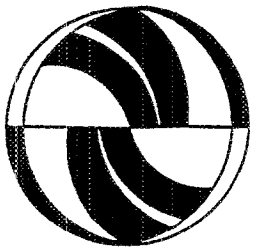

Private Toll Roads: Acceptability of Congestion Pricing in Southern California

Gordon J Fielding

Reprint
UCTC No 497

The University of California
Transportation Center

University of California
Berkeley, CA 94720

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The University of California Transportation Center
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Private Toll Roads
Acceptability of Congestion Pricing in Southern California

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University of California, Irvine

Private toll roads in Southern California demonstrate attempts to price highways realistically and to use high-occupancy-vehicle (HOV) lanes efficiently. Such routes are located in areas in which population and employment grew impressively during the 1970s and 1980s, peak-hour congestion is severe, air pollution exceeds health standards for ozone 180 days per year, and earlier attempts at congestion relief have had limited success. The objective in describing one of these toll roads is to suggest how obstacles to congestion pricing might be overcome by combining congestion pricing with expansion of HOV lanes and successful ride-sharing programs The heavy hand of politics rests on all congestion pricing projects, and this case study is no different It does illustrate, however, that congestion pricing can be made politically acceptable. If the private toll lanes are successful, a new opportunity for congestion relief will be available using regional HOV facilities.

INCREASING CONGESTION

Traffic congestion in Southern California is bad and becoming worse. Hanks and Lomax (1990) constructed an index of congestion by comparing daily vehicle miles traveled per lane-mile with optimal capacity in 39 metropolitan areas (Figure 1) By their index, the Los Angeles Urbanized Area, which includes Orange County, is the most congested metropolitan area in the nation, and the adjoining San Bernardino-Riverside Urbanized

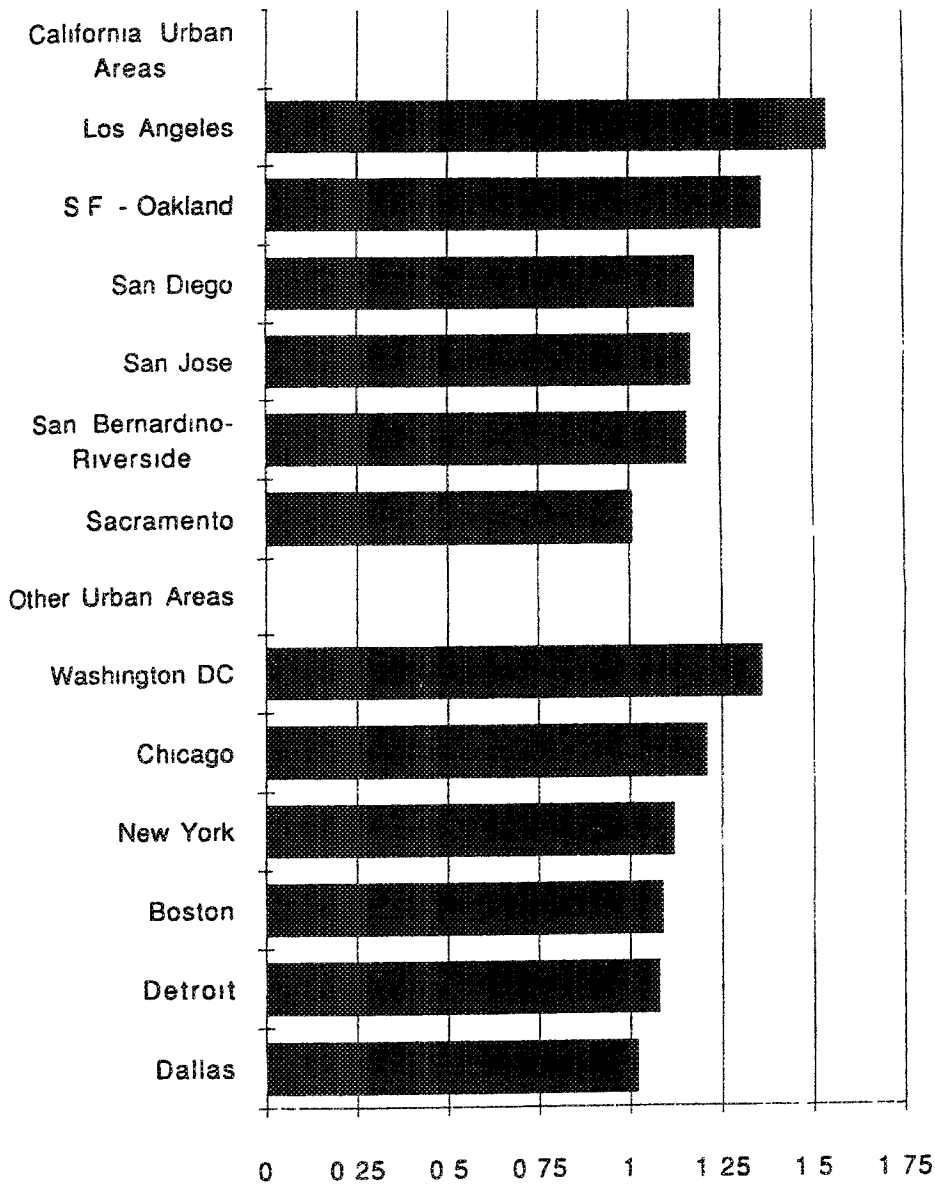


FIGURE 1 Roadway congestion index on freeways and principal arterial streets, 1989 (Hanks and Lomax 1990, Table 9).

Area is almost as congested as Chicago. A superb highway network has been constructed, but it is fouled by heavy travel demand (Figure 2) Hanks and Lomax estimated that travel delays cost residents and business in Los Angeles and Orange counties $6.8 billion in 1988 The loss to individuals is annoying, but the loss to business relying on truck freight is more serious because it impairs productivity growth.

