

Caltrans District 7

*HIGH OCCUPANCY VEHICLE
LANE STUDY*



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Prepared By:

Transportation Planning Branch

California Department of Transportation

Caltrans District 7

February 1988

CALTRANS DISTRICT 7
HIGH OCCUPANCY VEHICLE (HOV) LANE STUDY

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Caltrans District 7 High Occupancy Vehicle (HOV) Lane Study

I. INTRODUCTION

The implementation of high occupancy vehicle (HOV) lanes represents a cost effective means of increasing the efficiency of existing freeway facilities. This is very significant since economic, social, political, and environmental constraints collectively deter any major future expansion of the freeway system in the foreseeable future. But even with a substantial construction program, recurrent congestion on freeways in the Los Angeles Metropolitan Area is unlikely to be significantly reduced.

Increased freeway congestion, caused by increasing demand and a lack of capacity, is inevitable in the Los Angeles region despite additional freeway construction and improvements to existing freeways. Increases in housing, employment, and population are expected to continue at least through the early 21st century. In 1984 approximately 40.4 million average daily person trips were made in the Los Angeles Regional Transportation Study (LARTS) modeling region each weekday. The LARTS model predicts the daily person trips will increase to 54.5 million in the year 2010. The growth in portions of Orange, Riverside, and San Bernardino Counties is especially intense; consequently, trips from these areas to Los Angeles are likely to increase substantially.

The nature of recurrent congestion in the Los Angeles Region is complex. Unlike travel in many large cities, trips made in the Los Angeles Region are dispersed because of the many employment, activity, and housing centers scattered throughout the region. Because of dispersed trip patterns, some freeways may experience non-directional congestion. In other words some segments are congested in both directions during the morning and evening peak periods.

The 1986 Caltrans freeway congestion maps indicate

virtually all metropolitan freeways are congested at some time during the morning or evening peak periods. Existing HOV lanes, demonstrate the potential to improve person capacity on congested freeways because they encourage carpooling and transit usage by providing preferential service to carpools, vanpools, and buses. In other words, high occupancy vehicles can move faster on free flow HOV lanes and consequently save time. Thus, as long as traffic on HOV lanes moves significantly faster than that on mixed flow lanes, there is an incentive for people to form and stay in carpools. The table on the next page illustrates the advantage existing HOV lanes have over mixed flow lanes in terms of reducing congestion and improving person throughput.

In addition, HOV lanes can result in reduced vehicle miles traveled, energy consumption, and air pollution. Further, individuals in carpools save money in terms of parking and motor vehicle maintenance and operation costs.

Finally, HOV lanes may be considered long term solutions to recurrent freeway congestion as their use can be upgraded to accommodate increased demand. (e.g. 2 or more HOV lane can be upgraded to a light rail facility.) In contrast, the addition of mixed flow lanes to increase freeway capacity generally alleviates congestion temporarily. Experience has shown that the freeway will soon become congested again as commuters switch from surface streets to take advantage of improved freeway operation and trips not previously made materialize. Others who traveled during the fringe of the morning and evening peak, thus spreading the peak periods, will readjust their travel schedules to take advantage of improved operation. As the demand increases, the capacity (approximately 2000 vehicles per lane per hour) of a mixed flow lane can quickly be attained. When demand exceeds capacity, vehicle throughput will decrease to as low as 1,400 to 1,500 vehicles per lane per hour as congestion worsens. On the other hand, vehicle throughput on HOV lanes may take years to reach capacity. HOV lanes encourage the continual formation of carpools and vanpools which results in a steady improvement of person throughput on the additional lane.

The development of HOV lanes on the freeway system is a departmental priority. Caltrans has adopted the policy of recommending implementation of preferential lanes on freeways when such projects are feasible and have the support of local and regional agencies. HOV implementation is also part of the Caltrans policy of improving the efficiency of existing facilities by implementing transportation system management (TSM) measures.

HOV LANE COMPARISONS
2 HOUR AFTERNOON PEAK PERIOD
1530 TO 1730 HOURS

COUNTY	LA	LA	ORA
ROUTE	10	91	55
DIRECTION	EB	EB	NB
LOCATION	WARWICK	LAKEWOOD	17TH ST
DATE	10/7/86	9/10/86	9/23/86
CARPOOL DEFINITION	3+	2+	2+
MAINLINE FREEWAY OCCUPANCY	1.20	1.08	1.09
FWY + HOV LANE OCCUPANCY	1.41	1.25	1.32
FWY + HOV + BUS OCCUPANCY	1.62	1.28	1.33
% OF HOV LANE OCC VIOLATORS	10.1%	4.3%	5.9%
# OF HOV LANE OCC VIOLATORS	169	94	152
# OF LEGAL CARPOOLS IN HOV LN	1273	1933	2450
# OF VANPOOLS IN HOV LANE	117	78	41
# OF BUSES IN HOV LANE	113	12	6
# OF VEHICLES IN HOV LANE	1672	2117	2649
# OF MIXED FLOW LANES	5	4	3
# OF MIXED FLOW VEHICLES	14496	12065	9431
# OF MIXED FLOW PEOPLE	17400	13015	10301
# OF MIXED FLOW PEOPLE/LN	3480	3254	3434
HOV LANE PEOPLE/LANE EXCLUDING BUSES	5452	4717	5703
PEOPLE/LANE IN BUSES	3561	400	130
TOTAL HOV PEOPLE/LANE	9013	5117	5833
# OF MIXED FLOW PEOPLE	17400	13015	10301
TOTAL HOV PEOPLE/LANE	9013	5117	5833
TOTAL FWY+HOV PEOPLE	26413	18132	16134
% CARRIED IN HOV LANE	34%	28%	36%
%CARRIED PER LANE MIXED FLOW	13%	18%	21%
# OF MIXED FLOW LANES NEEDED TO CARRY PEOPLE IN HOV LANE FOR 2 HOUR PEAK PERIOD	2.6	1.6	1.7

SOURCE: CALTRANS DISTRICT 7 TRAFFIC OPERATIONS BRANCH

Definitions

There are basically three different types of preferential lanes which have been implemented or are being planned on freeways in Southern California:

Transitways (or busways). Transitways are generally implemented within the freeway right-of-way but are separate guideways. Transitways may have on-line stations for passenger boarding or discharge. A buffer or barrier separates the guideway from the mixed flow lanes. In addition, a transitway will have limited access, egress, and may have direct ramp connections to surface streets. Transitways may be for exclusive bus use, or carpools and vanpools may be permitted. The El Monte Busway along Route 10 (San Bernardino Freeway) is an example of a transitway which accommodates carpools (3 or more occupants) as well as buses.

