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# **ROAD USE CHARGES and JITNEYS**

Some thoughts on how to introduce them to Los Angeles

14 July 1976

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#### ABSTRACT

According to most transportation economists, the two most badly needed reforms in urban transportation are road user charges (for smog and congestion) and legalization of jitneys. Together, these two reforms show good promise of cutting peak-hour traffic by about a quarter in cities like Los Angeles. This cut, which would reduce total daily traffic by about 5%, would reduce daily vehicular smog by at least 10% and eliminate most congestion, at a net savings to the public of at least \$150 million a year. No other transportation reforms remotely approach these two in combining high benefits with low cost, yet neither has received much planning attention. They have no organized political support, and, once placed on the transportation agenda, they would draw much organized opposition.

On the other hand, attitudes toward public transportation are changing rapidly as present practices become more and more prohibitively expensive in time, money, and pollution. There is a good chance that the California Transportation Plan will, for the first time, give the public good information on the costs of transportation alternatives. If so, the man who objects to paying a one-dollar use charge today might pay it willingly if he knew he would otherwise have to pay five dollars tomorrow for building more roads (or a hundred dollars for building rapid rail), or else lose ten dollars worth of travel time from congestion the next day. This paper considers some of the problems of transition from the present overregulated, oversubsidized transportation market, to one which is more open, more responsive to demand and cost, and hence, more efficient.

The first section, on phasing in road user charges, indicates that total system costs of a hybrid Automatic Vehicle Identification (AVI)/sticker system

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would be 4-8¢ per trip for AVI, and 7-21¢ per trip for stickers, or \$20 a year for regular commuters with AVI. To succeed politically, a sticker-based pilot test of congestion charges would have to show quick, good results. This suggests that a very badly crowded freeway must be initially targeted, and problems of sticker sales would have to be carefully worked out to avoid congestion from on-freeway purchases. Charged access to the Santa Monica Freeway diamond lanes would make them work better and minimize transaction costs. Self-cancelling stickers, now under investigation at Arthur D. Little Corporation, could solve the purchase congestion problem, which could also be much reduced by selling monthly stickers and exempting multi-passenger vehicles, as is now done in Singapore, and eventual conversion to AVI.

The second section reviews the problems of transition from the present overregulated, undersupplied, and underused public transit market to a more open one with jitneys and carpool-for-hire incentives. Both of these are more attractive than carpools because they do not require a prearranged match of passengers, routes, destinations, and hours. A practical series of steps toward a more open transit market would leave existing carriers intact but (1) permit free jitney or bus competition on all routes; (2) start a phased changeover from subsidies to carriers to subsidies to needy users; (3) during the changeover, divide subsidies to carriers among all carriers on a passenger-trip or fare-matching basis, not a deficit-filling basis for a few carriers; and (4) loosen or abolish restrictions on all carriers as to rates, routes, hours, and kinds of service. Amateur jitneys, or carpools for hire would be much encouraged by limiting driver liability and insuring riders. Professional, full-time jitneys could be developed from a deregulated, demonopolized taxi industry.

Opening the transit market would not wipe out existing bus and taxi services, which retain some competitive advantages over jitneys and flourish in other countries.

with jitneys. Jitney competition would improve busline profitability in several ways: skimming peak-hour trade, which is costly for bus companies to provide, providing feeder service, and stimulating public willingness to use public transportation by providing more of it. In general, both isolated and congested areas would get more, better, and cheaper public transportation from open, competitive public transportation than from closed bus and taxi monopolies. In Los Angeles, the marketplace weaknesses of existing bus and taxi monopolies which incapacitate them for attracting riders (together, buses and taxis carry less than 3% of trips) may also weaken their power, hitherto strong, to block an opening up of the transportation market.

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## I. Ultimate and Immediate Needs.

Most transportation economists believe that legalizing jitneys and charging road users for the smog and congestion they produce would provide more transportation for less total cost than other transportation alternatives which have received much more attention in the planning literature (1,2,3). These conclusions appear to apply to California (4,5) and to Los Angeles (6,7). In Los Angeles, for example, it appears that 10% of daily traffic--upwind, morning, peak-hour traffic--accounts for 40% of vehicular smog and congestion. Time-specific and place-specific user charges could cut that 10% by a quarter (2 1/2% of total daily traffic), and eliminate most of the 40% of congestion and at least 10% of daily vehicular smog (6/16-18). Net savings to the public could be about \$100 million a year in smog and congestion costs from controlling the morning peak; controlling the afternoon peak might save another \$50 million in congestion costs (6/17).

Jitneys in poorer countries carry between 9 and 70% of urban passenger trips, averaging about a third of passenger trips in the countries for which figures are readily available (1/ 182-185). In San Francisco, 116 Mission St. jitneys carry 10-16,000 passengers a day, perhaps 10-20% of daily passenger trips on Mission Street (1/179). No one knows how many riders jitneys would attract in Los Angeles if jitneys were permitted, let alone encouraged, but, if they could do one tenth as well as other cities they would double or triple the patronage of public transit in Los Angeles. Jitneys are faster than buses for short trips, more flexible than carpools, cheaper than taxis or dial-a-ride. They are especially well suited for service to the young, the old, the poor, and the handicapped. They typically operate at the times and places of greatest congestion, when and where attractive public transportation is most badly needed. They offer an ideal complement to smog and congestion charges

for damping peak-hour traffic and postponing or eliminating large costs of road-building, delay, and air pollution.

