angeles	0.10	-0.17	-0.06	1.35	-0.28
Orange	0.22	-0.15	-0.11	0.40	-0.17
Riverside	0.53	-0.21	-0.22	-0.46	0.84
San Bernardino	0.41	-0.30	-0.17	0.65	-
Ventura	0.02	-0.12	0.02	1.53	-1.06

* From LARTS tabulations 400603 through 400607 and 1976 Urban-Rural Survey.

EXHIBIT 3-3

TRIP GENERATION MODEL (3)

$$\mathrm{Log}_e(R) = C_0 + C_1(S) + C_2\left(\frac{1}{P}\right) + C_3\left(\frac{1}{I}\right) + C_4\left(\frac{1}{I^2}\right)$$

where: R = ratio of one to two+ vehicle housing units

S = ratio of single housing units to total units

P = ratio of population to total units

I = median household income in $1000's

$C_0 - C_4$ = regression coefficients*:

County	C_0	C_1	C_2	C_3	C_4
Los Angeles	-0.67	-1.54	0.23	13.44	-19.02
Orange	-2.74	-1.20	4.95	12.77	-19.68
Riverside	-4.90	0.92	5.01	18.11	-30.01
San Bernardino	-2.68	-0.65	3.59	15.96	-24.69
Ventura	+0.14	-1.79	-0.60	8.41	- 9.68

* From LARTS tabulations 400603 through 400607 and 1976 Urban-Rural Survey.

EXHIBIT 3-4

PERSON-TRIP REALLOCATION MODEL

$$R\,(\text{trip type } 2) = A_0 + A_1(P) + A_2(RE)$$

$$R\,(\text{trip type } 3) = B_0 + B_1(RE) + B_2(NR)$$

where: R = person trip reallocation factor

P = population

RE = retail employment

NR = non-retail employment

$A_0 - A_2$ and $B_0 - B_2$=regression coefficients*:

County	A_0	A_1	A_2	B_0	B_1	B_2
Los Angeles	446	0.18	4.03	490	1.44	0.23
Orange	879	0.16	4.67	505	1.25	0.32
Riverside	517	0.18	6.21	142	2.03	0.24
San Bernardino	950	0.13	6.05	298	1.60	0.38
Ventura	1223	0.18	4.73	464	1.41	0.37

* From LARTS tabulations 400603 through 400607 and 1976 Urban-Rural Survey.

EXHIBIT 3-5

RELATIVE ATTRACTION

$$A = C_0 + C_1(P) + C_2(E) + C_3(RE)$$

where: A = relative attraction

P = population

E = total employment

RE = retail employment

C_0 - C_3 = regression coefficients*:

Trip Type	C_0	C_1	C_2	C_3
1 (home-other)	1539	0.46	-	5.93
2 (other-other)	666	0.18	-	3.98
3 (other-work)	308	-	0.46	-
4 (home-work)	202	-	1.58	-
5 (home-shopping)	1033	-	-	4.18

* From LARTS tabulation 400603.

EXHIBIT 5-1

TRAVEL-TIME FACTORS

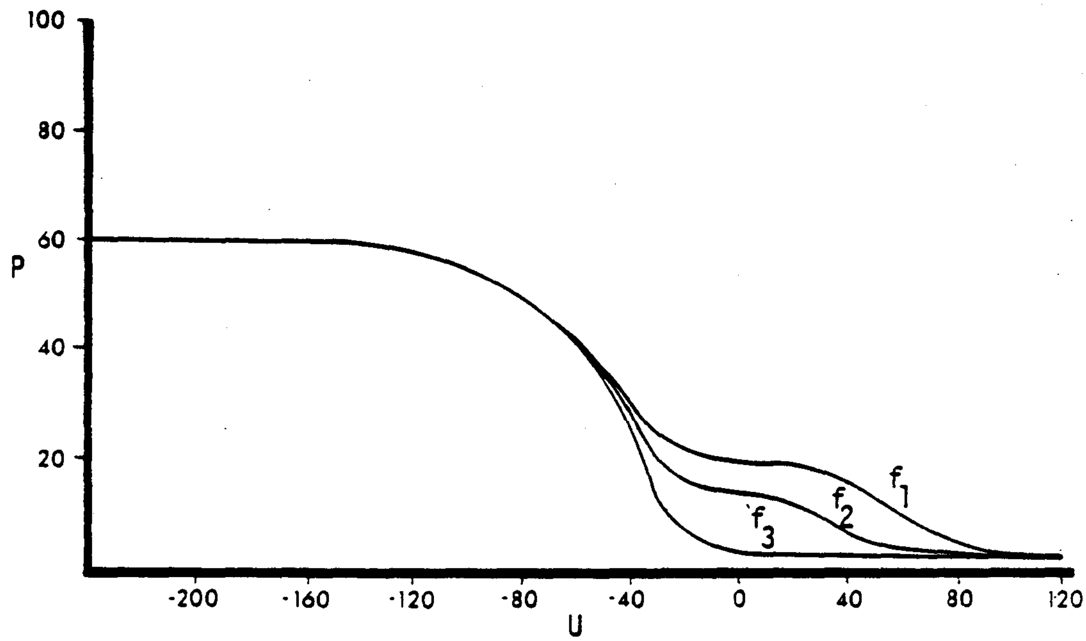
Interval Midpoint	Trip Type 1	2	3	4	5
0.5	54000	72000	46000	43500	46000
1.5	46500	56500	42000	39500	35500
2.5	37500	44500	39900	35500	27750
3.5	31000	35000	35600	31750	22300
4.5	36750	28300	30400	27800	18250
5.5	22500	22800	27000	24200	14300
6.5	17700	17750	23500	21250	10300
7.5	13400	13600	20350	18000	6900
8.5	9900	10800	17450	15300	4700
9.5	7300	8100	14100	12700	2950
10.5	5300	5300	11100	10650	1900

