POLICY INSIGHT

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# INTRODUCING CONGESTION PRICING ON A NEW TOLL ROAD

*by*

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## EXECUTIVE SUMMARY

Congestion pricing—charging a price to use highways that is high at peak hours and low at off-peak times—holds great potential for easing traffic congestion and reducing auto emissions in Southern California. New technology for nonstop electronic toll collection, coupled with increased public concern over congestion and auto emissions, makes implementation of such pricing more feasible today than in previous decades. But the political risks of charging for freeway use suggest the need for demonstration projects, both to introduce the public to the idea and to collect data so as to quantify its effects.

This paper proposes a specific demonstration project in Southern California. Orange County, part of the greater Los Angeles metro area, has five new toll road projects under development: two private and three public. Two of these projects will begin construction before the end of 1992. The private project to add HOV/toll lanes to SR 91 already plans to use congestion pricing. This paper suggests that the public San Joaquin Hills Toll Corridor also adopt this technique, rather than the flat-rate tolls currently planned.

Specifically, a five-year experiment is proposed, in which the peak-period tolls would be increased every six months, while keeping off-peak tolls at a constant low level. Measurements of traffic flow and ride-sharing would be made, comparing the SJHTC with the competing (free) parallel routes, I-5/405 and SR 1. Emission-reduction effects would be calculated from the measured data. To ensure that transportation alternatives were available for those "tolled-off" the SJHTC by high peak-hour tolls, door-to-door van service would be offered in the corridor, providing a flexible alternative mode.

## I. INTRODUCTION: WHY CONGESTION PRICING?

For more than three decades, economists have urged that direct pricing of road-use be employed in an effort to bring demand and supply into balance.[1,2,3] To date, pricing for congestion-control (as opposed to the use of tolls to pay for road construction and operation) has seen only limited use, and only overseas. Singapore is thus far the only location of pricing instituted to limit vehicular traffic entering the central business district.

The implementation—or even serious consideration of the implementation—of congestion pricing in the United States has been held back by two problems, one technical and one political.

The technical problem has been the difficulty of instituting variable pricing with conventional methods—either toll booths or access-control stickers. Stickers—as used in Singapore—permit only a single price to be charged for access to a certain region or facility. Toll booths, in addition to being unpopular with users and causing additional congestion, do not lend themselves to variable pricing (being set up with fixed-price exact-change lanes, for example). The advent of automatic vehicle identification (AVI) systems eliminates this technical obstacle and makes it feasible to implement sophisticated pricing schemes in user-friendly ways.[4]

The political problem has been at least equally formidable. During the 1970s, the Urban Mass Transportation Administration offered grants to cities willing to serve as test sites for some forms of road pricing, but the idea was considered too controversial. Likewise, when California's special task force on transportation proposed the idea in 1976, it was viewed as an anti-auto measure and dropped as politically infeasible.

But increased concern over vehicle emissions and congestion levels has made both ride-sharing and mass transit popular causes in the past decade. The idea that drivers should pay the full costs of their auto use has gained respectability—especially when seen in the context of achieving overall air quality goals. Increased awareness of the costs of congestion has diminished political opposition to the idea of congestion pricing.

These changes are beginning to affect transportation policy overseas. Norway is considering the conversion of its toll rings around central business districts from flat-rate tolls (for raising highway funds) to peak and off-peak pricing for congestion controls. Trondheim has implemented electronic toll collection, and Bergen and Oslo are converting their manual toll-systems to electronic toll collection, as well. The Dutch government has announced plans for electronic congestion pricing in Amsterdam, Rotterdam, Utrecht, and The Hague as part of its National Environmental Policy Plan to reduce urban air pollution. Singapore plans to convert its sticker-based central-business-district pricing system to a full-fledged congestion pricing system using electronic toll collection. Cambridge and Edinburgh plan to be the first cities in the United Kingdom to implement congestion pricing on city streets,[5] and London transport officials are also studying the idea.

In the United States, Congress embraced the idea in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) by incorporating a provision for up to five pilot projects for congestion pricing in urban areas. As many as three of these can involve segments of Interstate highways, which have historically been off-limits to the addition of tolls. The Federal Highway Administration and the Federal Transit Administration held a well-attended symposium on congestion pricing in June 1992 and plan to issue guidelines for the pilot projects in autumn of 1992.

## II. THE NEED FOR DEMONSTRATION PROJECTS

The idea of charging for freeway use is still unfamiliar to most Californians and their public officials. Less familiar—even within the toll-road community—is the idea of using prices as a means of managing traffic demand (as opposed to simply a means of financing the road). The theoretical work carried out to date suggests that region-wide congestion pricing in Southern California would have large positive impacts on vehicle miles traveled and vehicular emissions.[6] But even if the theoretical benefits were overwhelmingly persuasive, it is unlikely that state or local officials could be convinced to implement such a far-reaching measure on every congested freeway in the region.