If jitneys and user charges make so much sense, why don't we have them? The short answer is politics. Unlike roads and rapid rail, jitneys and user charges have no organized supporters. In the rare instances when they appear on a political agenda, they draw strong opposition, not the least of which is that of the general public. The public knows and cares little about jitneys, but it knows about charges and it does not like them. User charges are designed to smack the user in the eye with a bill for costs of use now hidden in various public and private budgets, and often unknowingly paid for by other people. The more effectively they do this, the more certain they are to arouse political opposition. On the other hand politics is too simple an explanation for the short run and too short an answer for the longer run. Ignorance and inertia are powerful immediate factors, but they are also subject to change. The man who objects to paying a dollar use charge today might pay it willingly if he knew he would otherwise have to pay five dollars tomorrow for building more roads or lose ten dollars worth of travel time from congestion the next day. Likewise, taxi drivers and bus companies whose operations are geared to the anomalies of the present overpaid, overregulated, underused public transit market would object to a sudden, radical change of rules which might put them out of business, but the more ambitious of them might ultimately welcome a broader, freer market for their services, especially if they are given time to adjust to it.

The first antidote to ignorance and inertia, addressed in a prior paper (6), is the effective marshalling of knowledge in the form of a clear, well-costed presentation of transportation alternatives in the state transportation plan. The second antidote addressed here, is careful sizing, pricing, and timing of steps toward a more rational transportation market.

## II. Road User Charges.

### 1. System costs.

In all probability the ultimate road user charge system for Los Angeles would be a combination automatic vehicle identification and sticker system. AVI would require the placing of identifiers on about a third of the cars, buses, trucks and motorcycles registered in the Los Angeles Basin, and monitors at every freeway entrance and exit, and around designated traffic zones. Several AVI systems have been proposed; the only one with high tested reliability uses low-frequency radio transponders for identifiers and induction-loop interrogators for monitors. It has worked well for automatic toll collection for trucks and buses in the East (7,8,9). Its advantages are low cost and high convenience to frequent users, high information yield to transportation planners, and very high pricing flexibility. Like a sticker system, it would be generally targeted on the most congested and smog-producing traffic in the Basin, the morning peak in and around Los Angeles, but it could be smoothly graduated to avoid peaks at the boundaries of a block charge period, and it could be raised or lowered to match varying circumstances within the time and areas generally targeted, or the emissions characteristics of the using vehicle.

#### a. AVI

The cost of an AVI system would be about \$144 million in capital costs. \$40 million in annual system costs. System costs, not including charges, would be \$20 a year for the average user, 8¢ per round trip, 8 mills per charged mile, computed as follows:

The total light vehicle fleet in the Basin is about 6 million. About 4.5 million vehicles operate during peak periods, and perhaps 3 million of these operate in the congested target area. Let us suppose that 11% of the three million, or .33 million are from out of the Basin, that the remaining 2.67 million



is evenly divided between regular and sporadic users, and that half of the sporadic users, .67 million, use stickers in preference to AVI. That leaves 1.33 million regular users plus .67 million sporadic users = two million likely AVI purchasers.

Prior computations extrapolated from existing freeway entrances and exits and traffic zones indicate that the whole basin, including freeways and surface streets, could be priced with about 4,000 pricing points (7/34-35). Let us suppose that half of these would cover the target area and that the average pricing point would have three lanes each way. AVI monitors, at \$7,000 per lane, would cost \$42,000 per 6-lane pricing point, \$84 million for 2000 pricing points, and have a nine-year useful life (8/14-16). Let us further suppose that 1,000 signalling devices of about the complexity and cost (\$10,000) of a simple stoplight were added, for \$10 million, with a ten-year life. Transponders would probably cost about \$25 installed, and have a six-year life (8/14-16). Total capital costs would be about \$144 million; annual system costs would be about \$40 million (Table 1).

Table 1

System Costs of AVI

Component	Capital Costs	Ann. Costs Including 7% Interest
2 million transponders @ \$25	\$50 million	\$11.83 million
2,000 pricing points @ \$21,000	\$84 million	\$15.2 million
1,000 signals @ \$10,000	<u>\$10 million</u>	<u>\$ 1.7 million</u>
	\$144	\$28.73
		Operating Costs
Maintenance 2,000 pricing points @ \$1,000/yr. (8)		\$ 2.0 million
Data transmission @ \$2,200 per pricing pt./yr. (8)		4.4
Computer processing cost (8)		.4
Billing costs @ \$4 per client/yr. (8)		<u>8.0</u>
		\$10.8 million

Total annual cost	\$39.53 million
Cost per charged vehicle	\$19.77
Cost per morning trip @ 240 workdays per year	.08
Cost per charged mile for 10.5 mile average trip	.008
Cost per mile for all mileage	.002

b. Stickers

Under these assumptions, two of the three million targeted peak-hour users would have AVI. Of the remaining million, a third would be registered outside the Basin; two thirds would be sporadic users from inside the Basin who chose, for reasons of economy or privacy, not to spend \$25 on a transponder. With current technology, these users would be best served with a sticker system resembling the one now in use in Singapore. To drive in the targeted area the user must have a sticker costing whatever price is necessary to hold congestion or pollution to desired levels. In Singapore, an initial sticker charge of \$1.20 cut targeted morning peak traffic by 40%, with, according to its sponsors, no administrative problems.