HOV / Commuter Lanes. Concurrent HOV lanes are the most common type and will be referred to in this study as HOV lanes or commuter lanes. HOV lanes usually occupy the median of the freeway and are separated from mixed flow lanes by a four foot painted buffer. All HOV lanes have traffic enforcement areas which allow CHP officers to cite offenders with minimal disruption of traffic. The HOV/commuter lanes will be reserved for vehicles carrying a minimum of two people (three people where warranted).

Ramp Metering and By-pass Lanes. Ramp metering regulates the number of vehicles entering freeways to manage freeway demand. By-pass lanes on metered ramps, a type of HOV lane, allow ride-share vehicles to by-pass any resultant queuing from ramp metering. Overall, by-pass lanes and metering are integral elements of a controlled freeway system.

There are other types of HOV preferential treatment on freeways such as peak direction reversible lanes. This type of lane has been implemented in other parts of the state and the country but is not considered at this time for implementation in the L.A. Metropolitan Area.

II. BACKGROUND

The first High Occupancy Vehicle (HOV) facility in California was opened to traffic in 1972. This was the San Bernardino Busway, a 17 mile facility located in the median of

the San Bernardino Freeway, which was restricted to bus operations and which featured exclusive right of way, direct access to stations at the Los Angeles County/USC Medical Center and California State University, Los Angeles, and connected the City of El Monte to East Los Angeles. This facility, built as a federal demonstration project, has subsequently been opened to carpools (3 or more people), and is presently being extended to the Los Angeles civic center.

More recently, two additional HOV facilities were opened in the Los Angeles region. In November 1984 HOV lanes were opened in the medians of the Route 55 Freeway in Orange County, and the Route 91 Freeway in Los Angeles County. Addition of the HOV lanes in both projects entailed taking a portion of the freeway median and reducing the width of each existing lane by one foot. Opened as demonstration projects, each has since been made permanent.

The Route 55 HOV lanes run from the San Diego Freeway (Route 405) to the Route 91 Freeway, a distance of approximately 11.5 miles, and operates 24 hours a day. The Route 91 HOV lanes run from just east of the Harbor Freeway (Route 110) to the Route 605 Freeway, a distance of approximately 8.7 miles, and operates only in the eastbound direction and during the evening peak period.

In both cases the HOV lanes are separated from the adjacent mixed flow lane by a double painted line, and access is limited. Access and egress points are indicated by signing and breaks in the painted line. Although the HOV lanes on both freeways have significant user acceptance, a vocal minority continues to oppose them, contending that they are unsafe.

In February 1987, the department decided not to implement a proposed HOV lane on the Ventura Freeway (Route 101) in the San Fernando Valley because of significant political opposition and lack of visible public support.

Experience to date suggests that HOV lanes, which provide an opportunity for the user to bypass congestion, have broad user support and foster the growth of ride sharing, particularly car and van pooling. However, in order to have a measurable impact on congestion (reduce vehicle trips during peak periods of travel and increase vehicle occupancy) an integrated system of HOV lanes is necessary. This report discusses in general terms the progressive development of such a system (For a comprehensive discussion of the history and effectiveness of HOV lanes, please refer to the HOV Facilities Plan prepared by The Southern California Association of Governments (SCAG), September 1987).

III. PURPOSE OF STUDY

This study focuses on identifying segments of freeway congestion which suggest HOV lane implementation, and routes on which HOV lanes can be implemented. In addition, since other public transportation agencies are conducting rail, transitway, and HOV studies, this study considers the planning and coordination of both transitways and HOV/commuter lanes. This is consistent with Caltrans statutory authority of constructing and operating the state highway system.

In corridors where fixed rail systems are proposed or built to accommodate travel demand, complimentary commuter bus lanes may be appropriate.

The objective of this report is to identify an integrated system of HOV lanes on the freeway system in the Los Angeles Region. (See Figure 8, 1988 HOV Candidate Map.)

Specific HOV lane dimensions, construction costs, signing, implementation strategies, funding, legal aspects, and operational details are beyond the scope of this study. Specific HOV issues will be addressed in greater depth when the route is to be considered for implementation.

IV. METHODOLOGY

The following outlines the methodology used to identify and categorize candidate HOV projects.

Modeling

In order to assess the potential demand for HOV lanes in District 7, regional trip assignment model runs for the years 1984 and 2010 were executed. The network for the year 2010 included all existing freeways and projects in the State Transportation Improvement Plan (STIP). Assumed were the completion of the Century and Long Beach Freeways, the extension of Route 30, and completion of the proposed San Joaquin Hills, Eastern, and Foothill transportation corridors.

Carpool trips were then assigned to this network and plotted. The assignment network plots indicate projected demand in terms of AM and PM peak hour and 24 hour volumes for the years 1984 and 2010.

Future rail projects and non-state highway facilities are not included on the network plots (trips by rail were split off in the mode choice phase of the model runs). Some, but not all, freeway to freeway interchanges include direct HOV lane connectors.