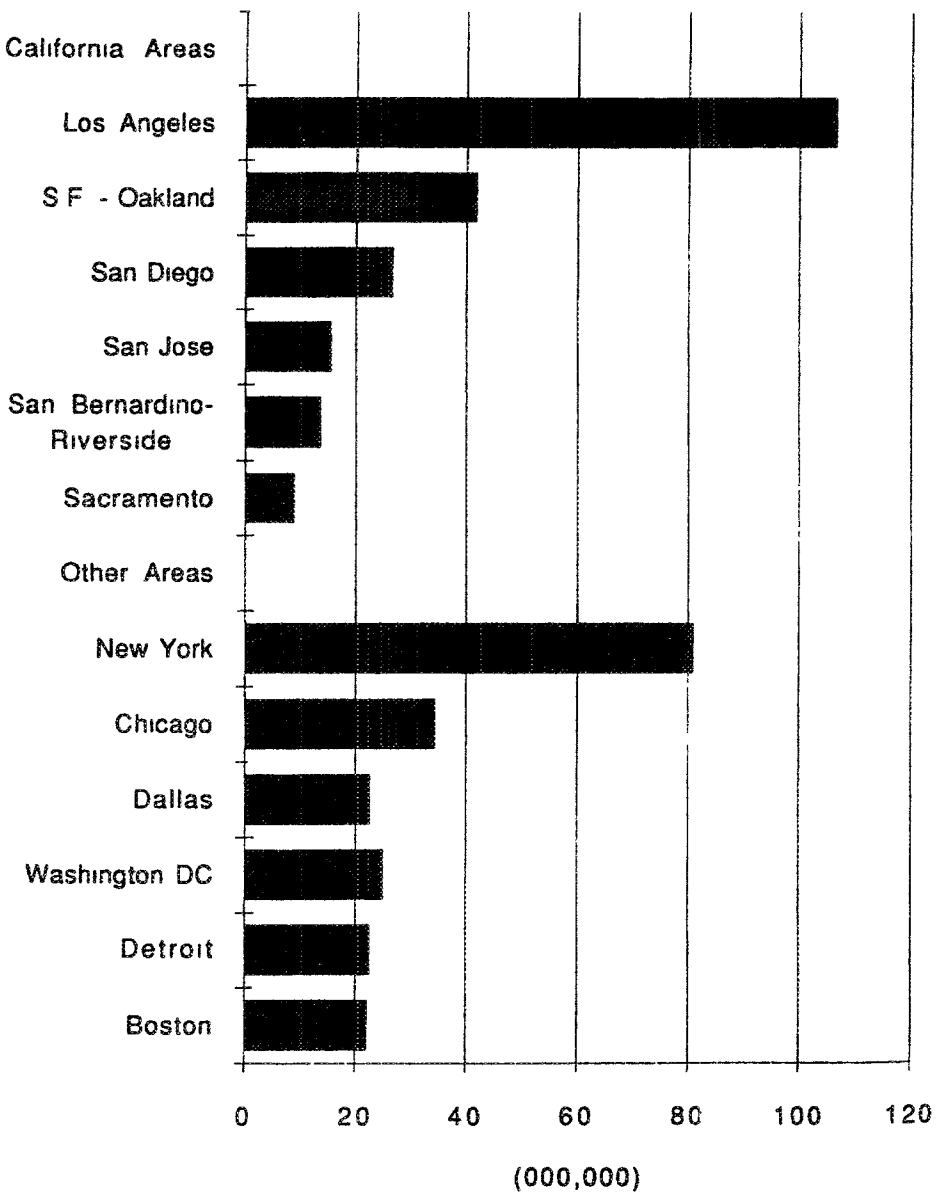
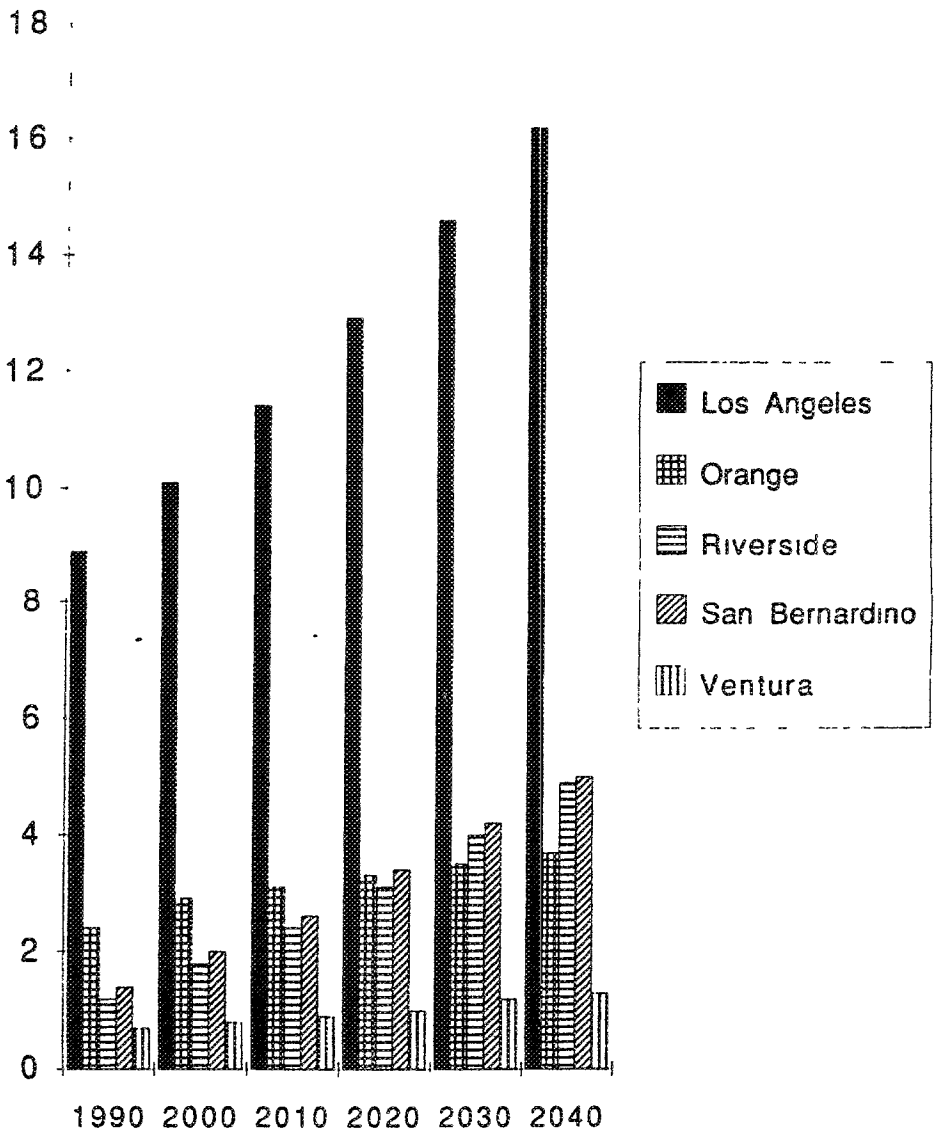


FIGURE 2 Daily vehicle miles of freeway travel by urbanized area, 1989 (Hanks and Lomax 1990, Table 2). (1 mi = 1.6 km.)

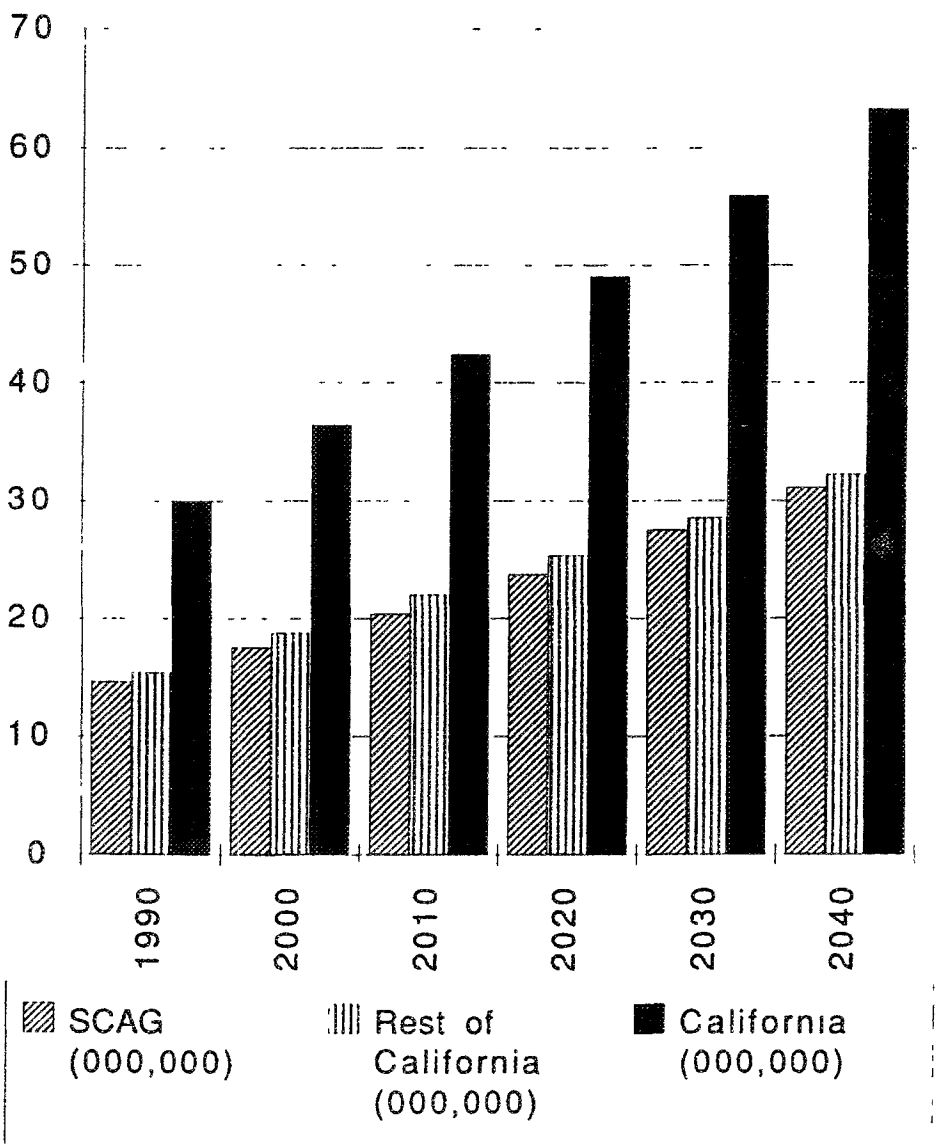
High rates of population and household income growth together with the unwillingness of elected officials to increase taxes and the opposition to new urban highways have exacerbated congestion. The population increase in California has continued to exceed the national average and, despite the current downturn in the economy, is likely to continue (Figure 3). Within the counties that compose the Southern California Association