* From LARTS tabulation 400675.

Notes: Interval midpoint is for path value in minutes. Factors are those used when access and terminal time are included in path values. Full table includes factors for 143.5 minutes.

EXHIBIT 6-1

BINARY MODE CHOICE DEMAND FUNCTION



P = interzonal percentage of person trips using transit

U = interzonal marginal utility, in minutes

f_1 is for low level income (under $7000)

f_2 is for medium level income ($7000 to $12,500)

f_3 is for high level income (over $12,500)

10.0 REFERENCES

(1) 1967 Origin - Destination Survey, Los Angeles Regional Transportation Study, Dec. 1971

(2) 1976 Urban and Rural Travel Survey, Los Angeles Regional Transportation Study, Nov. 1976

(3) Trip Generation Analysis Report, Urban Planning Department State Of California, Sep. 1971

(4) 1976 Distribution Documentation, Technical Work Paper 2, Los Angeles Transportation Study, Sep. 1973

(5) Los Angeles Metropolitan Area Mode Choice Development, A. M. Voorhees Association, Inc., Feb. 1972

(6) Disaggregate Behavioral Work Mode Choice Model, Cambridge Systematics, Inc., Jan. 1977

(7) Travel Forecast Summary, Vol 1,2,3,4,5 Southern California Association Of Governments

(8) SCAG-82 Growth Forecast Policy, adopted Oct. 1982.

APPENDIX C

Traffic Engineering Improvements

The following is a brief description of the Traffic Engineering improvements proposed by the various jurisdictions involved, for each arterial within the study area.

- o Add two lanes plus left turn lane each direction on Will Rogers Street at Sepulveda Boulevard;
- o Add a northbound to westbound left turn lane (making 3) to Sepulveda Boulevard at Lincoln Boulevard;
- o Add additional northbound lane on Sepulveda Boulevard between 96th Street and Lincoln Boulevard;
- o Change eastbound Centinela Avenue at Sepulveda Boulevard number two through lane to optional right-turn or through lane; or
- o Provide three through lanes, two right turn, one left turn lane for eastbound Centinela Avenue at Sepulveda Boulevard;
- o Remove medians and restripe to provide dual left turn lanes for both directions on Sepulveda Boulevard and change northbound right turn only lane to continuous through lane; or
- o Provide dual left turn lanes for southbound Sepulveda Boulevard at southbound on-ramp to I-405;
- o Prohibit peak hour parking on Sepulveda Boulevard northbound between 22nd Street and Marine Avenue;
- o Provide dual left turn lanes on Sepulveda Boulevard at Grand Avenue, El Segundo Boulevard, Rosecrans Avenue, Marine Avenue, Manhattan Beach Boulevard, and change signal phasing accordingly;
- o Provide reversible mixed flow or high-occupancy vehicle (HOV) lane between Imperial Highway and Artesia Freeway on Sepulveda Boulevard;
- o Provide one through, one through-or-right, two left turn lanes for and restripe westbound Centinela Avenue at Sepulveda Boulevard;
- o Restripe Maple Avenue at Sepulveda Boulevard to provide separate left turn lane on eastbound approach;
- o Provide double left turn lanes for eastbound, westbound, and southbound approaches at Rosecrans Avenue and Sepulveda Boulevard;
- o Add separate right turn lane on southbound approach on Sepulveda Boulevard at El Segundo Boulevard;

APPENDIX C

(continued)