For the 2010 two or more person carpool network plots, peak hour volumes under 1000 vehicles per hour per lane, were generally considered too low to justify HOV lanes since the lane would be underutilized. Conversely, volumes ranging from 1000 to 1700 warrant HOV lanes and would permit free flow or near free flow speeds. The 1984 and 2010 two or more person carpool volumes were color coded on maps using the following scheme:

1. Volumes under 1000 were not coded
2. Volumes between 1000-1700 coded green
3. Volumes of 1700 and higher coded red

For the 2010, vehicles carrying three or more persons, volumes under 700 vehicles per hour per lane during peak hours were considered too few to warrant HOV lanes. Volumes over 700 would justify HOV lanes. The 2010 vehicles carrying three or more persons volumes were color coded on maps using the following scheme:

1. Volumes under 700 were not coded
2. Volumes over 700 were coded green

Figures 1-6 were based on the 1984 vehicles carrying two or more persons, 2010 two or more persons, and 2010 three or more persons plots, respectively. Separate maps for am and pm peak hours for each year and carpool type are presented for ease of interpretation (For more details on the modeling process, see Appendix).

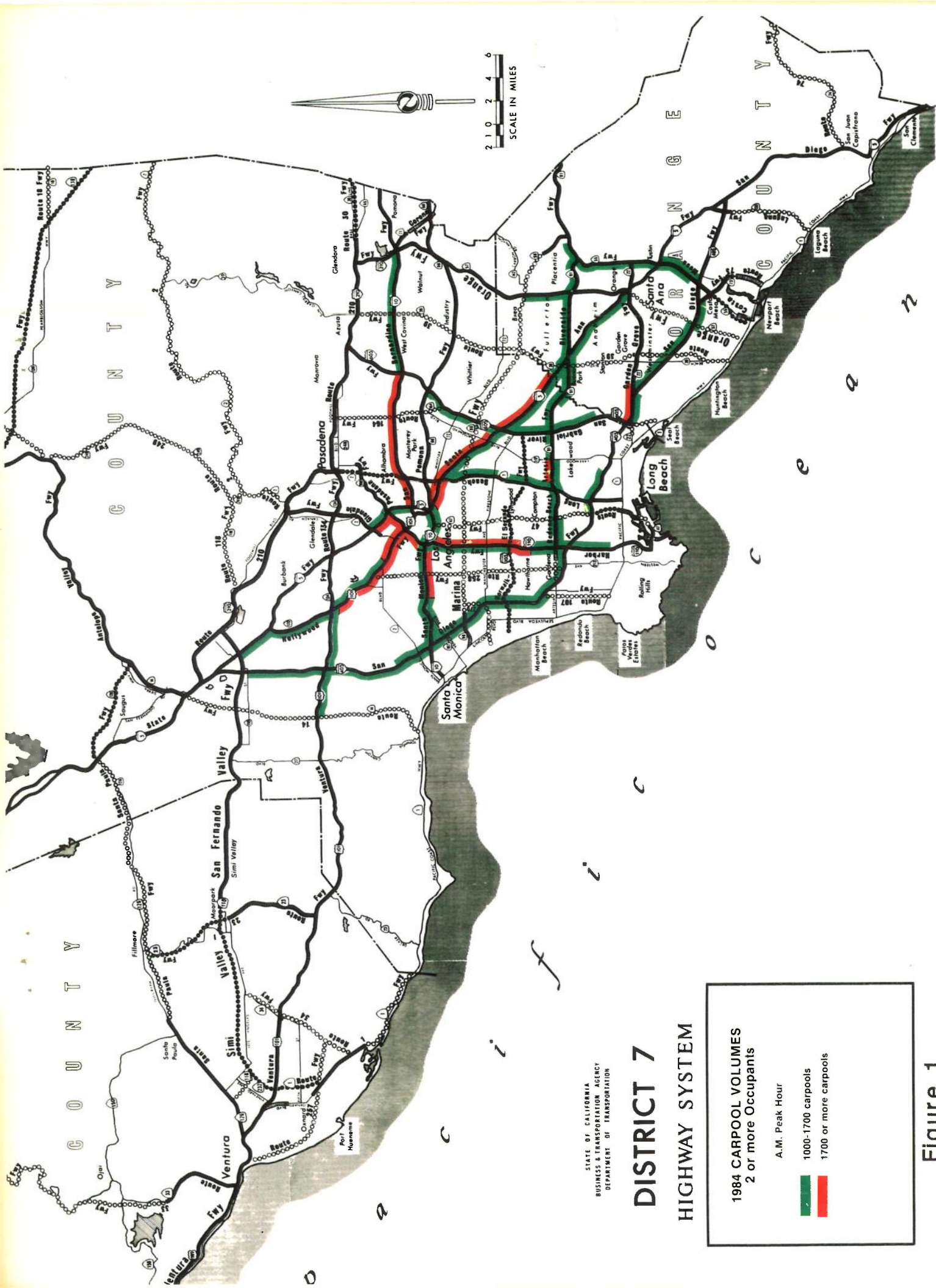
The map which depicts vehicles with two or more people in 2010 indicates that the Santa Ana (5), San Bernardino (10), Hollywood (101), Harbor (110), and Santa Monica Freeways (10) have the highest demand and warrant restriction to three or more person carpools to avoid congestion in the HOV lane. Most other routes warrant carpool lanes which are restricted to vehicles with two or more persons.

The map which depicts vehicles with three or more people in 2010 supports the demand that warrants restriction of HOV lanes to vehicles with three or more people on Routes 5, 10, 101, and 110, especially near the Los Angeles CBD. Other freeways which reflect a high demand for carpools with three or more people are Route 57 in Los Angeles County and Routes 5, 55, 57, and 91 in Orange County.

Overall, virtually all metropolitan freeways in Los Angeles and Orange Counties warrant HOV lanes which are at least restricted to carpools with two or more people.

Costs

The cost of implementing HOV lanes is a major criterion for determining feasibility and costs can vary significantly.