SOURCE. California State Department of Finance 1993

FIGURE 3 Future population growth by county in Southern California.

of Governments (SCAG), population is projected to increase from 14.6 million in 1990 to 20 4 million by 2010 (Figure 4) Meanwhile, increasing household incomes, primarily achieved through growth of multiple-income households, have enabled Southern Californians to increase vehicle ownership at a rate slightly faster than population growth By 1990 there were almost 10 million drivers, driving more frequently and further,



SOURCE California State Department of Finance 1993

FIGURE 4 Future population growth in Southern California.

and although the ratio of automobiles to licensed drivers is approaching saturation, projected population increases through natural growth will add a new cohort of eligible drivers each year.

Nevertheless, road capacity has not increased with demand (Figure 5) Congestion has resulted because elected officials have been unwilling to increase fuel taxes and urban residents have opposed having more highways built near them Vehicle miles of travel (VMT) doubled in California between 1973 and 1990, whereas lane-miles of state highway increased from 45,600 to only 48,700 (73,430 to 78,422 lane-km)—a mere 6 8 percent increase.

Increased travel and congestion have had many undesirable consequences. Although hydrocarbon and particulate emissions have been reduced, the increased number of vehicles continues to degrade air quality

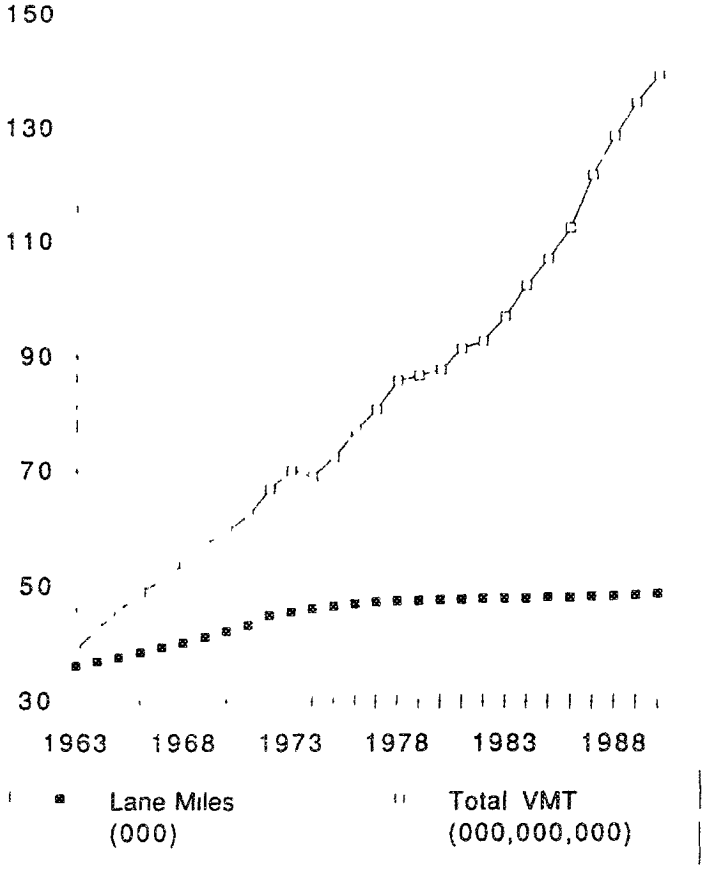


FIGURE 5 Increasing highway congestion in California, 1963–1990 (California Department of Transportation 1992, Table 3–1-2).

Ozone is the most hazardous pollutant, and the concentrations at monitoring stations in Los Angeles and Orange counties continue to exceed the state's maximum 1-hr standard of 9 parts per million on half of the days each year (Figure 6).

An even more damaging effect of traffic congestion is its influence on business decisions. Uncertainty over delivery time compels manufacturing and commerce to hold larger inventories and pay higher transshipment costs It also discourages agglomeration of warehouse and distribution facilities into larger and potentially more efficient centers The Southern California economy developed in association with the superb highway system built during the 1950s and 1960s. Subregional specialization occurred in aerospace, entertainment, and manufacturing (Scott 1988). As

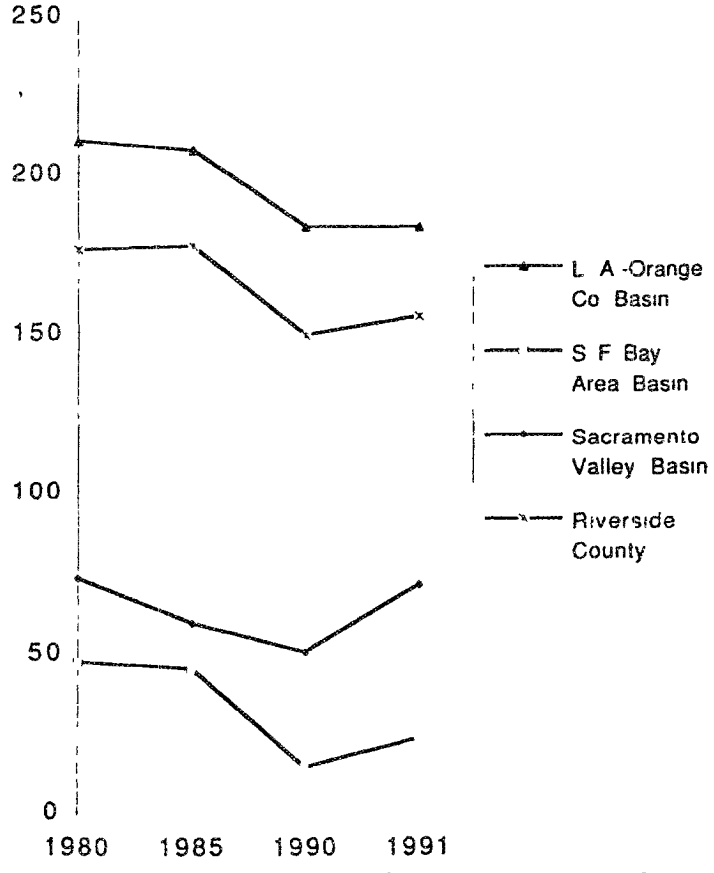


FIGURE 6 Air pollution: days with ozone concentrations exceeding the California standard, 1980–1991 (California Air Resources Board 1992, Table D).

congestion increased, firms sought to relocate, and those who were not tied to the local market have expanded in less-congested metropolitan areas

Although there have been several attempts to plan for increasing travel demand, there have been few successes Most of the effort has been devoted to managing traffic without expanding road capacity. Increasing taxes to pay for additional roads has been unpopular; from 1967 to 1982 there was no increase in the fuel tax although VMT increased from 51 million to 93 million (82 million to 150 million VKT) Recent increases in fuel and sales taxes have financed reconstruction and expansion of existing facilities but have been insufficient to accommodate demand.