Singapore differs from Los Angeles in several important respects. It has 2.2 million people and a quarter of a million vehicles, compared with 7 million people and 5 million vehicles in the Los Angeles-Long Beach metropolitan area; it is far more densely settled and more congested; and its unitary authoritarian government is more capable of imposing stringent restrictions than the mild fragmented governments of the Los Angeles Basin. Its targeted vehicle population is on the order of 80,000, not two or three million. Since vehicles with four or more occupants are exempted from the sticker requirement, only about 7,000 vehicles a day (of about 48,000 post-charge vehicles driving in the target zone) required stickers and most of these, perhaps more than 90% , had monthly, rather than daily stickers (10/10, 11/4). Singapore's mechanism for distributing a few hundred daily, and a few thousand monthly stickers was post

office windows and roadside booths. To distribute a million daily stickers, Los Angeles would need something more.

For Los Angeles, the basic distribution agency would probably be retail sales outlets, perhaps at gas stations. Backup distribution could take place at each of the pricing points needed for AVI, and at 15 or 20 on-freeway sticker plazas. Let us suppose that only the morning peak will be targeted, using date-specific stickers. Let us further suppose that 80% of the one million sticker users buy their stickers at a gas station, that the gas station follows the practice of lottery ticket distributors in the East and charges 4% of face value, and that face value of the sticker is \$2.00 (8/11). The system cost per sticker would be 1.5¢ for the sticker, 8¢ distribution costs, and 3.3¢ buyer's time costs assuming it takes him 40 seconds to buy a sticker and his time is worth \$3 an hour. Total system cost per trip, 11.3 cents, x 240 working days = \$27.12 if every buyer commuted every working day. \$27.12 x 800,000 users would be \$21.7 million annual systems cost for this category. System costs per charged mile one way would be a penny.

Let us further suppose that 10% of sticker users would buy their stickers at on-freeway plazas and another 10% would buy them at on-ramps and other pricing points. This 20% of sticker users amounts to only 6.67% of all targeted peak-hour users. It could probably be supplied at 1,000 pricing points and 20 on-freeway plazas. Costs for this category are outlined in Table 2.

Table 2

System Costs of Stickers for 200,000 daily on-road buyers

Component	Capital Costs	Annual Costs, Including 7% Interest
20 sticker plazas \$1 million each, 30 year life	\$20 million	\$2.07 million
3,000 sticker vendors x 1,000 pricing points, \$4,000 each, 6 year life	<u>12</u> \$32 million	<u>2.84</u> \$4.91 million
		Operating costs
Maintenance and Servicing 1,000 pricing points @ \$2,000 year		\$2.0 million
Man plazas, 40 attendants @ \$10,000 year		.4
Administration costs entire system		.1
Stickers, @ 1.5¢ each		.7
User time cost @ 3.3¢ per 40-second transaction		<u>1.6</u>
		\$4.8 million
Total Annual cost		\$9.81 million
Annual cost per vehicle if used every workday		49.05
Cost per morning trip @ 240 workdays per year		.20
Cost per charged mile for 10.5-mile one-way trip		.018
Cost per mile, all mileage		.005

System costs of each strategy should also include enforcement costs of about 3.5 mills per trip, reckoned, following Bhatt (8/26) as follows:

3 million daily vehicles x 2% violation rate = 60,000 violators per peak  
 x 50% caught = 30,000 to process  
 ÷ 20 violators per hour processing rate = 1,500 man hours per day needed  
 x \$7 per hour = \$10,500 per day enforcement costs  
 x 240 working days = \$2.52 million annual enforcement costs  
 ÷ 3 million vehicles = 83¢ per vehicle per year  
 ÷ 240 working days = 3.5 mills per trip  
 ÷ 10.5 miles = .33 mills per charged mile.

Total system cost for each strategy, counting enforcement costs, are summarized in Table 3.

Table 3

## System Costs of AVI/Sticker System

Component	Capital Costs	Annual Costs	Cost per Trip	
			a.m. charge only	a.m. & p.m. charge
AVI	\$144 million	\$41.2 million	8¢	4¢
Retail stickers	-----	22.4 million	12¢	7¢
On-road stickers	<u>32 million</u> \$176 million	<u>10.0 million</u> 73.6 million	21¢	15¢

Although the afternoon peak involves 90% less smog than the morning peak, it presently also involves 25% more traffic, which implies more than 25% more congestion. In Singapore, morning charges drastically reduced the morning peak but, contrary to expectations, did not affect the afternoon peak. The sticker costs in Table 3 are based on date-specific daily stickers. Non-date specific, self-cancelling stickers might cut on-road sticker purchase costs by a third and retail sticker costs by a sixth.

c. What to charge.