Demonstration projects are therefore an attractive next step. There is much that economists and transportation planners still do not know about possible behavioral response to the choices posed by congestion-priced facilities. Also unknown are the political dynamics of congestion-priced projects: which groups will support and oppose such projects and why.

In selecting demonstration-project sites, the least desirable place to start would be on an existing freeway, no matter how congested. Putting a price on something that has traditionally been offered free at the point of use risks major public and political resistance, akin to that encountered when an existing freeway lane is "taken away" to create a high-occupancy vehicle (HOV) lane (e.g., the infamous Diamond Lane episode on the Santa Monica Freeway). The two best types of facilities for introducing the concept are:

(1) existing toll roads and bridges, where off-peak discounts and peak-hour surcharges can be introduced as fine-tuning the existing pricing in order to benefit users via reduced congestion and incentives to ride-share, and

(2) completely new facilities which give users a choice compared with existing, unpriced facilities. New toll roads, in particular, offer an ideal setting.

Designing and carrying out demonstration projects is important because there is a great deal that the transportation community does not know about user response to congestion pricing. A controversy has developed between traditional toll-road planners and economists modeling congestion pricing over the appropriate modeling techniques to use.[7] Thus far, the financial community is very cautious about revenue projections based on anything other than traditional analysis using flat-rate tolls, because they have no empirical data on which to make judgements about congestion-pricing revenue projections.

Specifically it is unknown what the response of drivers in auto-oriented California will be to peak-hour pricing incentives. What fraction of users will shift their travel to off-peak times? To what extent will time-sensitive drivers be attracted to a less-congested highway? What fraction of people will opt for ride-sharing or transit, and how will this vary by income level and other socio-economic factors? To what extent will there be displacement of traffic onto non-priced or conventionally priced facilities? And finally, despite the expected environmental benefits (reduced emissions, reduced auto use, etc.), to what extent will environmental and pro-transit organizations support congestion pricing?

These significant unknowns can best be assessed by means of carefully designed demonstration projects. Because of the very large potential gains from congestion pricing, it is important that such experiments be designed and implemented in the near future. If congestion pricing on the entire freeway network truly is a more cost-effective way of achieving important transportation goals (e.g. increased vehicle occupancy, reduced vehicle-miles-traveled, increased demand for transit, etc.), then it is vital to quantify those effects in order that this information be available for use in transportation and air-quality planning.

## III. SELECTING A TEST SITE

As noted above, a new toll road provides a desirable venue for demonstrating congestion pricing. Southern California happens to be the site of six planned toll roads. In Orange County, the Transportation Corridors Agencies (TCAs) are developing three new toll roads. And the private sector, under the provisions of California's private tollway law (AB 680), is developing one new toll road in San Diego County (SR 125) and two in Orange County (SR 91 and SR 57). All three private projects plan to use congestion pricing, for two reasons: to manage traffic flow and because they believe it will maximize their revenues to charge a higher price during periods of peak demand and a lower price at off-peak hours (when they might lose most or all of their traffic to competing free routes).

In terms of timing, one private project—the toll/HOV lanes on SR 91—expects to begin construction in autumn 1992. The other two AB 680 projects still have several years of environmental review and design work before going to the financial markets to raise funds and begin construction. One of the TCA projects (the Foothill corridor) is already under construction, with its first segment scheduled to open in summer 1993. The Eastern corridor will not begin construction until 1996 or 1997. The San Joaquin Hills corridor is expected to break ground before the end of 1992.

For generating useful information about congestion pricing in the near term, the private SR 91 toll lanes will be very valuable, but the other two projects will occur too far in the future. Of the TCA projects, the Foothill is probably too far along to be changed from flat-rate to variable tolls. That leaves the San Joaquin Hills project as a potential near-term candidate.

The San Joaquin Hills Transportation Corridor (SJHTC) is a 17-mile (14.5 mile tollable) extension of the Corona Del Mar (SR 73) Freeway in Orange County, from Newport Beach and John Wayne Airport southeastward to San Juan Capistrano.[8]

The current design for this tollway is referred to as a 3-2-3 configuration: three lanes southbound, three lanes northbound, and (at a later date) either two reversible HOV lanes or two concurrent-flow HOV lanes in the median. In addition, the median has room for further HOV lanes or a bus or rail transit corridor. The configuration is referred to as the Demand Management Concept, intended to limit the overall width of the tollway to three primary lanes in each direction, plus the median.