MANAGEMENT SOLUTIONS

The Transportation Development Act (TDA) of 1971 was intended to expand transit service in major metropolitan areas as a substitute for home-to-work travel by automobile (Lamare 1981). The state sales tax was increased and one-fourth of the 1-cent tax increase was allocated exclusively for transit in metropolitan counties Transit was struggling to survive in California cities before the TDA Only three Bay Area counties had a guaranteed source of funding and this was dedicated to the Bay Area Rapid Transit (BART). Southern California Rapid Transit District (SCRTD), the regional bus system in Southern California, had not purchased a new bus since 1960 TDA changed this· new buses and maintenance facilities now prevail even in rural counties. Local sales taxes have augmented state funding and enabled development of new rail systems in five metropolitan areas and a 114-mi (184-km) commuter rail system in Southern California.

Transit ridership has increased, but despite generous state and federal assistance, only 5 percent of commuters in Southern California used public transit in 1992 as the primary mode of travel. Commuting by rail and bus is important in central cities and along high-density corridors, but it remains a minor contributor to regional solutions.

Innovations in state planning were proposed by the State Transportation Board in 1978 (Elliot 1986) Eight principles for transportation planning were outlined, but one suggesting that "users should be required to pay a fair share of the costs that occur from their use [of transportation facilities]" created such an outcry from interest groups that the entire plan

was rejected by the governor The intention was to introduce congestion pricing, but the board failed to develop a constituency of support for their imaginative plan and it collapsed like the Hindenburg.

In their attempt to reduce travel, the South Coast Air Quality Management District (SCAQMD) adopted Regulation XV in 1988 requiring employers with more than 100 employees to take responsibility for changing their employees' commuting patterns. Initial results are promising, single-occupant vehicle (SOV) commuters decreased by 5.8 percent in the first year for covered firms, and carpooling increased (Giuliano et al. 1993) Because carpooling and vanpooling account for 15 percent of commuter trips in Southern California, Regulation XV has created optimism. To increase ridesharing, however, will require real incentives involving time savings rather than plans; 77 percent of commute trips are still made in SOVs

Expanding HOV facilities provides an incentive for ridesharing because it allows long-distance freeway commuters to save time when passing through congested bottlenecks. Since they have recovered from the disastrous experience on the Santa Monica Freeway (Billheimer 1978), the California Department of Transportation (Caltrans) has aggressively expanded HOV facilities throughout California whenever they have added lanes (Figure 7). With 173 lane-mi (279 lane-km) of HOV available and another 392 lane-mi (631 lane-km) committed, Los Angeles and Orange counties have the largest HOV system in the United States. In 1992, 12.7 percent of the freeway miles in Los Angeles and Orange counties provided HOV lanes, and proposed projects will increase availability to 28.7 percent (Turnbull 1992)

Impressive additions are under construction The Century Freeway (Route 105) was completed in 1993 with space for HOV lanes as well as transit HOV lanes are being added to the San Diego Freeway (I-405) from Century Boulevard (adjacent to the Los Angeles airport) to Carson, and these will eventually connect to the existing lanes through Orange County; a 10-mi (16-km) transitway is under construction on the Harbor Freeway from the Route 91 freeway to downtown Los Angeles. These lanes will be reserved for carpools and buses, thereby linking the Harbor transitway with Route 91 HOV lanes to provide access between the "job belt" of central Los Angeles and the residential areas of Riverside and San Bernardino counties

Despite their proximity to major traffic generators, the potential travel advantage of the HOV lanes has not been realized Of the respondents to

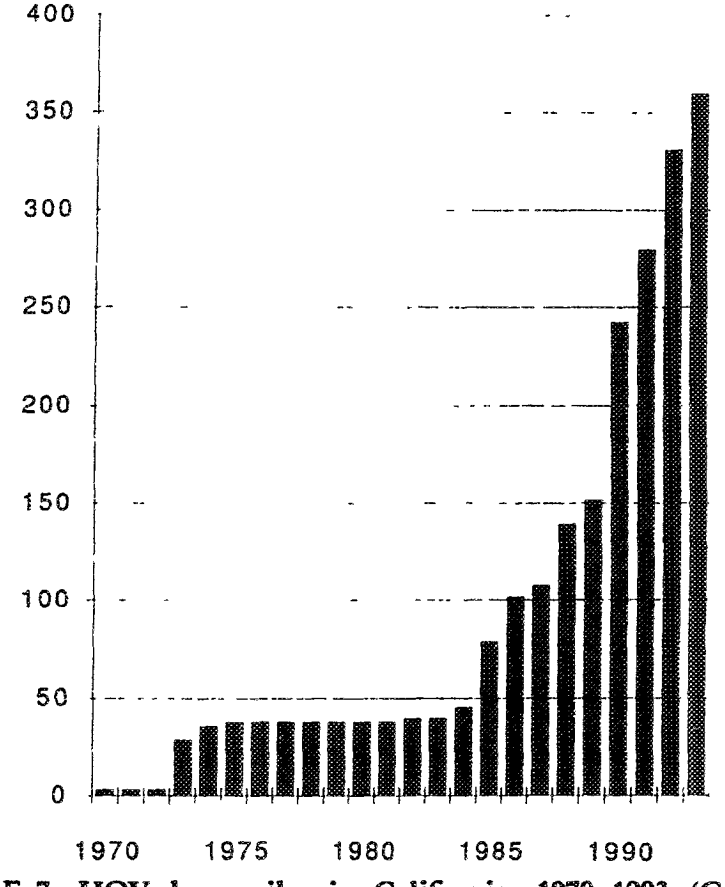


FIGURE 7 HOV lane-miles in California, 1970–1993 (California Department of Transportation 1993). (1 mi = 1.6 km.)

a 1992 survey of all commuters who have access to commuter lanes, only 28 percent use them occasionally (Collier and Christiansen 1993) Ride-sharing has increased slightly, but not nearly to the extent anticipated. The mean travel time savings of 14 min one way has not been sufficient to persuade a higher proportion of drivers of SOVs to forgo the convenience, flexibility, and comfort of driving alone

During the peak-of-the-peak travel period, HOV lanes are fully utilized. But in the shoulders of the peak when other lanes are congested, many HOV facilities are underutilized. This encourages illegal use by SOVs, criticism of HOV facilities, and the lowering of eligibility from vehicles with three occupants to those with two (HOV3 to HOV2). Because 43 percent of HOV2 users are family members commuting to

work, school, or daycare facilities, effectiveness in trip reduction tends to be exaggerated.

Nevertheless, the combination of increasing ridesharing and the availability of HOV facilities offers a marvelous regional opportunity to minimize congestion As HOV2 vehicles begin to crowd out higher-occupancy vehicles from commuter lanes, access will need to be restricted to HOV3 vehicles. This is already the practice in Northern California and on the San Bernardino Busway. And if introduced gradually with sufficient time given to build a constituency for the change, the HOV3 restriction combined with an opportunity for SOV and HOV2 to purchase access to the lane could increase efficiency and expand congestion pricing.

Paying for access together with free access for HOV3 would be a win-win solution because it would make most people better off.