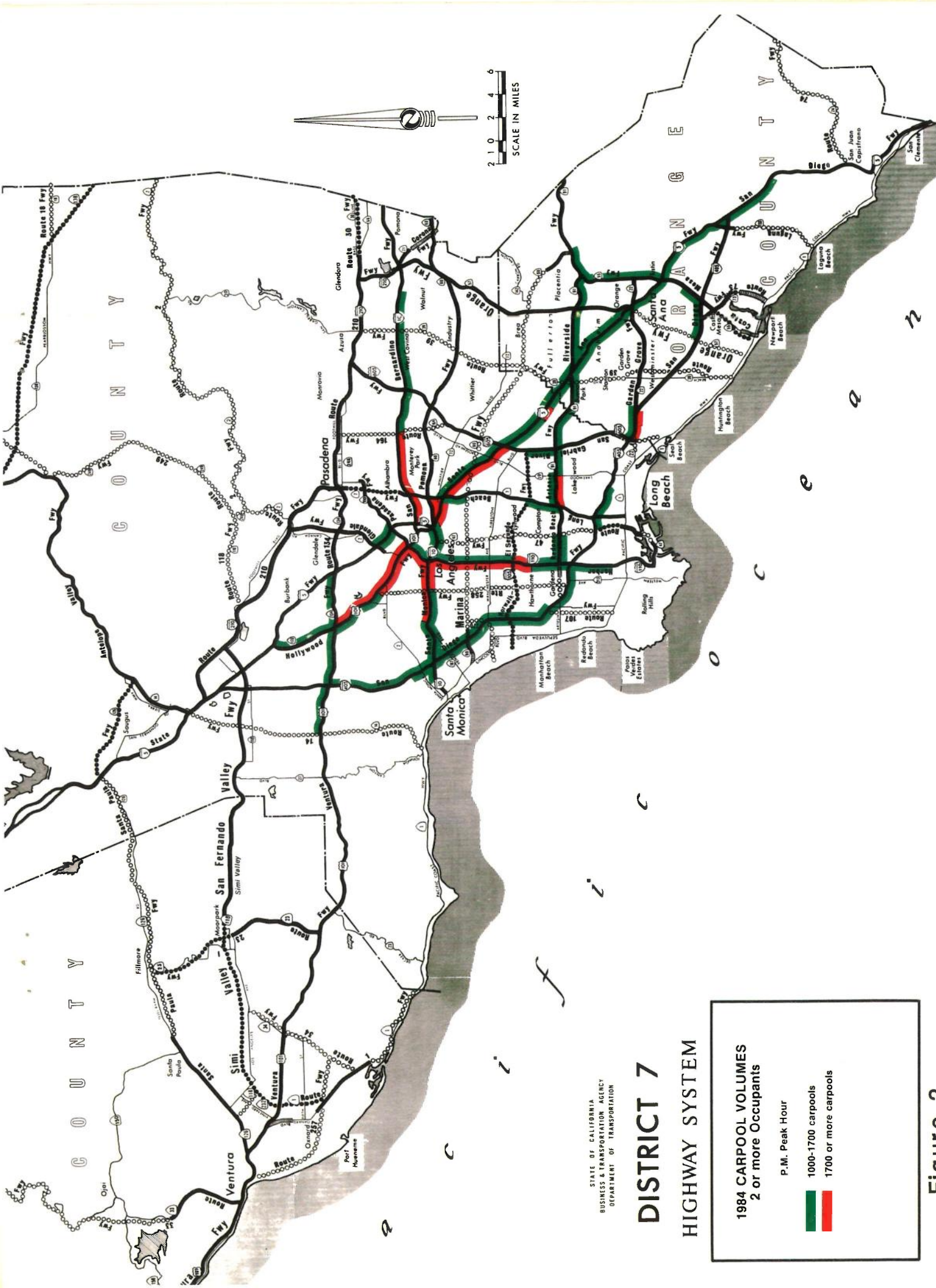
STATE OF CALIFORNIA
BUSINESS & TRANSPORTATION AGENCY
DEPARTMENT OF TRANSPORTATION

DISTRICT 7 HIGHWAY SYSTEM

1984 CARPOOL VOLUMES
2 or more Occupants

- A.M. Peak Hour
- 1000-1700 carpools
- 1700 or more carpools

Figure 1



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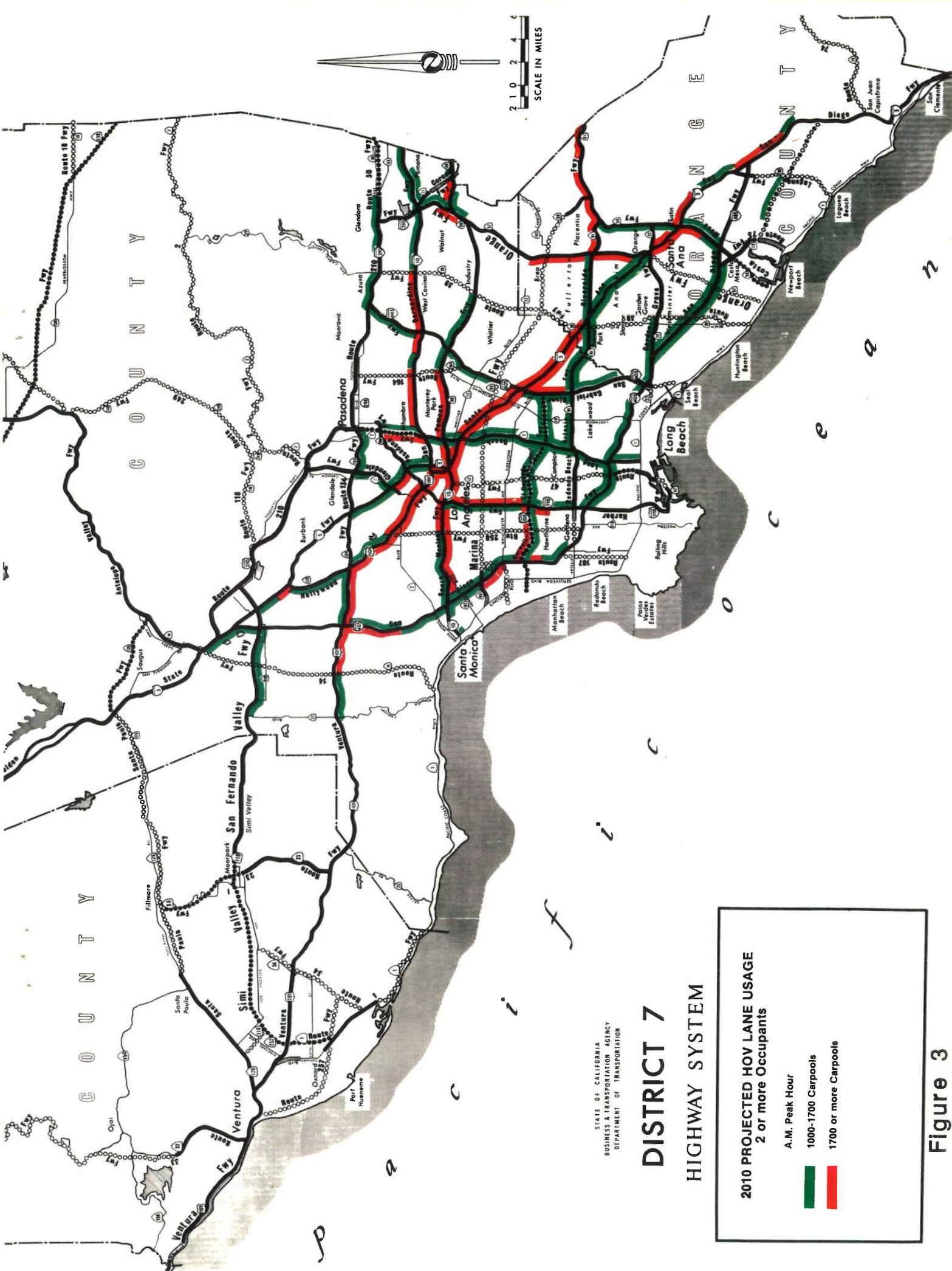
DISTRICT 7 HIGHWAY SYSTEM