In Singapore, original daily and monthly sticker charges were the equivalent of US \$1.20 a day and were buttressed with stiff additional charges on all-day parking, on vehicle ownership, and on use of business cars--and balanced with exemptions for public transportation and multi-occupant private vehicles. A park-and-ride shuttle service was set up to accommodate the anticipated additional demand on public transportation. Although the shuttle service was little used at first, targeted morning traffic plummeted 72% for private vehicles, 40% overall. The sticker price has since been raised to \$1.60 and the shuttle service subsidized, with some success, to attract more passengers. What effect, if any, these further changes have had on the drastic initial traffic reductions has not been published.

In California, Theodore Keeler, Kenneth Small and associates have worked out an optimum charge schedule for Bay area freeways, designed to cover the full costs of use in various times and places, ranging from rural freeways at

total costs per passenger mile to a minimum (5). As far as I know, Keeler and Small's work is the most sophisticated available on congestion costs. It implies congestion charges for near-peak traffic (the two lesser hours of a three-hour peak) of a penny or two per mile in addition to the penny now paid in fuel tax, and peak-of-the-peak surcharges ranging from 3-6 cents per mile for rural freeways to 3-10 cents per mile for urban-suburban freeways, and to 13-38 cents per mile for central-city freeways.

Whether Keeler's figures apply to Los Angeles freeways depends on how similar their traffic patterns are to those of the Bay area, a study which has not yet been made but should be. Los Angeles is more spread out than the Bay area, and its congestion costs may be lower. A full-cost accounting of Los Angeles freeways should also pay more attention to smog costs than the Keeler study did because smog is at least twice as severe in the Los Angeles Basin as in the Bay area and daily, seasonal, and spatial variations in the cost of pollution are more important. Keeler merely added an average pollution cost estimate of about a penny a mile to his congestion estimates. In Los Angeles, the average cost of smog is around three cents a mile (6/App.IV; 14/App.B), but it varies from half a cent a mile from downwind sources on winter afternoons to ten cents a mile for upwind sources on summer mornings (6/App.IV). We need a sharp-pencil analysis of smog, congestion, and hidden public service costs in the Los Angeles Basin, and perhaps San Diego and Sacramento as well as the Bay area. Sophisticated analysis might not set the actual prices to be charged, but it could provide much-needed guidance for administrable approximations.

Pending the development of such sophisticated analysis, Table 4 outlines what average smog and congestion charges might look like in Los Angeles if the AVI/sticker system summarized in Table 3 were in place today, and if both morning and afternoon peaks were charged. It should be remembered that a few years hence, when a charge system might finally be emplaced, smog charges would be lower, and congestion charges

higher than they are today.

Table 4

Upwind, peak-hour smog and congestion charges

	Smog	10-mile trip (per 6/App. II) Congestion (@ 2.5¢/peak-hour mile)	Total	Daily total
Summer a.m. (10¢/mile)	\$1.00	.25	\$1.25	Summer \$1.75 + Svces <u>.20</u> \$1.95
Summer p.m. or Winter a.m.	.25	.25	.50	Winter: \$ .85 + Svces <u>.20</u> \$1.05
Winter p.m.	.10	.25	.35	

A rounded twice-a-day sticker price system might call for three 50-cent stickers for the summer morning peak, one for all other peaks. Morning-only charges might be a dollar in the winter, two dollars in the summer. AVI could be much more flexible, with higher charges for central-city peak-of-peak, where costs per vehicle mile may be ten times the 2.5¢ used here (4/23), and lower charges for near-peak, minor direction, and other less crowded road conditions. No one knows how much traffic these charges would divert, but one relatively conservative model, inflated to \$1976 dollars, suggests that a two-dollar charge would cut one-way traffic by about 30%, while 50¢ and one-dollar charges would cut it by 2% and 4% (13/149).

d. Phased transition to comprehensive charge system

The problem of moving from no time/place-specific road charges to a comprehensive charge system is a problem of political acceptance and system workability. These will depend heavily on transition costs. Charge equipment and

strategies should be field tested in small, temporary applications before they are bought for large, permanent ones, yet the limits of test situations are often so narrow as to guarantee that the test will fail. The demise of the Yellow Cab jitney experiment on Wilshire Boulevard has been attributed to its small scale and constricted running rules; so have many of the difficulties of the Santa Monica diamond lane experiment. Transportation pilot projects tend to languish because, while held back by most of the anchors of the old system, they have only a tiny spread of the sails of the new.

A crucial need is to show quick, good results. Singapore was brilliantly successful in this; so were the John F. Kennedy and Heathrow airports in New York and London in 1968 and 1970. All were badly overcrowded; all achieved dramatic, immediate improvement by raising the price of peak-hour use. California cities, by contrast, are not yet critically overcongested, thanks to decades of prodigious road construction. Even San Francisco, while more congested than Los Angeles, is not a near-terminal case in the same sense as pre-charge Singapore, New York, or Boston on that famous day when all traffic stopped for six hours. The handiest pilot project in California is the Golden Gate Bridge, (12). Its traffic demand has increased by 4-5% a year for 39 years; it peaks violently; and, despite the use of subsidized buses, mass transit lanes, contraflow lanes, and other tricks of conventional traffic management, its present peak-hour traffic is just about at capacity. Another year or two of continued demand growth, and the bridge will pass the point of hypercongestion and transmit fewer vehicles per peak hour than it does now. The resultant delay would be particularly costly to the Marin and Sonoma County commuters who now use the bridge and who appear to value their time at upwards of \$6 an hour (12/4-5); moreover, the systems cost of a peak-hour surcharge would be zero since the old-fashioned flat-rate tolls are already charged on south inbound traffic, and a peak-hour surcharge would require no additional investment or delay.