- HOV3 and buses would encounter less congestion and attract more riders;
- HOV2 users could share the cost between them;
- SOV users who value time savings more than the toll would be better off;
- Regular lanes would operate more effectively, at least for a short time, because more space would be available;
- Air pollution and congestion would be reduced because there would be an incentive for HOV3;
- Users would be paying for the additional capacity; and
- Libertarians would cheer because travelers would have a choice when they need to save time, they could use the toll lanes, when arrival time is not critical, they could save money by using the uncontrolled lanes.

The losers would be the HOV2s who travel with family members or those who are unwilling to share the toll. Opposition should be expected from other highway interests such as trucking associations, automobile clubs, and local agencies whose residents may be adversely affected However, the opposition might be persuaded if the policy were introduced gradually as a carefully designed regional policy to improve mobility and reduce air pollution as well as to fund additional facilities.

Congestion pricing is essential; only by controlling access through charging tolls can the commuter lane operate efficiently Prices must be varied in response to demand so as to encourage some SOV and HOV2 commuters to change their travel behavior and avoid peak-of-the-peak periods. Fortunately, the technology is now available to price facilities in

response to demand, as well as HOV facilities on which to evaluate public acceptance of congestion pricing.

CONGESTION PRICING IN CALIFORNIA

Private firms have proposed two toll roads using public rights-of-way to expand state highways· Route 57, an 11-mi (18-km) extension of an existing freeway that will be constructed as an elevated highway (on a viaduct) down the middle of the seasonal Santa Ana River at an estimated cost of $625 million, and Route 91 [10-mi (16-km)] utilizing the median of the existing Riverside Freeway along the congested Santa Ana Canyon at an estimated cost of $110 million, the initial segment of which is shown as a solid line in Figure 8 An option to expand the project on Route 91 in the future is shown by the hatched line in Figure 8

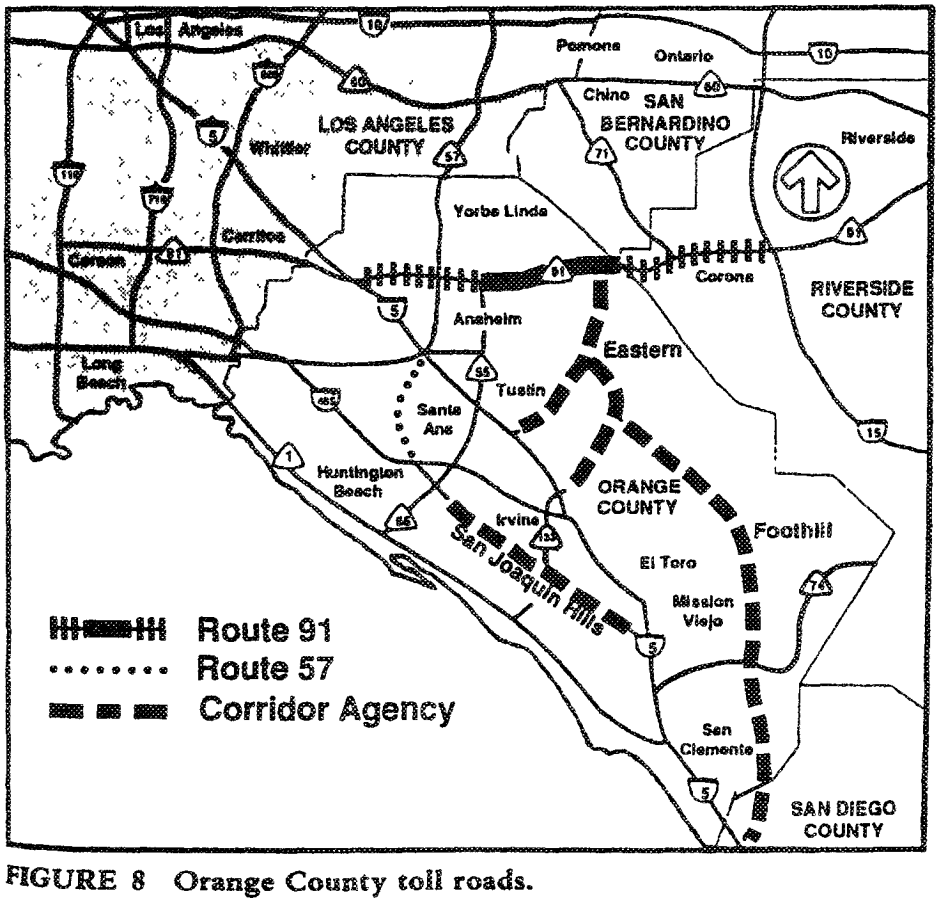


FIGURE 8 Orange County toll roads.

Both toll roads will use automatic vehicle identification (AVI) technology, automatic toll collection (ATC), and changeable message signs to guide traffic. These toll roads offer students of transportation an unparalleled opportunity to investigate how travelers respond to congestion pricing because both roads will be built as HOV lanes and use congestion pricing to allow access for SOVs and HOV2s. Tolls will be varied to reduce peak-period demand, to increase revenue, and to provide a competitive return on investment for private firms.

Because the Route 91 toll lanes have received all environmental clearances and are scheduled to open in 1996, more information is available on their operation and expected use. Less information is available on the Route 57 toll road. The franchise is owned by the Perot Group, and they have vexing environmental and community issues to mitigate before they can obtain environmental clearance. The viaduct is proposed as a four-lane HOV facility that will link with HOV facilities to the north and south, but operating and travel forecasts are not in the public record. For this reason, operating features of Route 91 only will be detailed.

In the median of Route 91, the primary link between Orange and Riverside counties, the California Private Transportation Corporation (CPTC) has been granted the right to plan, construct, and operate four tolled lanes for 35 years. These lanes will operate like an HOV facility, but unlike the usual HOV facility, vehicles with one or two occupants will be permitted to enter only by paying a toll. Vehicles with three or more occupants (HOV3) will travel free at first, and at a discount later should the use of free travel jeopardize the economic viability of the project.

Congestion on Route 91 is already severe for 5 hr each day and this period is expanding as travelers shift to the shoulder of the peak to avoid congestion Caltrans had planned HOV lanes for the median They had cleared the project environmentally but had insufficient money for construction By using private funds, lanes can be constructed sooner and state funds can be shifted to higher-priority construction along the I-5 corridor.

By making excess HOV lane capacity available to toll-paying vehicles, CPTC estimates that they will receive sufficient tolls to cover operating and maintenance cost as well as to provide a 17 percent rate of return on investment (which is capped under the franchise agreement). An additional 6 percent can be earned by increasing vehicle occupancy through promotion of ridesharing and transit Excess income will be shared with the state.

Preliminary estimates indicate that travelers would be willing to pay a toll of $2 50 per trip during peak hours for the time saved to travel 10 mi Trips on the facility when the highway is uncongested will be discounted

Tolls will vary in response to demand, prices will be increased during peak periods to avoid congestion in the restricted lanes, with roadway signs designed to flash numbers as high as $9 99 The aim is to maintain speed on the restricted lanes so that patrons save time compared with users of the unrestricted lanes Toll charges are based on a value of time saved, estimated at $0.22/min, for peak-period commuters in SOVs During the shoulder of the peak and the off-peak periods, tolls will be lowered automatically to encourage use of the tolled lanes

Fortune Magazine summarized operations as follows.