1984 CARPOOL VOLUMES
2 or more Occupants

P.M. Peak Hour

- 1000-1700 carpools
- 1700 or more carpools

Figure 2



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DISTRICT 7 HIGHWAY SYSTEM

2010 PROJECTED HOV LANE USAGE
2 or more Occupants

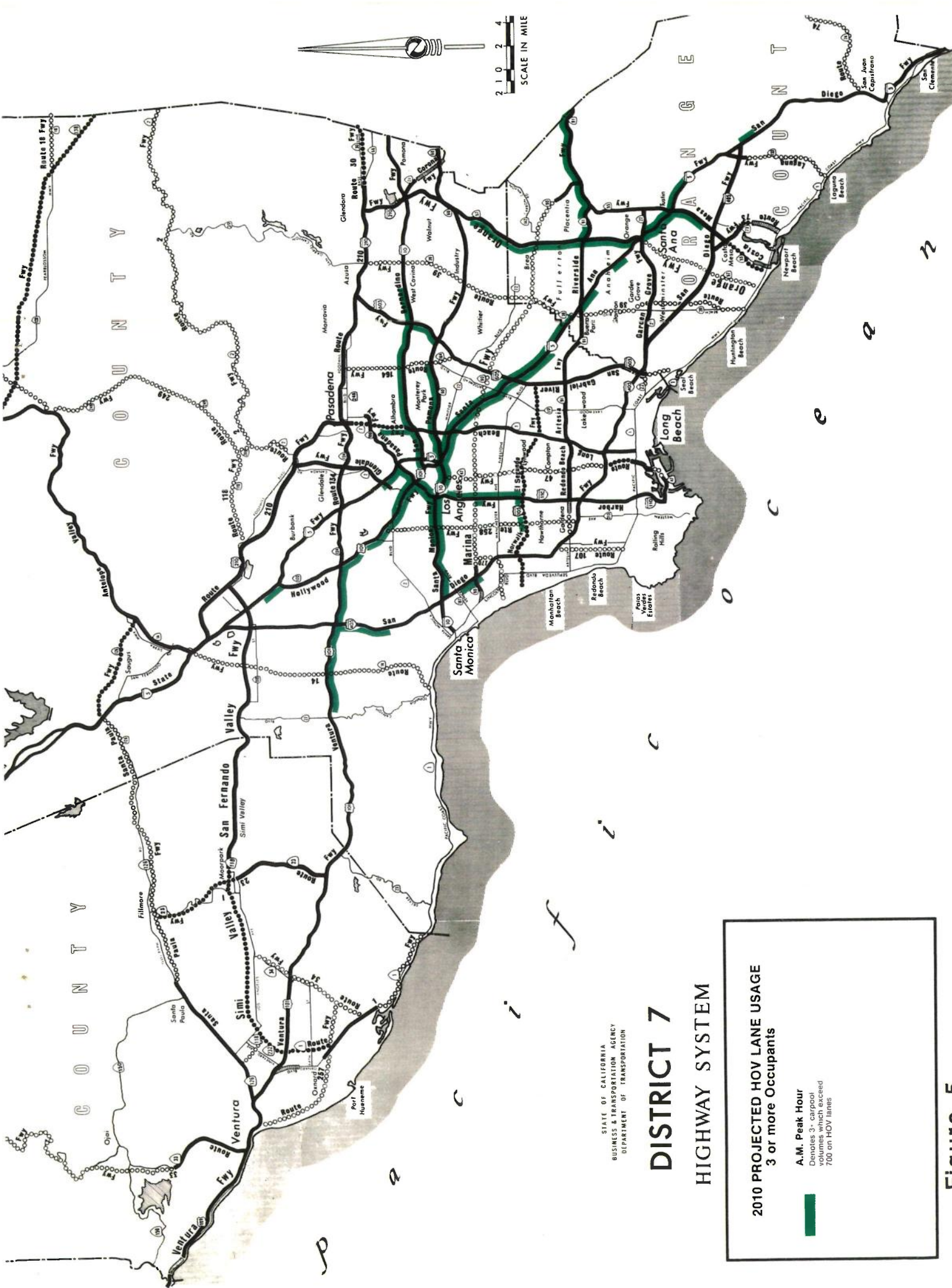
A.M. Peak Hour

1000-1700 Carpools

1700 or more Carpools



Figure 3



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DISTRICT 7 HIGHWAY SYSTEM

2010 PROJECTED HOV LANE USAGE
3 or more Occupants

A.M. Peak Hour
Denotes 3+ carpool
volumes which exceed
700 on HOV lanes

Figure 5

Freeway median width, right-of-way constraints, bridge widening, facility type, and HOV lane design geometry generally determine whether an HOV lane can be implemented by simply re-striping and signing or if costly widening and construction will be required. HOV lanes are usually more expensive to implement than mixed flow lanes due to the requirement of a four foot buffer, appropriate signing, enforcement areas, and so forth. HOV lane operation and maintenance costs also tend to be higher.

If the freeway median is sufficiently wide, and there are no physical constraints such as tunnels or narrow bridges, a conventional commuter (as opposed to a bus guideway) HOV lane can be implemented without any major widening or construction. Thirty feet is generally the minimum median width needed to re-stripe for HOV lanes with four foot wide buffers in both directions for an eight lane freeway.

Because design standards for freeway median widths have changed over the years, median widths vary on the Los Angeles freeway system. Some of the older freeways were built with no median shoulders. In addition, some of the freeways have already been re-stripped and available median space is limited.

It may be feasible to implement HOV lanes where there is insufficient median width by widening on the outside of the freeway. Such widening is of course, expensive. Factors which affect costs include, but are not limited to, acquiring right-of-way, earthwork, moving existing or building new sound walls and retaining walls, and bridge widening. At the downtown confluence of the Santa Ana, Hollywood, and Pasadena Freeways, the extremely high costs of widening tunnels and numerous bridges, and purchasing expensive right-of-way makes the construction of HOV lanes unlikely.

Existing and Planned Projects