Nonetheless, when a peak-hour charge was proposed for the bridge in 1975, 2,000 angry commuters blistered the hearing body with protests and the project



was shelved. An important ingredient of their annoyance was the fact that traffic on the bridge was still flowing relatively freely. By official statistics, delay on the bridge amounted to five minutes each way; unofficial and anecdotal timing efforts suggested that two minutes might be a better figure than five, and most of that was the tie-up around the toll stations, which would be little affected by a congestion charge. Although congestion charges have value for traffic moving faster than hypercongested speeds, the value in most cases would be obvious to the user only where congestion was serious. For political success, congestion charges on the Golden Gate might appropriately be deferred until congestion becomes burdensome enough for the charges to make a quick and visible difference.

This problem of timing may be highly pertinent to Los Angeles. The initially targeted roads should be badly enough crowded for congestion charges to make a plain difference, and the charge method used should not add so much delay as to cancel out the effect of the charge. Los Angeles already has some badly crowded roads. The Santa Monica, Harbor, and Hollywood Freeways are often mentioned as bad examples, and Los Angeles Traffic Director Sam Taylor has recommended Mulholland Drive as a possible congestion charge rest site. On the other hand, the official difference between transit time on the free-flowing diamond lanes of the Santa Monica Freeway and that on the crowded ordinary lanes is only five minutes during peak hours. Unofficial impressions suggest a greater difference, and some drivers have bought the time savings, for \$2, by hiring passengers to qualify for the diamond lane, but one may wonder whether the small time savings, for most drivers, would be enough to assuage their outrage at having to pay for what they now get "free." The pilot freeway should be carefully chosen for high congestion, and it may be that a later experiment would get better results than an immediate one. I would much rather see a late one that works than an early one that fails. Whenever such an experiment may be or become opportune, there should be a well-considered foundation already worked out to make it a success.

Conceptually, the logical sequence would be something like this:

(1) Do the paperwork with real, verified figures and a sharp pencil, rather than the crude, improvised figures and methods used in this paper.

(2) Test and cost some prototype equipment. What is available? How fast is it? How reliable? What does it cost? Both (1) and (2) can be done now without a showdown with the public, though some political leaders may worry, correctly I hope, that such groundwork may make such a showdown possible within the next few years.

(3) Try congestion charges on a badly crowded section of freeway. This will be the hardest part, both for novelty to the public and for the problem of getting everyone charged without a systems tieup, and without the large established core of AVI users, or purchasers of yearly or monthly stickers which makes it possible to handle day-by-day sticker purchasers without swamping the collection system. The biggest problem would be service at sticker plazas and on-ramps. Existing parking-lot ticket-spitters pass one car every ten seconds; a dollar-identifier would add four seconds; waiting for access, fumbling for bills, and posting stickers could raise purchase time by tens of seconds. At 40 seconds per purchase (an important estimated figure which should be field-tested), one sticker vendor would pass only 90 purchasers per hour. Three vendors, assuming all were working smoothly, would pass 270 vehicles per hour, but that is only a sixth of the traffic which would otherwise pass in one lane, a twelfth of two lanes.

The great bulk of traffic would have to have bought stickers off the freeway, which, in turn presupposes a well-developed distribution system--only a well-developed market support system is not likely to spring up for a pilot program, least of all by the crucial first weeks of operations. For a pilot program to work, massive off-freeway support would have to be supplied, along with bigger

on-freeway sticker plazas than a large, established system might require, and either huge banks of on-ramp vendors or, initially, none at all to force users to buy their stickers off-freeway. Some regular users might buy monthly stickers, like the great majority of Singapore users, but, with a pilot program, there is always the thought that it might fail and be cancelled, and many such users would probably hold off long-term purchases. A refund feature might greatly reduce transactions costs by encouraging purchase of monthly stickers. Exemption of multi-occupant vehicles might cut transaction costs by 10-20%. Non-date specific, self-cancelling stickers would cut transactions costs of sporadic daily users radically. These have not yet been shown to be feasible, but Arthur D. Little Corporation has just started a feasibility study for UMTA and expects to have preliminary conclusions by the end of the year. Some combination of these transactions-cost reducers would probably be indispensable for a successful experiment.

A very attractive transaction-cost reducer would be to add a charge alternative to the Santa Monica Freeway diamond lane experiment. This project, which reserves the fast lane for buses and carpools with three or more occupants, has had trouble matching the pre-project performance of the freeway in person trips because its efficiencies in moving people have been offset by inefficiencies in moving vehicles. The project appears to have doubled carpools of three or more from 2-3% of the pre-project vehicle population to 4-5%, and doubled both carpool ridership and bus ridership from 6% of person-trips to 12% of pre-project person-trips. It also appears to have reduced vehicle traffic on the freeway by about 15% and person-trips by about 10%, and the most recent report, for the 14th week of the project's operation, indicates that vehicle trips were 10% less than pre-project, and person-trips equal to pre-project. Whether these end-of-school year figures will hold up remains to be seen, but it is clear that the diamond lane experiment is aimed at a proper target and that it is

at least within striking distance of improving the freeway's capacity to transmit people during peak hours.