The SJHTC corridor has several advantages as a site for such a demonstration project. For one thing, the area is affluent, which means that objections to pricing based on ability to pay or on equity (rich/poor) grounds will be fewer for this corridor than for alternatives such as the Foothill or Eastern. (On the other hand, price may be less effective in deterring peak-hour use than it would be in a less-affluent area.)

Secondly, there is some degree of support for the concept on the staff and board of the San Joaquin Hills Transportation Corridor Agency (TCA). On February 14, 1991, the TCA board adopted a resolution supporting its decision to postpone construction of HOV lanes in the median until 2010 stating that "Tollways provide an inherent financial incentive to encourage HOV usage," and noting that "If additional incentives are necessary [to achieve targeted vehicle occupancy rates], the Board of Directors of the Agency shall adopt appropriate financial toll discounts for high occupancy vehicles in order to achieve equivalent occupancy rates as would occur with construction of the planned HOV lanes."[9] The board cited an assessment by Wilbur Smith Associates which showed that it is possible to decrease tolls for HOV vehicles (in lieu of designating special HOV lanes), and increase tolls for general use, without a major loss of revenue.[10]

The proposed controlled experiment on the SJHTC would have three principal purposes:

(1) To determine what levels of peak-hour price differentials will produce a given level of net traffic reduction, permitting traffic to flow more smoothly on the SJHTC (service level C or better) compared with traffic service levels on the competing parallel routes, Highway 1 and the I-5/405 corridor.

(2) To compare ride-sharing behavior on the congestion-priced SJHTC and the parallel free routes.

(3) To quantify the degree of emission reductions brought about by congestion pricing.

## IV. DEFINING THE EXPERIMENT

Traffic forecasts prepared by the TCA's staff (the Corridor Design Management Group) indicate that the SJHTC will experience serious congestion during its initial 15 years. The planned toll rate of 13.8 cents per tollable mile, though considered high in comparison to what is charged on most existing toll roads elsewhere in the United States, appears to be lower than what the traffic would bear.

The planned flat-rate toll is based on demand studies carried out by Wilbur Smith Associates (WSA). WSA used trip tables and link-node traffic networks from the Orange County Environmental Management Agency, revising them to take into account the addition of the SJHTC and other new expressways through the year 2010. WSA then used a capacity-restrained assignment model, with a dual-path choice feature to assign trips to tolled and non-tolled segments. For each assignment condition, three separate capacity-restrained assignments were made: A.M. peak, P.M. peak, and off-peak. Separate values of time were used for peak and off-peak conditions, and for three types of trip: to/from work, company business, and recreation/other.

The Wilbur Smith demand studies produced a toll sensitivity curve (toll revenues vs. toll rate) with a continued positive slope at the maximum toll rate shown—20.7 cents/mile. A visual extrapolation of that curve suggests a revenue-maximizing toll of around $3.25, or 22.4 cents/mile (Figure 1). This is significantly higher than the planned $2.00 toll (13.8 cents/tollable mile). If the curve accurately represents reality, these higher tolls could be charged without reducing total revenue, and even higher tolls might be feasible if charged only for congestion-control during peak hours.

How high might that price level be, and how would the optimum level be established? In order to take maximum advantage of this experimental setting, it will be important to test a number of different price levels. Each should be left in place sufficiently long enough to permit behavior patterns to stabilize, between six and 12 months. Since price levels for other goods and services can be expected to continue rising at perhaps five percent per year, the experimental design will call for the peak-period toll to be increased by at least 10 percent each period (so that what is being tested are higher charges in real terms).

Perspective on the proposed pricing levels can be gained from the 1975 simulations of congestion pricing in the San Francisco Bay Area by Theodore Keeler and Kenneth Small. Their estimated optimal (long-run marginal cost) peak-hour charges for urban freeways ranged from 14.5 to 34.3 cents per mile, and on urban-suburban freeways, from 3.3 to 9.1 cents/mile—in 1972 dollars.[11] Converted to 1990 dollars, that would be 42.9 cents to $1.02 per mile for urban routes and 9.76 to 26.9 cents/mile for suburban routes. Southern Orange County is best