A number of transitways and fixed rail projects are currently being planned or being studied. (See Figure 7, LACTC Transit Development Map.) However, only the Route 110 transitway, the light rail project on the Century Freeway, L.A./ Long Beach Light Rail project, and the Metro Rail starter line are in stages of implementation. Many proposed rail transit projects parallel freeways on which HOV lanes are being considered. However, the demand along many of these corridors could warrant both HOV lanes and rail service. For example, forecasts indicate that HOV lanes and the rail transit in the median of the Century Freeway will not be underutilized. HOV lanes may be a viable interim alternative where a rail project may ultimately be implemented.



Transit Development in Los Angeles County

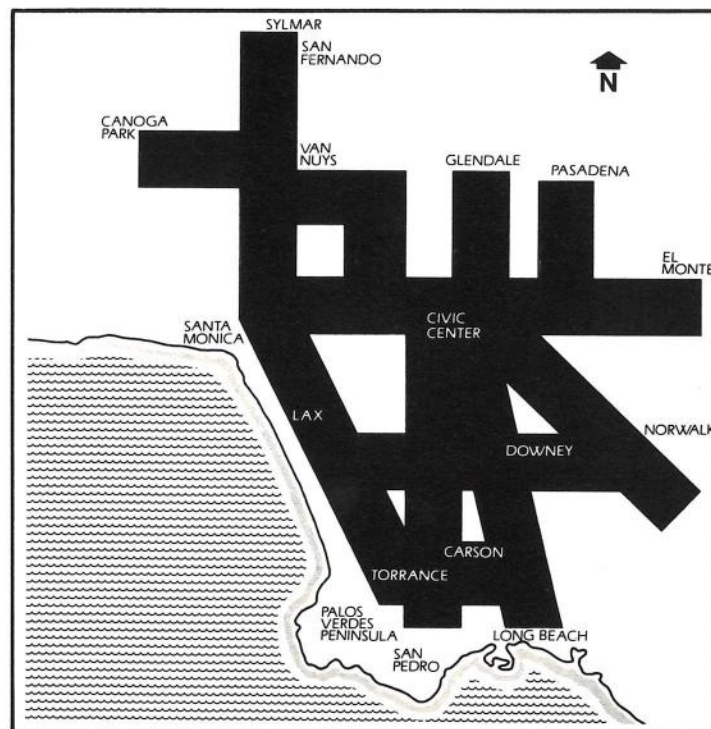
LOS ANGELES COUNTY TRANSPORTATION COMMISSION





TRANSIT DEVELOPMENT IN LOS ANGELES COUNTY

- Proposition A is Los Angeles County's half-percent sales tax for public transit, passed by county voters in 1980.
- 35 percent of these tax revenues (about \$110 million per year) are dedicated to the construction and operation of a rail transit system serving the entire county. Rail lines will be built in the transportation corridors outlined on the map below.
- The **SCR**TD's Metro Rail starter-line had been identified in previous studies as the most effective way to serve the densely populated regional core of the county; it will be built using federal, state, and local funds and private benefit assessments, as well as Proposition A funds.



- The **LACTC** selected a route from downtown Long Beach to downtown Los Angeles as the next line of the system; it will be constructed using only Proposition A funds.
- The **LACTC** also is building a rail line with Proposition A funds in the middle of the new Century Freeway. The line turns southward near LAX to serve the El Segundo employment area; in the future, plans call for extensions north and south along the coast.
- Projects are being developed in other corridors as well. The **LACTC** is studying possible routes for an east-west rail line in the San Fernando Valley and for a line from downtown L.A. to Pasadena. In the San Gabriel Valley, when passenger-demand warrants, the El Monte Busway can be converted to rail. Caltrans is designing an exclusive busway along the Harbor Freeway, which will serve the needs of that corridor and also may be converted to rail at some time in the future.
- The color map on the reverse side shows corridors where projects are under construction and other corridors that have been designated as 'high priority.' The **LACTC** will study corridors not yet designated as high priority when conditions in those areas justify building more rail lines.