A congestion-charge modification might put the diamond lanes over the top. Diamond lanes are less efficient than unrestricted lanes in moving vehicles because, by diverting vehicles from the reserved lane to other lanes which are already crowded, they can reduce the vehicle capacity of all lanes, the reserved lane by underuse, the other lanes and surface streets by overuse. On the Santa Monica Freeway the diamond lanes carry almost their pre-project share of people but, with, say, 5-6% of the vehicle population, counting buses, they operate at only a third of their vehicle capacity. The other 94% of vehicles, minus fractions diverted to carpools, buses, other roads, or other hours, must squeeze into the remaining 75% of road space. If the diverted fractions are large enough, less than 75% of pre-project users will be left to compete for road space, traffic will flow more freely, and everyone will come out ahead, thanks to people-moving efficiencies which outweigh vehicle-moving inefficiencies. Even in this situation, and certainly in the near-standoff situation of the Santa Monica, where the diamond lanes are very lightly used, illegal users of the diamond lanes actually add to the freeway's overall performance by relieving congestion in the free lanes. A charged-access provision which would legally fill the diamond lane to, say, two-thirds capacity would likewise add to the freeway's performance without swamping the reserved lanes or undermining the social discipline which makes them work. Because the diamond-lane system has three free lanes, paid access to the reserved lane is completely discretionary with the user and the problem of testing the market for congestion charges without prohibitive transaction costs is eased enormously. Charged access to diamond lanes could make both the diamond lane project and a congestion-charge pilot project work better than either might by itself.

The simplest charge regime would be a two-dollar sticker to use the

diamond lanes or enjoy ramp priority during peak-hours. This could be cut to one dollar for two-occupant vehicles, if it could be done without overfilling the reserved lanes. For a single-occupant vehicle, the sticker would confer about a ten-minute time advantage per one-way trip, five from ramp priority, five on the freeway, twenty minutes per peak-hour round trip. Driver's travel time would have to be worth \$6 an hour, twice the conservatively-reckoned average, to make such a sticker an attractive buy. For two-occupant vehicles the two-dollar sticker would confer forty person minutes of time savings, attractive at \$3 an hour. A one-dollar ticket for two-occupant vehicles would be attractive at \$1.50 an hour time value. If these charges divert enough traffic back to the reserved lanes--but not too much--traffic in the free-access lanes would speed up without noticeable slowing of traffic in the reserved lanes. This would reduce the access and accident problems of putting a fast lane side-by-side with a slow one, and it might permit a slightly higher speed limit in the reserved lane. Excessive demand for the reserved lane, of course, would fill it to capacity and negate its time advantages. If left alone, fewer people would then buy stickers and the time advantage would recur; alternatively, additional lanes could be limited of access, depending on demand levels, till most or all of the freeway is limited. Again, the traffic planner's flexibility is greatly increased, and so is that of the public, which would have much the same choices for road use that it now has for mail or wire service between priority access at premium rates and slower access at cheaper rates. Eventually, as with air mail and first-class mail, all long trips or all freeway trips might be charged at the premium rate. In the meantime, the transition from no charges to standard charges could be greatly eased by charging one lane at a time.

(4) Extend to all crowded freeways and central business district. If the pilot test works, charges can be extended to all or most of the initial test

freeway, then to other freeways. The larger and more permanent the market for priority access, the lower transactions costs would be. A large, settled market would justify a good off-freeway sales system and encourage many regular users to buy monthly, and perhaps yearly stickers, whose transactions costs are low, or books of daily stickers, redeemable at face value if not used, whose transactions costs might still be lower than separately purchasing a sticker for each trip. It might be that yearly sticker transaction costs would be too low, giving the user no incentive, once purchased, to conserve on peak-hour use. Experience with partially charged roads would indicate whether charges could be geared to smog control, as well as to congestion control. A stiff smog charge, on top of an optimal congestion charge, might divert traffic to the uncharged part and produce the same inefficiencies as those of the present diamond lanes, making both smog and congestion worse than congestion charges alone might do. Keeler and Small believe that high (4-28¢ per mile) optimal congestion charges alone would divert very little freeway traffic to surface arterials, owing to the much higher service characteristics of freeways (5/70). If they are right, and if vehicular smog is still as predominant as it is now, a smog charge might be tried successfully. Even without smog charges, congestion charges alone would probably cut out more smog, more efficiently, than other use disincentives.

(5) Offer an AVI option. Many regular road users, if they have to pay a congestion charge, would prefer a precise one to a rough one for the same reasons that they prefer itemized tax deductions to the standard deduction. Greater precision could save them money with lower charges for near-peak use, minor direction, shorter or more peripheral trips, separate charges for morning and afternoon peaks, and so on. Yearly stickers, if used at all, should be phased out at this stage, and monthly stickers perhaps made more expensive to encourage AVI as the method of choice for heavy, regular users. Eventually,

60-90% of users should use AVI and the rest daily or weekly stickers, approximating the ultimate user configuration.