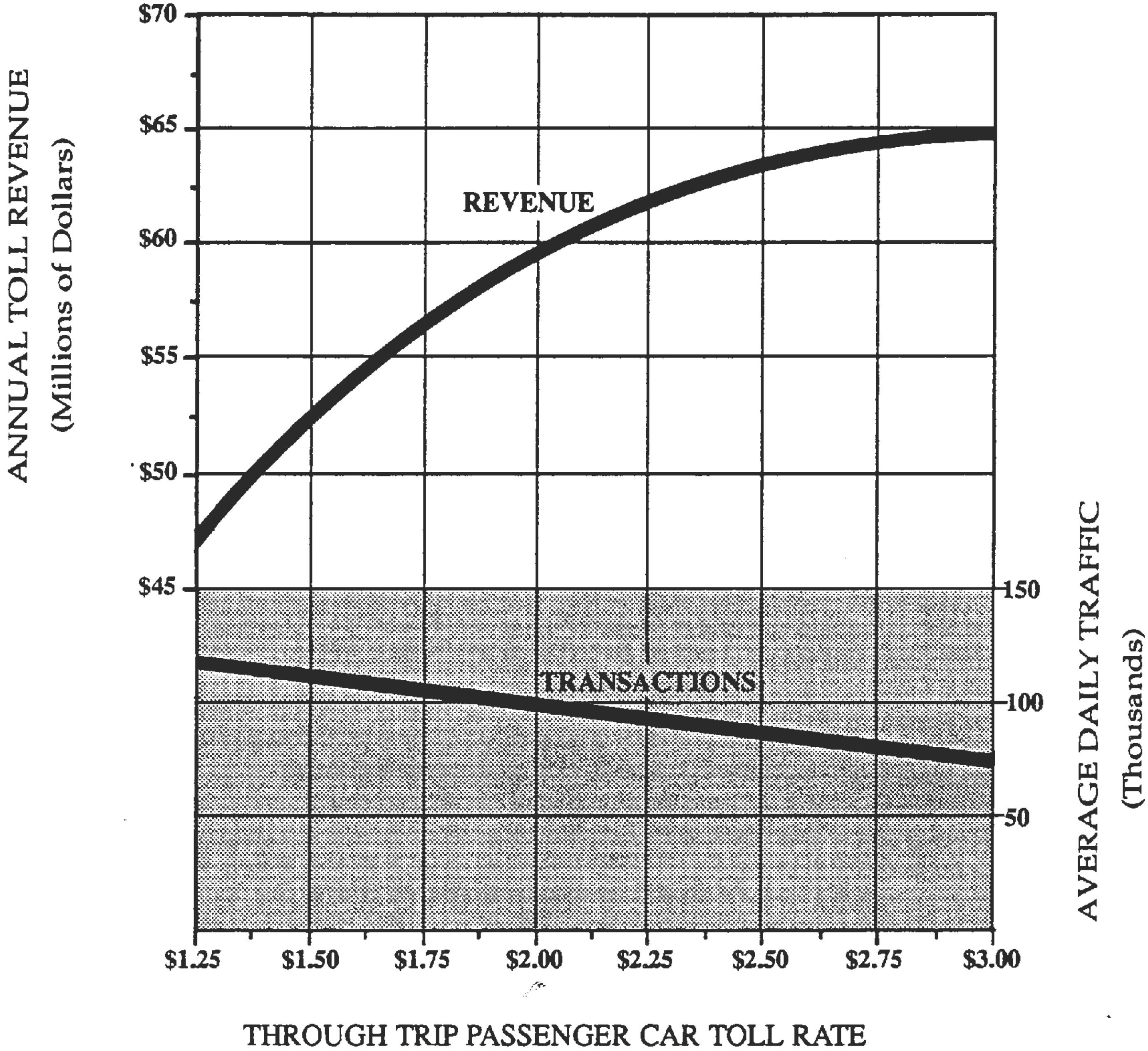


**FIGURE 1**

**TOLL SENSITIVITY CURVE**
**1997 LEVELS**

SOURCE: WILBUR SMITH ASSOCIATES

described as suburban, so the 10 to 27 cents/mile should be taken as representative of 1990 figures. The proposed peak-hour prices are in line with these numbers derived from simulation modeling.

One possible scheme for the pricing strategy is given in Table 1. The basic idea is to keep the off-peak toll constant at 10 cents/mile while increasing the peak-period toll by 10 percent each period, starting at 13 cents/tollable mile (slightly less than the currently planned flat-rate toll). As can be seen, this means that the differential between peak and off-peak charges would begin at 33 percent, and would increase to nearly 100 percent by the fifth period of the experiment. If the experiment continued for another five periods, the differential would exceed 200 percent by the 10th period. A "period" would be anywhere from six to 12 months. If six-month periods are used, the increase in nominal tolls would be 20 per year, large enough to be significant if we continue to have moderate levels of consumer price inflation.