For more information, please write or call the **LACTC**'s rail hotline, (213) 620-RAIL, or write to the **LACTC** at:

LOS ANGELES COUNTY TRANSPORTATION COMMISSION

403 W. Eighth Street, Suite 500

Los Angeles, CA 90014

V. HOV LANE OPERATION CONSIDERATIONS

HOV lane operation considerations are included in this study because of their relationship to the costs, benefits, and effectiveness .

Continuity

The continuity of HOV lanes along a given corridor and/or connecting with other corridors is a significant factor contributing to the effectiveness of an HOV lane system. Thus, freeway routes with HOV lanes need to be continuous and long enough for those using carpools to save significant time. And since many commuter trips in the Los Angeles region take place on two or more freeways, HOV continuity could provide additional savings in time by allowing commuters efficient freeway to freeway transitions. In some cases exclusive HOV lane connectors between freeways may be warranted where there are heavy carpool, vanpool, and bus movements. Exclusive HOV lane freeway to freeway connectors will be expensive.

A lack of HOV lane continuity which results in a lack of significant time savings by commuters could act as a deterrent to carpool formation and/or public transit usage.

Occupancy Requirements

It is critical that the initial decision as to whether a carpool lane shall be restricted to vehicles carrying a minimum of two people, or of three people, be thoroughly analyzed. If we are optimistic and a carpool lane restricted to vehicles of three or more people is underutilized, it shouldn't be difficult to re-define the restriction to vehicles of two or more. The converse, however, is not true. If a carpool lane restricted to two or more people is over utilized, re-defining the lane to a more restrictive three or more people is fraught with potential problems. No where in the United States has the utilization of a carpool lane been made more restrictive after inception. Obviously as carpools become more widely accepted, this more restrictive transition may become necessary. Research is needed to make such a transition publicly and politically acceptable.

A potential solution is changeable requirements. Let us say that a carpool lane is restricted to vehicles of two or more people, 24 hours a day all week. As utilization of the lane increases, the restriction during the peak hour may be changed to three or more people, with the restriction of two or more being maintained during the remaining hours. As lane utilization continues to increase the restriction could be incrementally increased to three or more people, as necessary.

Admittedly, differential definition of a carpool lane poses potential problems relative to signing, compliance, enforcement, and overall operation. Significant research is necessary for successful implementation.

Another consideration in developing a system of HOV lanes is the potential merger of HOV lanes where the criteria is two or more people with those where the criteria is three or more. This phenomenon also requires additional study.

Peak Period or 24 Hour a Day Operation

HOV lanes may be operated 24 hours a day or only during peak periods. (Generally, a 24 hour HOV lane is the easiest to sign and enforce, is safer, and causes less driver confusion.) However there is concern that 24 hour a day HOV lane operation can breed driver resentment, since the HOV lane will probably be underutilized during off peak hours. The El Monte Busway along the San Bernardino Freeway and the Route 55 commuter lane are 24 hour operations. The Route 91 commuter lane now operates only during pm peak hours.

Access and Egress

There are two basic types of HOV access and egress. The simplest type is to enter the HOV lane from the freeway proper at designated locations. The HOV lane along the Route 55 Costa Mesa Freeway is an example of this type of access and egress. A disadvantage is that a driver entering or exiting the HOV lane must cross mixed flow lanes which may be operating at or above capacity.

Exclusive HOV access and egress ramps are the most ideal. The El Monte Busway is an example of a facility with exclusive HOV access and egress ramps. However, exclusive HOV ramps are costly to construct and may conflict with existing physical features and thus are not always feasible. Another related issue is the location and number of access and egress points. If there are too many points of access and egress the speed and time savings may be decreased because of numerous lane changes along with increased lane volumes. However, carpool drivers may not be able to use HOV lanes if there are too few access and egress points or they are not located close to trip destinations or origins. Access and egress points should be provided at least every 3-4 miles. The issue of access and egress to HOV facilities should be covered in more detail in specific route studies.

A final consideration is the end treatment of HOV lanes. HOV lanes can merge with mixed flow traffic where congestion tapers off. An HOV lane which ends at a location such as the CBD would cause queuing and friction if it merges with

congested lanes. A possible solution might be exclusive off-ramps or freeway connectors to local streets that have designated lanes for carpools or buses.