(6) Extend to all crowded roads in target area and charge for smog. The last steps would be to expand the charged area to include all congested roads in the target area, as easy task with AVI, and, if still necessary by then, to add smog charges. The problem of a partially charged target area would no longer be present and diversion would not be to crowded but uncharged roads but to uncrowded roads or times, to group transit, walking, or other desirable alternatives. The net effect would be much fuller use of existing transportation resources, better information to guide transportation investment, faster access for users, less smog, less regressive allocation of transportation costs and benefits, and more effective incentive to combine trips, use mass transit, live closer to work, or drive in off-peak hours, in short, to do some of the things that everybody recommends but, under the present incentive structure, nobody does.

### III. Jitneys

Jitneys, as noted earlier, would fill an important service gap in the urban public transportation spectrum. They are faster than buses for short trips, cheaper than taxis, more flexible than carpools since they do not require advance scheduling for all passengers. They are well adapted to serve those who cannot use cars: witness their success in most American cities before World War I, in poor cities around the world today, and in poor sections of American cities today where illegal jitneys and gypsy cabs outdraw and outperform legal cabs and buses (1/180-82; 15/263);16). They are also found most frequently at peak-hour in the most heavily congested corridors, exactly where better public transportation is most needed. They would complement smog and congestion charges beautifully. Yet they are illegal in Los Angeles, as in most American cities.

In Los Angeles, the very marketplace weaknesses of existing bus and taxi monopolies which incapacitate them for attracting riders may also weaken their power, hitherto strong, to block an opening up of the transportation market. Los Angeles limits taxi competition and has less than a thousand taxis. This amounts to four cabs for every ten thousand residents, which carry one person trip in a thousand. By contrast, Washington, D.C. does not limit taxi competition and has 133 cabs per ten thousand residents (17/50). Los Angeles sells exclusive zone franchises and does not permit drivers franchised in one zone to pick up passengers in another. It bans group fares and owner-drivers, artificially limiting the supply of taxi service and making it needlessly expensive for both the operators and the public. Though they offer less, and more expensive service, taxi companies are no healthier in tightly regulated cities like Los Angeles and New York than they are in loosely regulated cities like Washington, nor are drivers' wages relative to the cost of living any higher (16/50-52; 1/106-112). On the contrary, fleet owners are perpetually on the verge of insolvency, owing to the burgeoning operations of gypsy cabs (1/106-109), and they have great difficulty in hiring and keeping drivers at the going wages. In Los Angeles, cab companies estimate that there are hundreds of gypsy cabs which "prey" on the high-demand airport, bus station, and hotel market and "grab" about \$5 million a year in gross revenues from the franchised operators (17). Efforts to put them out of business have not been very successful. In Washington, by contrast, the open cab market discourages gypsy cabs, encourages individual cab operations (which comprise two-thirds of the Washington fleet), and offers more service at lower prices. Though it is no doubt unlikely, despite the experience of other cities, that Los Angeles cab owners would ever voluntarily relinquish their franchise monopolies, their operations are so small that the city could probably buy them out for perhaps two or three million dollars and open up the taxi market on its own.



The bus monopolies of the Southern California Rapid Transit District and smaller municipal lines offer a more formidable problem. These have thousands of employees and the third largest bus fleet in the country; they carry hundreds of thousands of passengers a day. Since 1970 they have expanded the bus fleet by about a third and increased ridership substantially, with the help of \$100 million or so of annual subsidies, which is twice what they make in fares. They have ambitious plans for further subsidized expansion and ample political resources to lobby for it--and also to oppose any competition from jitneys, as they did the now-failed Yellow Cab and La France 'jitney' lines in 1974. Both jitney operators had to go through the full formalities of satisfying the Los Angeles Public Utilities Commission that their lines would serve public convenience and necessity, that they were adequately insured, and that they would earn a fair and reasonable return on capital and offer adequate service to the public. In La France's case, these showings required fourteen months of hearings, and each subsequent change in rates or service required a full notification of affected persons and a PUC hearing. Though SCRTD was unable to prevent the jitney competition, it was able to hold it up for months till SCRTD could lower its own fares to 25¢ and use its large, subsidized resources to insure the jitney's failure, running extra buses along the jitneys' routes and charging 50-75% less than the unsubsidized competition.

Some perspective on bus operations might cast light on what jitney competition might actually do to the bus companies. In Los Angeles the transition from moneymaking to moneylosing public transit has been very rapid and very recent. Most of the lines were at least breaking even in 1970. The rapid decline in six years to a two-thirds deficit has made the bus lines more dependent on political support than on customer support. This is administratively confining for the bus lines, owing to the many political masters they must consult before making a move. It allocates service wastefully and has raised questions as to how much more deficit can be tolerated. The subsidies have increased ridership

by about 200,000 per day, thousands more than BART carries, but still less than one percent of daily trips. \$100 million is the equivalent of \$40 a year for every household in Los Angeles County, \$200 a year for the poorest quintile of households.