- Provide one left turn lane, left/through lane, and right-turn-only lane on Hughes Way (south) at Sepulveda Boulevard;
- Provide dual left-turn lanes northbound and southbound on Sepulveda Boulevard at 96th Street;
- Restrict parking on Sepulveda Boulevard from Lincoln Boulevard to Manhattan Beach Boulevard (6:30-9:00 a.m., 3:00-6:30 p.m.);
- Provide dual left turn lanes for eastbound Jefferson Boulevard at Sepulveda Boulevard by restriping and parking prohibition on both sides;
- Restripe Sepulveda Boulevard from six to eight lanes from Imperial Highway, to El Segundo Boulevard;
- Restrict parking on Lincoln Boulevard from Venice Boulevard to Sepulveda Boulevard (6:30-9:00 a.m., 3:00-6:30 p.m.);
- Add second westbound left turn lane on Washington Boulevard at Lincoln Boulevard by redesignating the left-most through lane as optional through/left turn;
- Change the inside left turn lane to through, and change the optional right-turn or through lane to right-turn-only on Lincoln Boulevard northbound at Washington Boulevard;
- Provide reversible lane on Imperial Highway from Hughes Way to La Cienega Boulevard (only until I-105 is built); or
- Provide dual left turn lanes on Imperial Highway at Sepulveda Boulevard, Douglas Street, and Nash Street;
- Add left turn lane southbound on Vista del Mar Avenue at Imperial Highway;
- Lengthen left turn pocket on each approach from 250' to 540' on Rosecrans Avenue at Aviation Boulevard;
- Lengthen left turn pocket on west approach from 200' to 400' on Rosecrans Avenue at Aviation Boulevard;
- Relocate northbound bus stop on Aviation Boulevard at Rosecrans Avenue from nearside to farside;
- Make south approach curb lane on Aviation Boulevard at Rosecrans Avenue, "Right Turn Only--Buses Exempt"

APPENDIX C

(continued)

- o Widen and restripe east approach to make two left turn lanes, three through lanes, and one right-turn-only lane on Rosecrans Avenue at Aviation Boulevard;
- o Provide pedestrian grade separation at El Segundo Boulevard/Aviation Boulevard;
- o Restrict parking on Aviation Boulevard (6:30-9:00 a.m., 3:00-6:30 p.m.);
- o Add a lane each direction to Aviation Boulevard at Rosecrans Avenue by restriping and taking the median;
- o Convert Douglas Street (through from Imperial Highway to Rosecrans Avenue or Marine Avenue) and Nash Street to a one-way street pair;
- o Provide new signal at El Segundo Boulevard and Illinois Avenue, add right turn only lane (13') to westbound El Segundo Boulevard for 460' before Illinois Avenue;
- o Widen and restripe to provide separate left turn lane on El Segundo Boulevard at Chevron entrance/Maryland Street;
- o Restripe and relocate north side median to provide dual left turn lanes, two southbound and northbound through lanes and a southbound right turn lane for Douglas Street at El Segundo Boulevard. Restripe south leg of Douglas Street at El Segundo Boulevard to provide dual left turn lanes, northbound through lane, one optional northbound through/right turn lane and two southbound through lanes if Douglas Street stays two-way;
- o Restrict peak hour parking on Jefferson Boulevard between Inglewood Boulevard and Centinela Avenue on north side to achieve six-lane full capacity;
- o Provide dual left-turn lanes from Jefferson Boulevard onto northbound San Diego Freeway on-ramp;
- o Provide four-lane section plus turning lanes on Culver Boulevard from Marina Freeway to Sepulveda Boulevard (requires peak-hour parking restrictions on some sections);
- o Widen Grand Avenue at Vista del Mar Avenue at each leg to provide westbound left turn plus right-turn-only lane and optional through/right-turn lane;
- o Restripe I-405 to add a lane (either mixed flow or HOV) each direction from I-10 to Harbor Freeway.
- o Add a right-turn lane and change optional right/though lane to through only on southbound Lincoln Boulevard at Manchester Avenue. Eastbound on

APPENDIX C

(continued)

Manchester Avenue at Lincoln Boulevard, add a second left-turn lane and add two right-turn lanes and change the optional through/right lane to through only westbound on Manchester Avenue at Lincoln Boulevard.