Enforcement

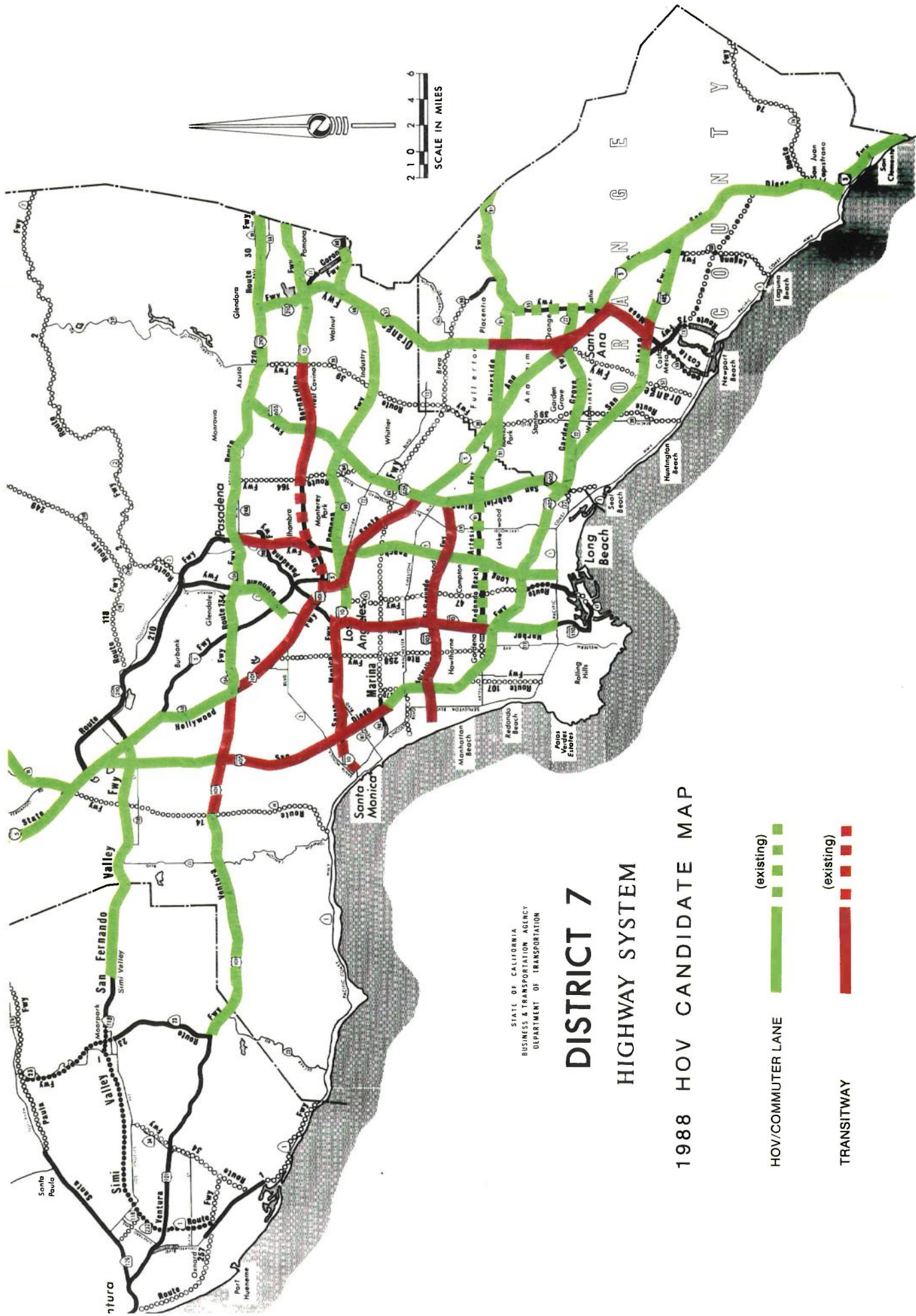
In terms of violation and enforcement issues, more research is needed as well as continued cooperation with the California Highway Patrol. Law enforcement refuge areas will be implemented on future HOV facilities. The adopted HOV lane project on the San Diego Freeway (I 405) in Orange County includes several uni and bi-directional CHP enforcement areas. The bi-directional enforcement areas will be created by offsetting the existing freeway center line and providing a median barrier passage for CHP vehicle turn around. (The table in the introduction shows the number of violators on the existing preferential facilities on the Artesia, San Bernardino, and Costa Mesa Freeways.)

VI. CONCLUSION

Figure 8, 1988 HOV candidate map, graphically summarizes this study. The map includes both HOV/commuter lanes and transitways. The solid green and red lines designate potential HOV lanes and transitways, respectively. The dashed lines depict existing HOV lanes and transitways. Since this is a general study, no attempt was made to prioritize projects, designate occupancy requirements of carpools, or address hours of operation. However, almost every metropolitan freeway corridor is in need of some form of HOV preferential treatment.

The individual HOV lane candidate corridors can stand alone or be part of an integrated network of freeway HOV lanes: thus, decisions can be made incrementally on a corridor by corridor basis. The intent of this report is to identify a potential system of commuter lanes and transitways that is compatible with county and regional transportation plans. It is not the intent of this report to set policy or standards for the implementation of HOV lanes.

In summary, this preliminary system wide study outlines major HOV freeway lane benefits, implementation strategies and considerations, and identifies HOV candidates in the Los Angeles Metropolitan Region. The implementation of HOV lanes as an integral part of an overall regional transportation demand management plan can help realize the potential for mitigating congestion by increasing vehicle occupancies on the freeway system. Implementation of a system of HOV lanes will require cooperation with other public agencies, the private sector, and the general public.



STATE OF CALIFORNIA
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DEPARTMENT OF TRANSPORTATION

DISTRICT 7

HIGHWAY SYSTEM

1988 HOV CANDIDATE MAP

HOV/COMMUTER LANE ■ (existing)

TRANSITWAY ■ (existing)

APPENDIX MODELING METHODOLOGY

The following section provides more detail regarding the modeling of HOV lanes in this study.

The network plots used in this study depict HOV trips assigned to District 7. The Urban Transportation Planning Software (UTPS) program UROAD assigned the carpool trips to the 1984 and 2010 carpool networks on an "all-or-nothing" basis (minimum time path). In other words, the plot reflects the actual demand on the facilities: thus, many of the volumes on the network are extremely high. An alternate assignment process, not used for this study, does additional assignment iterations to depict drivers selecting alternate routes in order to by-pass congestion. The primary reason for using a single iteration to assign trips is to show actual demand for HOV lanes.

With the exception of the Los Angeles Central Business District (CBD) and some of the outlying rural areas, most freeways in the 2010 network have continuous HOV lanes. HOV lanes on Routes 5, 10 (San Bernardino Freeway), 110 and 101 terminate at the CBD, while route 710 continues through the CBD and Route 10 (Santa Monica Freeway) connects to Route 60. Limited right-of-way and heavy access and egress movements generally preclude continuous HOV lanes through the CBD. However, the demand to make through trips by-passing the CBD may be high enough to warrant continuous HOV lanes on some of the routes. In addition, exclusive HOV off-ramps may be desirable since heavy movement from HOV lanes onto CBD surface streets may create bottlenecks on the freeways (e.g. Route 110 Transitway).

The volumes on the 2010 network indicate the split between the number of carpools using the HOV lanes and the carpools which would use the mixed flow lanes. The model assigns a small number of carpool trips on mixed flow lanes because of inadequate access or egress on the network. In reality, some carpool drivers drive on mixed flow lanes because of perceived weaving problems or unfamiliarity with HOV lanes in addition to a lack of access and egress.

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High occupancy vehicle lane

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