> The new road's most appealing feature is its ability to operate without toll plazas, which often cause backups To enter the fast lane, a car must have an automatic vehicle identification (AVI) tag clipped to its rearview mirror The tag, which is being developed by MFS (Omaha, Nebraska) and Texas Instruments, could cost drivers around $30 About the size of a credit card but twice as thick, it incorporates a microchip, an antenna, and a lithium battery As a car approaches the toll road, the card exchanges radio signals with the highway's computers, which charge the toll against the driver's prepaid account, typically $80 a month If a car has no AVI tag, the system will alert a waiting highway patrolman to nab the interloper or will videotape the car's license place for ticketing by mail (Ratan 1993)

Routes 91 and 57 were chosen as privately funded toll roads in response to California legislation (AB 680), enacted in 1989 (Gomez-Ibanez and Meyer 1991; Poole 1992) A competition in 1990 produced eight proposals Four were selected and franchise agreements signed in 1991. Two proposals were for Orange County, a third for San Diego, and a fourth for rural Northern California between San Jose and Sacramento (Fielding and Klein 1993). All three of the Southern California proposals will use congestion pricing because it is the only way by which private firms can recover their investment. Varying tolls by time of day increases revenue and enables peak capacity to be accommodated by a smaller facility.

A unique coalition of interests enabled passage of AB 680. Its author was Assemblyman Baker, but the push needed for passage came from the Office of Privatization within Caltrans, from the private engineering and construction firms who desired a larger share of the state's business, and from a conservative governor who sought to expand highways without increasing taxes A highway bond issue had been defeated in June 1988. This led to a reconsideration of ways to finance highways, and private tollways were proposed (R.W. Poole, Jr , personal correspondence)

However, a majority of legislators as well as state employees were opposed to tollways. A compromise was reached in 1989 when the legislature desired the governor's support to place transportation bond issues on the ballot (to be paid for by an increase in fuel taxes) Governor Deukmejian agreed to let the electorate decide on the tax increase, but only if the legislature agreed to pass AB 680.

As Carl Williams, Assistant Director of Caltrans, remarked about the origins of AB 680: "Sometimes when you are moving around, trying different things, you get lucky. And this was pure luck" (Gomez-Ibañez and Meyer 1991, 67). Attempts to introduce road pricing in 1978 had been unsuccessful; in 1989 politics and substance coalesced.

Representatives for the professional engineers in California government have continued their opposition, but their appeal to the State Supreme Court over the legality of the process was rejected in 1993. Opposition continues to be expressed by members of the legislature· a constitutional amendment to limit the duration of private contracts was placed before the electorate but defeated in 1992, and legislation has been introduced to prevent local governments from assisting private toll road enterprises. It is unlikely that there will be additional private toll roads unless one of the current projects demonstrates financial success, which is why the Route 91 toll lanes in Orange County are critically important for the future of congestion pricing

Insufficient highway capacity and favorable attitudes to privatization contributed to the acceptance of private financing and toll roads in Orange County, where increasing jobs and travel had created severe peak-hour congestion Although population had increased by 25 percent to 2.2 million between 1975 and 1985 and VMT by 50 percent, only 4 mi (6 km) of additional state highway had been constructed. Routes had been designated, but there was insufficient state or local money for construction All this created a perceived need for additional roads as well as the availability of expansion opportunities like completing Route 57 and constructing the planned but unfunded HOV lanes on Route 91.

Orange County Transportation Authority (OCTA) has been an innovator in privatization. In the 1970s, an extensive system of dial-a-ride modules was established using private contractors. In 1992, 125 small buses were operated by private companies with coordination provided by OCTA. Staff experience in contracting out for service has encouraged the authority to expand opportunities for private firms in commuter rail and highway services

Research from the University of California at Irvine has popularized privatization From the early work on taxis and privatization of transit to

articles and national conferences on HOV lanes, ridesharing, and road pricing, the university has diffused information that has influenced decision makers University extension activities gave credibility to toll roads as a way to expand highway capacity (Austin et al. 1986). Orange County was designated for a federal pilot project in 1987 and this led to the creation of the Transportation Corridor Agency (TCA) to be responsible for planning and constructing three public toll roads.

The TCA legislation allowed local governments to form joint-powers agencies for the purpose of planning and constructing toll roads Orange County and 20 cities have created three agencies administered as one unit. These public agencies control development of three toll roads: San Joaquin Hills Corridor, a 17.5-mi (28 2-km) road slicing through rugged hills from Route 73 in Irvine to I-5 in San Juan Capistrano and estimated to cost $1 billion, Foothill Corridor, a 30-mi (48-km) freeway running from I-5 in San Clemente to Tustin and estimated to cost $746 million; and Eastern Corridor, a 23-mi (37-km) road linking Route 133 with Route 91 in the Santa Ana Canyon and estimated to cost $630 million (Figure 8). TCA plans to charge uniform, distance-based tolls and not vary charges according to congestion

Although TCA has rejected congestion pricing, the agencies have popularized toll roads with elected officials Without this initial understanding, congestion pricing may not have been acceptable. As public agencies, TCAs can fall back on federal and state assistance if tolls are insufficient to service their debt; they are designing their toll roads as very expensive, general purpose freeways The private toll road companies cannot do this; they will lose their investment if the roads revert to the state Therefore, they seek to limit their investment and maximize revenue.

The TCA toll roads could be built as smaller expressways rather than eight-lane freeways if congestion pricing were used (Austin et al. 1986) However, their purpose is to open up areas for urban development rather than to operate as cost-effective roadways. Route 91, by comparison, is in a heavily congested corridor. The HOV lanes cannot operate effectively as a toll road unless prices are varied to provide travelers with a financial incentive to move their travel times to the shoulder of the peak

OPPOSITION TO CONGESTION PRICING

Primary opposition to congestion pricing has come from the Riverside County Transportation Commission (RCTC) Route 91 is the major link between the dormitory suburbs in Riverside County and the employment

centers in Orange and Los Angeles counties Commuters using the eight-lane freeway already battle severe congestion, and the peak hour is expanding as travelers shift to both sides of the peak to avoid congestion (Figure 9).

Using local funds, RCTC assisted Caltrans in constructing two HOV lanes up to the county line and expected Orange County to continue the project. OCTA gave priority to the I-5 corridor and welcomed the private toll lanes. Riverside County officials believe that they were misled; they used local sales tax revenue for their section of Route 91, yet their residents will be expected to pay tolls to use the segment through Orange County.