## TABLE 1

### PROPOSED PRICING SCHEDULE
### SJHTC CONGESTION PRICING DEMONSTRATION

| Period | Peak-Hour Toll | Max. 1-Way Charge | Off-Peak Toll | Peak/Off-Peak Ratio |
|---|---|---|---|---|
| 1 | $.13/mile | $1.88 | $.10/mile | 1.33 |
| 2 | .143 | 2.07 | .10 | 1.43 |
| 3 | .157 | 2.28 | .10 | 1.57 |
| 4 | .173 | 2.50 | .10 | 1.73 |
| 5 | .190 | 2.76 | .10 | 1.90 |
| 6 | .209 | 3.03 | .10 | 2.09 |
| 7 | .230 | 3.33 | .10 | 2.30 |
| 8 | .253 | 3.67 | .10 | 2.53 |
| 9 | .278 | 4.04 | .10 | 2.78 |
| 10 | .306 | 4.43 | .10 | 3.06 |

The financial community has been very cautious about the untested idea of congestion pricing. It must be emphasized that for urban tollways facing competition, a pricing strategy which offers low rates during non-peak hours and high rates at peak hours is likely to produce more revenue than the conventional flat-rate toll. User sensitivity to price will be quite high at off-peak hours when the parallel free routes are relatively uncongested; by the same token, time-sensitive users will be relatively insensitive to price at peak hours, so it makes sense for the tollway to charge a significantly higher rate at those times.

In order to obtain the consent of the financial community for this experiment, provisions would have to be made for deferring or eliminating the next planned increase in any period in which total annual toll revenue was projected to fall below the sum which was projected to be raised via the flat-rate toll. This would ensure that debt-service payments would continue to be made at planned levels.

How realistic are the peak-hour charges proposed in Table 1? The Wilbur Smith studies for the Transportation Corridors Agencies use average commuter value-of-time numbers of $10.68 hour in 1995, $12.54/hour in 2000, and $15.48/hour in 2005.[12] The principal alternatives to the SJHTC are the Pacific Coast Highway (PCH-Route 1) and the San Diego Freeway (I-405/I-5). Assume that peak-hour speed on these alternate routes averages 20 mph in 2005, while congestion pricing keeps average peak-hour speed on the SJHTC at 45 mph. For the 14.5-mile tollable length of the SJHTC, the toll road would then offer a saving of 24 minutes during rush hour. Based on the Wilbur Smith figure for 2005, that time saving would be worth $6.23 to the average commuter—well above Table 1's highest peak-hour charge of $4.43.

The use of Automatic Vehicle Identification (AVI) will facilitate this experiment. Toll authorities using coin machines generally price in multiples of 25 cents, to facilitate maximum possible use of exact-change lanes (which have much greater throughput than change-made lanes). AVI will permit fractional prices (such as those shown in Table 1) to be charged, since the charging will take place electronically rather than by means of coin machines. As a further incentive for users to sign up for AVI, the tollway could round up each fractional toll to the nearest multiple of 10 cents or 25 cents for cash (toll-booth) customers, thereby giving a small price break to AVI patrons.

The AVI system also greatly facilitates price changes. This is useful when changing from one peak-hour rate to another for each new period of the experiment. It will also be useful on a daily basis in making transitions from off-peak to peak-period prices. When users know that access conditions will be easier or more difficult on either side of a point in time, they tend to form queues to wait for the transition to easier access. (This phenomenon is observed on Route 66 outside Washington, D.C., when this highway switches from HOV-only to regular access.)

To alleviate this problem, the AVI system can be programmed to make a smooth or stepwise transition between the off-peak and peak rates. If, for example, the peak period is defined as ending at 8 P.M., the transition to the off-peak rate of 15 cents/mile could be carried out in one-cent intervals spread over the period from 8 P.M. to 10 P.M. This transition period would be widely publicized, so that users would know that there was little benefit in waiting by the on-ramps for 9 P.M. to occur, since their savings would only be, say, one cent per mile for every three minutes they waited. The toll system could also display the current toll rate electronically on roadside or overhead displays at intervals along the route.

If the experiment runs for five years, and the SJHTC opens for traffic in 1995, then by 2000 extensive data will have been collected and analyzed on the effectiveness of congestion pricing. This information will then be available for transportation planning on other Southern California facilities, and may help in decisions regarding possible region-wide use of congestion pricing.

This information will also be available well in advance of the planned removal of tolls from the SJHTC in 2010. The Corridor Design Management Group's level-of-service estimates predict toll-free traffic volumes in 2010 that will result in Service Level F peak-hour conditions along nearly 50 of the northbound route and one-third of the southbound route (under the "conservative" [low HOV use] assumption).[13] If these projections are correct, service levels by the years 2015 or 2020 would be even worse, assuming continued traffic growth.

But if the demonstration of congestion pricing has worked as well as theoretical models predict, and traffic flows can be maintained at Service Levels C or D during peak hours, then the TCA will have sufficient information to present an argument for the continuing, permanent use of pricing as a basic tool of congestion management from 2010 onward.