APPENDIX D

Highway Improvements

The following is a brief description of the highway improvements proposed by the various jurisdictions involved within the study area

- o Relocate ramp on I-405 at Centinela Avenue;
- o Add two new streets: Riggs Place and Nancy Place (Spicer Prop.), with signals. No provision for left turn from Riggs to Sepulveda Boulevard;
- o Provide three through lanes: two left turn lanes each direction of Sepulveda Boulevard at Centinela Avenue plus southbound right turn lane (requires widening by 10' plus restriping);
- o Widen Sepulveda Boulevard from Grand Avenue to Rosecrans Avenue (from 76 to 117 feet) and provide double left turn lanes at Rosecrans, Hughes Way/Coke Road, and El Segundo Boulevard;
- o Add southbound lane from El Segundo Boulevard to Coke Road on Sepulveda Boulevard or widen Sepulveda Boulevard from five or six lanes to eight lanes from El Segundo to Marine;
- o Provide roadway separation over Sepulveda Boulevard at 96th Street;
- o Widen Lincoln Boulevard from south of Jefferson Boulevard to near Fiji Way (Summa property), (no curbs moved, just pave shoulders);
- o Widen Vista del Mar Avenue for approximately 500' north and south of Grand Avenue to allow two through lanes plus left turn lane each direction at the intersection;
- o Improve Jefferson Boulevard from Lincoln Boulevard to Culver Boulevard to change the existing 4-lane section to urban, divided roadway standards.
- o Realign and widen Culver Boulevard from Falmouth Avenue to Marina Freeway from 4-lanes to a 6-lane divided section with access controlled to adjacent land uses.
- o Extend Falmouth Avenue from Culver Boulevard to (new) Westchester Parkway to provide a 4-lane capacity.
- o Extend Admiralty Way from Fiji Way to Culver Boulevard to provide a 4-lane divided roadway.
- o Extend Bay Street from Culver Boulevard to Hughes Way (including a bridge over Ballona Creek) to provide a 4-lane roadway.
- o Extend Centinela Avenue from Jefferson Boulevard to Hughes Way to provide a 4-lane roadway south, then east to rejoin Hughes Way.

APPENDIX D

(continued)

- Improve and widen Hughes Way from Lincoln Boulevard to (extended) Centinela Avenue to provide 4-lane capacity.

- Construct a new 4-lane roadway, "Westchester Parkway", from Pershing Drive to Sepulveda Boulevard intersecting Sepulveda Boulevard at Will Rogers.

- Extend La Tijera Boulevard from 88th Street to Westchester Parkway as a 4-to-6 lane roadway, with left turns from northbound (new) La Tijera Boulevard to westbound 88th Street prohibited.

- Construct a new on-ramp from eastbound Marina Freeway to Southbound San Diego Freeway to provide a direct ramp connection.

- Add a second left-turn lane, a right-turn lane, and change the optional through/right lane to through only, northbound on Lincoln Boulevard and eastbound on Jefferson Boulevard intersection. Westbound on Jefferson Boulevard at Lincoln Boulevard, add a right turn lane, a through lane, and a left turn lane and change the two optional lanes to through only. These improvements will require Jefferson Boulevard on each approach to Lincoln Boulevard to be widened.

- Add one through-lane each direction on Sepulveda Boulevard from El Segundo Boulevard to Valley Drive (making 8 lanes) by widening.

- Add one through-lane each direction on Sepulveda Boulevard from Playa Street to Sawtelle Boulevard (making 6 lanes) by widening parking prohibition (west side only), and restriping.

- Provide a consistent 6-lane capacity on Lincoln Boulevard from Venice Boulevard to Sepulveda Boulevard, plus additional turning lanes. Requires minor widening from Fiji Way to Jefferson Boulevard (Summa property), peak-hour parking restrictions from 83rd Street to Manchester Avenue, and additional of one through lane in each direction from Manchester Avenue to Sepulveda Boulevard.

- Connect and extend Continental Boulevard and Airport Street from Imperial Highway to El Segundo Boulevard to provide 6-lane capacity.

- Add a through-lane in each direction on Aviation Boulevard from Imperial Highway to north of El Segundo Boulevard to provide 6-lane capacity, plus separate left-turn lanes.

- Add a through-lane in each direction on Aviation Boulevard from south of El Segundo Boulevard to Rosecrans Avenue to provide 6-lane capacity and also provide a 2-way continuous left-turn lane.

APPENDIX D

(continued)

- o Connect Douglas Street from Alaska Street to Park Place over the railroad tracks to provide a continuous 6-lane capacity from Imperial Highway to Rosecrans Avenue.
- o Provide through 6-lane capacity on Redondo Avenue from Rosecrans Avenue to Marine Avenue.
- o Widen and extend Hindry Avenue southeast to meet Florence Avenue at Compton Avenue, with 4 through lanes plus parking. Widen to 4-lanes and extend 147th Street west to Aviation Boulevard (under ATSF tracks), and east (with a jog at Hindry Avenue) under I-405 to Ocean Gate in existing railroad right-of-way; or
- o Construct a new on-off ramp from Compton Boulevard to north and southbound I-405 to provide a ramp connection to the freeway.
- o Extend Marina Freeway as a 4-lane arterial in the abandoned railroad right-of-way from Lincoln Boulevard to Washington Street.
- o Add one eastbound lane on El Segundo Boulevard from Aviation Boulevard to I-405 southbound on-ramp.