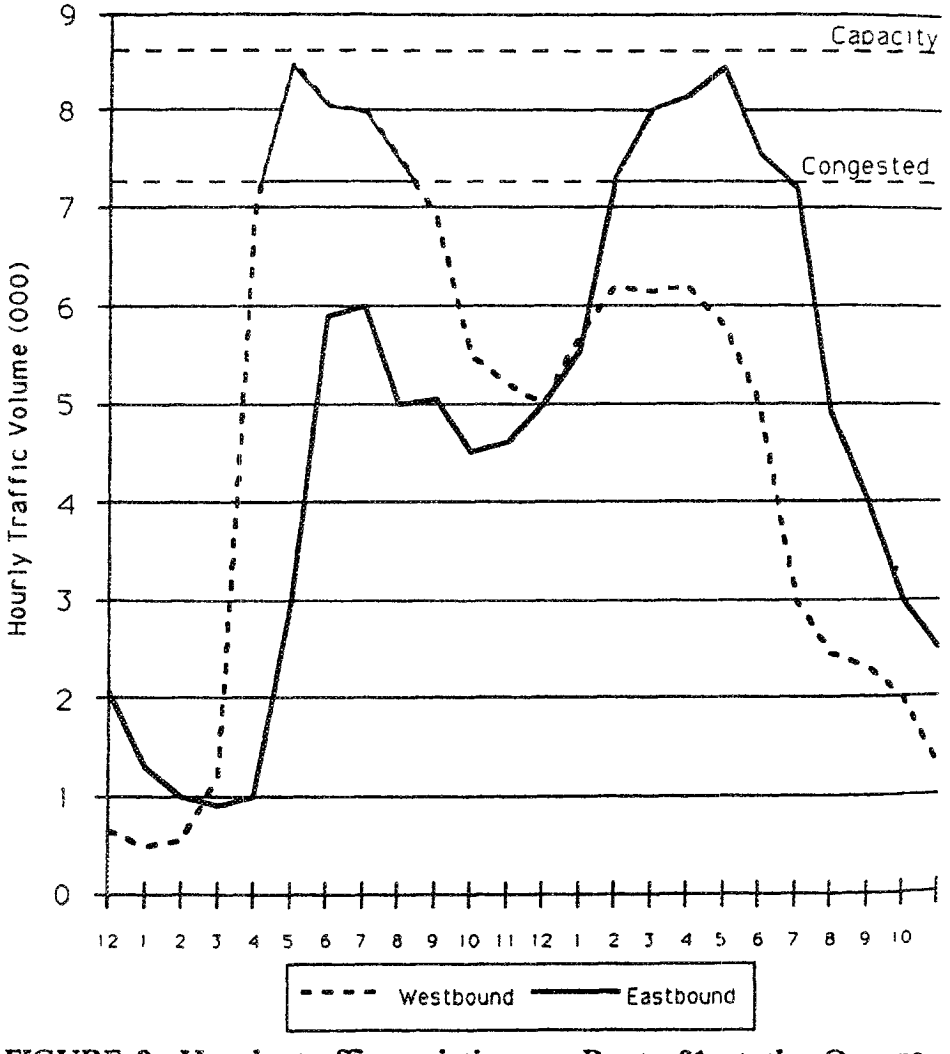


FIGURE 9 Hourly traffic variation on Route 91 at the Orange-Riverside County boundary (Wilbur Smith Associates 1992, Table 3).

Riverside claims that this action violates regional transportation policies. OCTA and the toll road company, CPTC, have attempted to accommodate Riverside by proposing free access for HOV3 vehicles with the provision that HOV3s will be charged discounted tolls should HOV3 demand jeopardize the financial viability of CPTC's investment.

Although they have accepted the compromise, RCTC representatives continue to criticize the tollway Among issues mentioned are safety, because vehicles with two persons weave out of the Riverside HOV lanes to avoid the toll lanes in Orange County, and the deterrence of ridesharing Objectors claiming that the toll lanes will discourage ridesharing are the most ominous; they cite inconsistency with regional policy adopted by SCAG and SCAQMD, and this challenges the constituency for congestion pricing If operating and safety problems arise when the toll lanes open, Riverside commuters angered by the change probably have sufficient political power to overwhelm a divided regional constituency (Lave 1993) They could compel Caltrans to buy out the private company and allow lanes to revert to free HOV operation.

Both Caltrans and FHWA are troubled by possible adverse effects on ridesharing of having to pay for access FWHA has announced that proposals allowing SOVs to buy into HOV lanes would be excluded from congestion pricing demonstration projects because "HOV buy-in projects would not promote the congestion relief and related air quality and energy conservation objectives of the ISTEA" (*Federal Register*, June 16, 1993)

Concerns expressed by state and federal agencies together with the objections cited by RCTC raise important questions that deserve to be answered Although analyses of travel demand in the corridor are dated, an estimate of daily demand is possible Using available survey data and a simple multinomial logit model, it is possible to generate a preliminary estimate of travel demand under congestion pricing by vehicle occupancy type

Tables 1 and 2 were calculated using projected daily travel demand from the SCAG regional model modified by Wilbur Smith Associates (1992) for the Route 91 corridor. A screen line at the county boundary was chosen to best represent commuter travel Calculations estimated by the author are based on the afternoon peak-period (2 00 to 6·00 p.m) demand eastbound A constant 14 5 percent of projected daily demand is allocated to the afternoon peak Eastbound maximum travel demand occurs on Monday through Thursday in the afternoon Potential demand is higher on Fridays when commuters are joined by recreational travelers, but Friday has been excluded from this exercise

TABLE 1 Projected Daily Vehicle Trip Demand in Five Lanes: Four Uncontrolled and One HOV (Without Tolls) After 2000

DAILY VEHICLE TRIPS SR-91			PEAK EASTBOUND TRIPS 2 - 6 p m (3)			
Year	Total (1)	p m Peak (2)	Total	SOV	HOV2	HOV3+
1991	222,000	56388	32190	24947 25	6148 29	1094 46
1996	262,000	66548	37990	29176 32	7446 04	1367 64
2000	290,000	73660	42050	30612 4	9713.55	1724 05
2005	337,000	85598	48865	34889 61	11825 33	2150 06
2010	370,000	93980	53650	37555 01	13573 45	2521 55

NOTE
1 SCAG regional model adjusted for capacity constraints by WS Assoc 1992, Fig 13
2 Caltrans traffic counts, 25 4% daily trips 2-6 p m
3 Caltrans traffic counts assuming constant 14 5% of daily trips Vehicle occupancy from Caltrans surveys Route 55 peak hours, Northbound, 1991 HOV lane not available until 2000

Tables 1 and 2 demonstrate the potential demand by various types of passenger vehicles under different assumptions The purpose of these simulations is to estimate the effect of the HOV buy-in plan on ride-sharing Figures 10 and 11 show how potential demand relates to highway capacity

Table 1 assumes that only a single uncontrolled lane will be added eastbound Afternoon demand is allocated to vehicle type using 1991 vehicle occupancy data recorded by Caltrans for Route 55. Proportional allocation remains constant through all time periods as trips increase

Caltrans had scheduled adding one untolled HOV lane in each direction to Route 91 by the year 2000. This would have increased eastbound afternoon capacity during the 4 hr from 32,000 to 39,000 vehicles. Projected demand by HOV2 and HOV3 vehicles is estimated to increase from 7,243 in 1991 to 16,095 in 2010 The single HOV lane would have been congested when it opened, and all eastbound lanes would have continued to operate beyond design capacity. Addition of a single HOV lane would not have promoted congestion relief for afternoon commuters.

If Caltrans had had sufficient funds to construct two HOV lanes, afternoon capacity (46,200 vehicles) would have exceeded potential demand until the year 2004. Funding was not available; this is why the private toll lanes were approved as an alternative that would provide additional capacity sooner

A simple multinomial logit model was used to calculate the effect of two controlled (tolled) lanes on projected afternoon demand eastbound on Route 91 The results are reported in Table 2 and Figure 11 Calculation of the logit model was simplified by the following assumptions

TABLE 2 Projected Daily Vehicle Trip Demand in Six Lanes: Four Uncontrolled and Two Controlled HOV (with Tolls) After 1996

DAILY VEHICLE TRIPS SR 91			DAILY PEAK PERIOD VEHICLE TRIPS EASTBOUND 2 - 6 p m (3)						
			Total	Four Uncontrolled Lanes			Two Controlled Toll Lanes		
Year	Total (1)	p m Peak (2)	2 - 6 p m	SOV	HOV2	HOV3+	SOV	HOV2	HOV3+
1991	222,000	56388	32190	24947 25	6148 29	1094 46			
1996	262,000	66548	37990	22869 98	6382 32	265 93	4368 85	1595 58	2507 34
2000	290,000	73660	42050	25314 1	7064 4	294 35	4835 75	1766 1	2775 3
2005	337,000	85598	48865	29416 73	8209 32	342 055	5619 475	2052 33	3225 09
2010	370,000	93980	53650	32297 3	9013 2	375 55	6169 75	2253 3	3540 9

NOTE

1 SCAG regional model adjusted for capacity constraints by WS Assoc 1992, Fig 13

2 Caltrans traffic counts, 25 4% daily trips 2-6 p m

3 Small (1983) estimated the lane capacity of a 10 mile nonuniform stretch of freeway with a single bottleneck at 1770 Route 91 will have 2 lanes operating over 4 peak afternoon hours for a free flow capacity of 14,160