## V. MEASURING TRAFFIC FLOW EFFECTS

The proposed demonstration project will compare traffic patterns on the congestion-priced SJHTC with traffic on the unpriced alternative north-south routes: the San Diego Freeway and the Pacific Coast Highway. Hence, we will need measurements on all three of these routes at various times during each period of the demonstration project.

Peak and off-peak traffic counts will be needed for all three routes. A simple comparison would contrast forecasted annual traffic levels on these routes (by Caltrans, the TCA's Corridor Design Management Group or other transportation agencies) with the measured levels on each route. On the SJHTC, we would expect peak-period traffic volumes to be lower than forecast and off-peak volumes to be higher than forecast. Peak-hour traffic volumes on the Freeway and the PCH may be somewhat higher than forecast, if there is diversion of some traffic from the toll road due to the higher peak-hour rates. These comparisons may not be highly reliable, since many factors can affect traffic levels on individual facilities—e.g., changes in local land uses. Nevertheless, to the extent that all three routes serve as substitutes for one another and are affected similarly by corridor-area growth, unemployment levels, etc., these comparisons will have some validity.

Better estimates of diversion could be obtained from two additional forms of measurement. One would be surveys conducted every period of random samples of I-5/405 and Route 1 users, based on license-plate readings and mail/phone questionnaires. Another form of measurement could be carried out using AVI technology. If AVI monitoring equipment were installed on - 5/405 and Route 1 lanes, that equipment would record the passage of AVI-equipped vehicles on those routes. Presumably, vehicles carrying AVI tags which had been purchased for use on the

SJHTC, but were operating instead on I-5/405 or Route 1 during peak hours, would be vehicles diverted from the SJHTC at some level of increased price.

## VI. MEASURING RIDE-SHARING EFFECTS

Increased peak-hour prices will lead to some degree of mode-shifting, as some fraction of users who cannot shift to off-peak times or to alternate routes decide to give up advantages of the drive-alone mode. One goal of the demonstration project will be to measure the degree of ride-sharing on the SJHTC and the alternate routes as various prices are tested on the former. This will be done by means of each-period surveys, based on license-plate readings and mail/phone questionnaires.

Southern Orange County poses a difficult challenge to ride-sharing. Orange County is one of the most affluent areas in the state, and the service area of the SJHTC is the most affluent portion of Orange County. Affluence is highly correlated with auto ownership and use, with low-density suburbs poorly suited to bus and rail transit, and with professional and managerial jobs. Surveys of commuters show that above-average-income people greatly value the door-to-door speed, flexibility, absence of waiting time, privacy, and safety of private automobiles. Conventional transit is unable to compete with the private automobile as the mode of choice for most of these commuters.

Added to this demographic factor is the decentralized pattern of land use in Orange County. The county is famous for having no "downtown"—yet it is one of the state's major centers of employment. Census data from 1982 identified nine central business districts in Orange County (defined only in terms of retail centers)—as compared with just two in 1977. The 1990 census will probably identify many more.

A December 1990 paper by Genevieve Giuliano and Kenneth Small sheds further light on the decentralized nature of Orange County.[14] The authors identify 32 employment centers in the five-county Los Angeles region. Six of these—Orange County Airport, Santa Ana, Fullerton/Anaheim, Santa Ana South, Orange/Garden Grove, and Garden Grove/Stanton—are in Orange County. But of all the 875,900 jobs (1980 census data) in the county, only 136,000 of them (15.5%) are in those centers. The rest are widely dispersed throughout the county.

The low density of employment makes both mass transit and informal ride-sharing unusually difficult. And the more affluent the area, the greater the value people will put on their convenience, as well as on their time.

A significant incentive would have to be offered to change the behavior of these affluent drivers. This experiment will enable a test of the hypothesis that unusually high prices—especially in the case of non-work peak-hour trips—may be sufficient to motivate increased ride-sharing behavior.

## VII. EMISSION-REDUCTION EFFECTS

Air quality is another important consideration. Congestion pricing can be expected to improve air quality in two ways.

The first improvement arises from the reduced level of congestion on the facility, compared with (a) the level of congestion on the parallel unpriced roads, and (b) the level of congestion forecast by CDMG for the SJHTC under flat-rate pricing. The California Air Resources Board points out that congestion—stop and go traffic—significantly increases emissions. As an example, one ARB report estimates that a 10-mile trip, using an average 1987 automobile, results in running exhaust HC emissions of 2 grams at a speed of 55 mph but that HC emissions would be 7 grams at an average speed of 20 mph, typical of stop-and-go conditions.[15]

The second impact on emissions is due to the reduced number of vehicles on the SJHTC. To the extent that higher prices succeed in reducing vehicle miles traveled (rather than simply displacing traffic to the competing routes), there will be fewer vehicles on the road. It is impossible to predict how much of the reduced VMT on the SJHTC will be displacement to other facilities and how much will be true reduction on overall demand. True demand reduction will be less than would be expected in an areawide implementation of congestion pricing, but this is one of the limitations of a demonstration project such as this.

Between reduced congestion and reduced demand, significant emission reductions can be achieved by adopting congestion pricing on the SJHTC. This emission reduction cannot be measured directly, but will have to be calculated from the information on traffic diversion, congestion reduction, and ride-sharing increase.

It is interesting to note that in December 1991, the Southern California Association of Governments issued a finding of conformity with the federal Clean Air Act and the Regional Mobility Plan for the SJHTC. The finding was based on a Memorandum of Understanding with the TCA that the toll-pricing policy will produce HOV-equivalency in terms of average vehicle ridership.[16]

The presently planned removal of tolls from the SJHTC in 2010 would result in significantly increased congestion and the accompanying worsening of emissions. That would be an important additional reason for using the results of this experiment to propose a permanent congestion-pricing regime for the SJHTC for implementation in 2010.

## VIII. EQUITY CONSIDERATIONS

The equity issue will be less serious for this project than for many other possible demonstration sites, given the demographics of the SJHTC service area. Nevertheless, equity must be taken seriously in designing the experiment and in explaining it to the public.

Transportation planners should point out that the reduction of congestion levels and increased trip speed on an entire facility will benefit users of buses, vans, and other forms of non-rail transit, and we know that, on average, lower-income people are the principal users of public transit in Southern California.

Secondly, it will be important for transportation planners and public officials to explain to the public that congestion pricing represents a step towards a more equitable method of paying for transportation systems. Existing county transportation improvement programs are paid for by a one-half cent sales tax, a regressive form of taxation. The gasoline tax, though bearing some relationship to vehicle use, is also regressive in its incidence on income groups. Congestion pricing requires those choosing single-occupant vehicles to pay significantly more than those choosing any other form of transportation, and those users tend to be more affluent.

Thirdly, it is critically important that alternatives be provided (and publicized) for those priced off the SJHTC. It was noted previously that the two existing north-south routes—I-5/I-405 and Route 1—are direct substitutes for the SJHTC for many users. Car pools and existing transit will provide alternatives for other residents. But given the poor suitability of Southern Orange County to conventional fixed-route transit, transportation planners should make a concerted effort to bring about additional transit alternatives for this corridor.

Demand-responsive door-to-door (dial-a-ride) service is available from the Orange County Transportation District only to senior citizens and the handicapped. More generalized minibus and parataxi service could provide both scheduled and demand-responsive door-to-door service, similar to the airport-only service pioneered by SuperShuttle and now offered by numerous firms. Scheduled door-to-door service would overcome the unpredictable waiting times typical of mass transit and sometimes of carpools and vanpools. And demand-responsive service would provide for the availability of a vehicle whenever the need for an unscheduled trip arose (e.g. for commuters during the day).

A high-demand corridor traversing an affluent area offers a prime location to test door-to-door commercial transportation service, as an adjunct to the tollway. If such commercial services (other than airport shuttles) existed, they would naturally tend to use the toll road during peak hours. In such a business, time is money, and a charge of $5.85 to go the full length of the SJHTC (at 39 cents/mile) would be spread over four to eight passengers, adding only a small amount to each person's fare. A reduced toll rate could be given for such vehicles, if further economic incentives were considered necessary. It might be useful to charge a reduced rate until several companies were established and had built up a market in the corridor. But if the service ultimately proved as popular as airport shuttles, there would be no need for permanent incentives of this sort. The former Urban Mass Transportation Administration (UMTA) funded research and demonstration projects on various forms of paratransit and its successor, the Federal Transit Administration, might be interested in helping such services to get under way in Orange County. The Transportation Corridors Agency could take the lead in encouraging the development of an effective door-to-door paratransit industry in the San Joaquin Hills corridor. Such services would be a natural complement to congestion pricing, by offering an additional alternative mode for those tolled off the facility by the higher prices.

## IX. MARKETING AND POLITICAL CONSIDERATIONS

How realistic is this proposed experiment? The basic issue of charging tolls is not in question here, since the SJHTC is already defined as a toll road. The controversial issues, instead, will be the environmental acceptability of congestion pricing instead of earlier implementation of HOV lanes and the fairness of allowing some to pay higher rates for (presumably) better service.