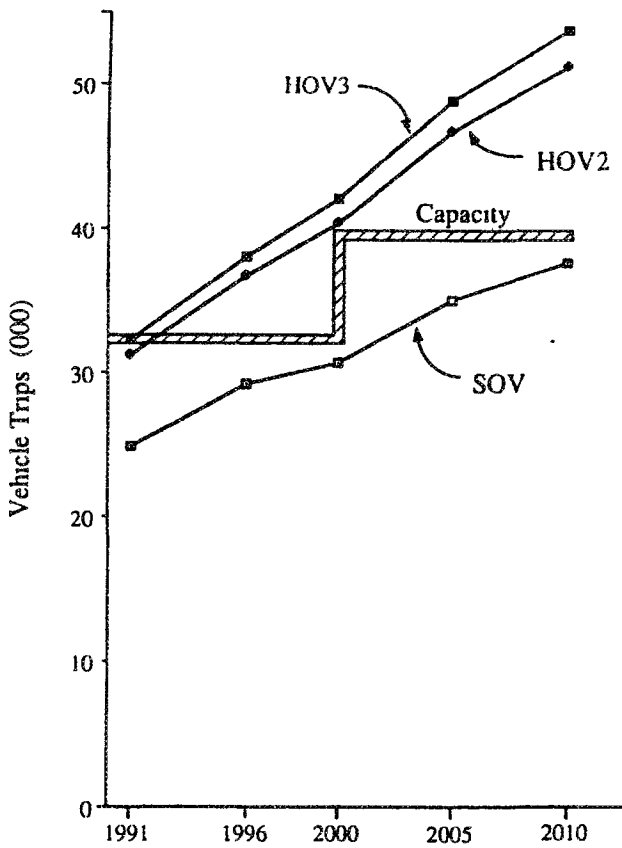


FIGURE 10 Projected peak eastbound vehicle trips in five lanes (four uncontrolled and one HOV without tolls), on weekday afternoons (2:00 to 6:00 p.m., Monday–Thursday), by vehicle occupancy at county boundary. Capacity would increase in 2000 from approximately 32,000 vehicles to 39,000 vehicles with the addition of one HOV lane.

- Projected eastbound afternoon trips were calculated at a constant 14.5 percent of daily trips with no capacity constraint,
- Trips were allocated to one of six mode and facility choices;
- Coefficients for individual utility were based on a survey conducted by the Resource Systems Group (1992); travel time and toll charge were assumed to be the parameters influencing choice, with modal bias constants that account for the unmeasured perception of the two ridesharing modes on each facility;
- All trips were 60 min;
- The potential time savings by using the toll lanes was 10 min,

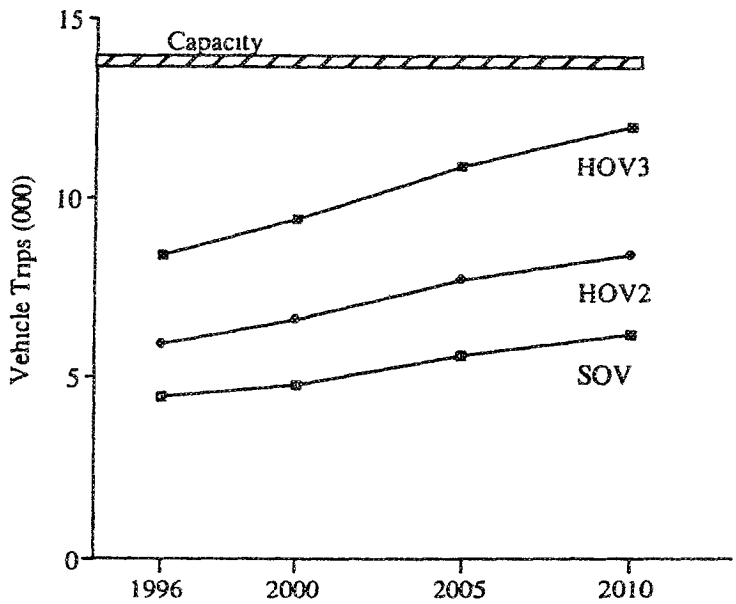


FIGURE 11 Projected peak eastbound vehicle trips in two toll lanes, on weekday afternoons (2:00 to 6:00 p.m., Monday–Thursday), by vehicle occupancy at county boundary. Approximate capacity would be 14,200 vehicles.

- Tolls were constant at $2 00 for SOV and HOV2, and
- Transponders were purchased by 90 percent of HOV3 vehicles to travel free in the tolled lanes

Comparison of Table 1 with Table 2 illustrates how HOV buy-in can encourage ridesharing Without tolls, the two eastbound HOV lanes would not be constructed; with the toll lanes, the following benefits would be achieved

- Congestion in the uncontrolled lanes would be reduced; the potential demand of 29,518 vehicles in 1996 is below the 32,000-vehicle capacity and free flow should continue until 1999
- The two controlled toll lanes would be uncongested.
- Although total HOV2 and HOV3 vehicles on the uncontrolled facility would exceed those on the controlled facility after 2005, the controlled lanes would encourage HOV3 vehicles. With an average occupancy of 3.6 persons per HOV3 vehicle, the number of people involved in ridesharing would increase

The number of people involved in ridesharing would increase as the result of constructing toll lanes with free access for HOV3+ vehicles. This estimate is probably conservative: first, the private operator has a financial incentive to increase vanpooling and buspooling, and second, projected travel demand will probably be constrained by capacity limits on the uncontrolled facility (Figure 10).

Preliminary results from the simple logit exercise are satisfactory They suggest that HOV buy-in projects promote congestion relief. However, more detailed studies are required before the hypothesis can be accepted or rejected Better data on travel demand utility under different situations are required as well as knowledge about the willingness of travelers to change to higher-occupancy vehicles. The assumptions of the current model are coarse In addition, the coefficients of demand utility are based on a selected sample that was not fully representative

Users of both the controlled and uncontrolled lanes appear to be better off than they would have been had a single HOV lane been constructed. Both groups have a wider range of travel choice, more of them will rideshare, and in addition, the cost of constructing the toll lanes is borne by the beneficiaries rather than taxpayers

CONCLUSION

Toll lanes on Route 91 provide a fascinating case study of how congestion pricing became acceptable Traffic congestion in the Santa Ana Canyon is already severe and will expand in duration. The highest weekday demand occurs in the morning, but the afternoon peak is longer-lasting and frequently affected by traffic incidents

Sufficient additional capacity to accommodate potential travel is unlikely to be constructed, and previous attempts to manage transportation demand have had limited success. The two most promising developments are ridesharing and construction of HOV lanes. If these were combined with congestion pricing, access could be expanded and the lanes could be used more efficiently

Blending congestion pricing with ridesharing, HOV lanes, and highway privatization facilitates development of a constituency for congestion pricing. Venture capitalists recognize that this is the only way in which they can earn a competitive return from highway investment, highway advocates see a way to expand capacity, private engineering companies

view it as an opportunity to obtain additional work, and clean air supporters and groups connected with conservation of resources recognize that incentives for ridesharing may reduce adverse environmental impacts. Regrettably, the publicly sponsored toll roads in Orange County are not organized along these lines—the agencies operating them are content to rely on flat tolls and may have to be bailed out by state and federal assistance.

Toll roads and congestion pricing remain controversial throughout California. The lesson from Route 91 is that a constituency can be developed and significant opposition overcome when toll roads and congestion pricing are introduced as part of a regional program to reduce congestion and air pollution. Political acceptance is also assisted when the beneficiaries are seen to be paying for the HOV expansion rather than the general public.

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