In contrast to a conventional freeway or even a flat-rate-priced toll road, a congestion-priced SJHTC should permit traffic to flow smoothly even at peak hours, thereby reducing emissions as much as 70 percent per vehicle trip (per the Air Resources Board, noted above). Congestion pricing would result in somewhat fewer trips, as well. These potential environmental benefits, it can be argued, may be greater than those provided by a conventional toll road (or possibly even a conventional toll road plus HOV lanes). The case for conducting the demonstration project is the need to quantify these potential benefits. If the experiment produces evidence to validate the results of the Environmental Defense Fund's recent computer modeling of region-wide congestion pricing,[17] there will then be a case for considering wider implementation of this pricing policy. But we will never know without such demonstration projects.

The experiment will also offer an opportunity to introduce a new form of commercial transit service to Orange County. Door-to-door van service, offering attributes superior to that of conventional mass transit and informal ride-sharing, may be the breakthrough that finally gets middle-class commuters out of their single-occupant automobiles. But it will take an uncongested, premium-service thoroughfare to make this form of transportation competitively attractive. This, too, is an important reason to test congestion pricing on the SJHTC—and it may be a factor that gains support from environmental and pro-transit groups.

On the fairness issue, it can also be pointed out that Americans are accustomed to selecting among combinations of price and service in using air travel (which, since deregulation, has become a truly mass-market phenomenon). Paying more to go first class is an ordinary, every-day phenomenon, whether it is restaurants, hotels, grocery stores, department stores, or airline service. The government-operated Postal Service now offers Express Mail service as a premium-priced alternative to first class letter mail, in order to meet the competition of private express services like Federal Express. And last December the Immigration and Naturalization Service announced that it would test "express pay lanes" for travelers at selected border crossings with Canada and Mexico.[18] Those who wish speedier service will be able to pay to get it.

There will certainly be opponents of congestion-pricing experiments. Environmental and pro-transit organizations have opposed the building of the SJHTC, per se. Others have ideological objections to charging tolls, believing that our highways should remain freeways. This paper has not attempted to make the case for building the SJHTC or for making it a tollway rather than a freeway. It has taken the existence of the San Joaquin Hills Transportation Corridor as a given, and then sought to suggest reasons why this toll road, if it is built, would be a good place to conduct a demonstration project with congestion pricing.

Assuming that the road will be built, and built as a toll road, there is at least a plausible case for diverse interests to support this experiment. Environmentalists should be interested in learning whether peak-hour pricing can significantly reduce vehicle miles traveled and the resulting total amount of vehicle emissions. Transit advocates should be interested in learning whether high prices on roads stimulate demand for new and old forms of transit.

One can hypothesize political support for this experiment coming from several parts of the political spectrum. Political conservatives interested in reducing the need for tax increases may be interested in the potential of highways becoming more self-financing. Liberals seeking a more balanced transportation system, with greater transit alternatives, may also find merit in a system that they would see as creating a more level playing field between auto-use and transit.

In short, the traditional fear that congestion pricing may be a political impossibility may well be overblown. Well-designed demonstration projects, carefully explained and justified, may find diverse support as we search for ways to deal with the serious problem of congestion.

## X. CONCLUSION

Southern California is well-positioned to be a national test site for congestion pricing in the 1990s, with six new toll roads under development. Orange County could apply to the Federal Highway Administration for designation as one of the five sites for congestion pricing pilot projects, under ISTEA's provisions for such projects. If two Orange County sites—the private SR 91 toll lanes and the public San Joaquin Hills Toll Corridor—make use of congestion pricing, and systematically measure the results, Greater Los Angeles transportation planners will gain a wealth of information that can be used to make decisions about the role of congestion pricing in this region. If congestion pricing reduces peak-hour vehicle trips and stimulates ride-sharing and transit use, these findings will suggest an expanded role for congestion pricing.

One possible next step would be to generalize the innovative concept of the private toll/HOV lanes on SR 91 to a regionwide network of such lanes. Permitting non-qualifying cars to buy their way onto HOV lanes would increase the utilization of these lanes and provide a source of funding to accelerate their development. A regionwide network of High Occupancy Toll (HOT) lanes would permit a much larger demonstration of congestion pricing, on a voluntary basis. If public acceptance is high, then the transition to such pricing on all congested freeways would be considerably more feasible than if such acceptance had not previously been developed.

## ABOUT THE AUTHOR

Robert W. Poole, Jr. is President of the Reason Foundation, and holds B.S. and M.S. degrees in engineering from MIT. He served on the Caltrans Privatization Advisory Steering Committee, assisting with the AB 680 private tollway development process. He has advised the U.S. Department of Transportation and its Federal Highway Administration on privatization and congestion pricing.

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