Where taxpayers are picking up two-thirds of transit costs, they might want to consider options other than the current practice of subsidized transit monopolies. The polar opposite policy, as George Hilton, the nation's leading public transit authority, has recommended, would be to break up the monopolies, sell the buses to private operators, abolish subsidies to operators, and give any subsidy considered socially desirable to qualifying individuals. In Los Angeles County, that might mean \$200 a year in cash or travel vouchers to poor families. The daily commuter from such a family now pays 35¢ for a \$1.00 ride 240 times a year. With \$200 in travel vouchers a year, he would pay the equivalent of 17¢ a ride from his own pocket if the price held at a dollar, and, in the competitive market, the same ride would probably cost less than a dollar. In San Francisco, for example, the Mission Street jitneys charge 25¢ or 35¢ per ride, depending on distance travelled. At these rates subsidy expenses could be cut in half, ordinary commuters would pay no more than they do now, and poor commuters could ride free.

A less radical, and perhaps more practical step in the same direction would be to leave existing carriers intact but (1) permit free jitney or bus competition on all routes; (2) start a phased changeover from subsidies to carriers to subsidies to needy users; (3) during the changeover, divide subsidies to carriers among all carriers on a per-rider or matching fare basis; and (4) loosen or abolish restrictions on all carriers as to rates, routes, hours, and kinds of service. In the days of street railways, economies of scale in power generation justified the award of public transit monopolies. The public got more, cheaper, service from one big streetcar line than several little ones. This is not generally true of bus lines. If it were, the big lines would outcompete the

little ones and would not need a governmentally guaranteed monopoly.

Loosening or abolition of rates, routes, hours, and types of service would permit many innovations and efficiencies which are now discouraged or forbidden. Buses, jitneys, and carpools should pay their share of hidden costs no less than private transportation; so should freight carriers, and each should pass the costs on to users. Such costs, divided among many passengers, would be much lower per passenger trip for public transit than for private transportation. Bus lines could offer charter services, school services, parcel delivery services, all now forbidden; jitneys and taxis could offer special services to the handicapped. All carriers could pay closer attention to their own true costs and economize accordingly.

Every bus operator knows that per-passenger service costs vary according to the hours and routes served. Very thinly travelled routes and hours cost more than "ordinary" routes and hours where carrying capacity is comfortably filled. Average semi-fixed costs are divided among only a few users. Peak-hour service also costs more than off-hour service, because the carrier must buy extra buses and driver-days to meet peak demand but only gets 2-6 hours a day of revenue from them. The Sacramento Transit Authority estimated that peak-hour passengers on its system cost 51.9¢ to carry, and off-hour passengers only 20.9¢ (18/108). A flat fare means that off-hour riders subsidize peak-hour riders, 150% in Sacramento, just as off-hour drivers subsidize peak-hour drivers. In both cases, the hidden subsidy is wasteful and regressive, peak-hour commuters being richer than off-hour travellers. With public transit, off-hour price elasticity is generally much higher than peak-hour. Flat fares depress off-peak ridership more than they raise peak ridership, accentuating the peaks, with their attendant extra costs, but holding down off-peak use, and hence depressing total revenues (18/108).

It is not likely that the bus companies would admit it, but jitneys, which are more oriented to peak hours than buses, might cut their operating costs

substantially by skimming off high-marginal-cost peak demand. The bus lines could then afford to offer a smaller but more fully used fleet, manned by a smaller but more fully used work force, and still meet effective peak-hour demands at lower cost. Freedom to vary fares according to marginal cost, plus jitney competition, would alleviate the present problem of some routes and times being undercharged and underserved or oversubsidized, while others are overcharged and underserved.

Unlike the Mission Street jitneys or the defunct Yellow Cab and La France jitneys, whose rates, routes, and hours of service (but not schedules) were fixed by law, the classical jitney of the pre-World War I "jitney era" was driven by an amateur operator whenever and wherever he pleased. Many jitneys were operated by unemployed or partially employed drivers; others were driven by fully employed drivers who would post their destination and pick up passengers on their way to or from work. Without benefit of computer matching, the early jitneys were much more effective in getting people to share rides than carpools are today. This is not because there were fewer cars then; carpools were available then as now, but little used. It is because jitneys required no prearrangement, did not require all passengers to match destinations, routes, and hours in advance, but still got you where you wanted to go faster than a streetcar and for the same nickel fare. The streetcar companies initially predicted that jitneys would fail, since their average costs per seat mile were three times those of streetcars. Instead of failing, they flourished because, operating where demand was high and operator's or vehicle's extra time costs were low, jitneys could match low marginal cost with high marginal revenue.

What finished the jitneys in California, as elsewhere, was a concerted effort by street railways, taxi operators, and city officials wanting to keep the street railways in business, to regulate jitneys out of business. Laws were passed requiring jitney operators to have franchises, post accident indemnity

bonds, operate longer hours on fixed schedules, on longer, fixed routes--preferably outside of central business districts and far removed from streetcar lines--and to drive more slowly, with fewer passengers, with full safety stops at every intersection. In short, jitneys had to forfeit every competitive advantage they had over streetcars and taxis, and the jitney episode came to an abrupt end in 1915, never to rise again(2). The street railways, of course, expired anyway, not because they could not compete with jitneys, but because they could not compete with private cars.

A revival of jitneys today should probably aim at two classes of jitneys which were intermingled in the Jitney Era: professional jitneys, like the Mission Street jitneys or those in poorer countries, and amateur, carpool-for-hire jitneys of the type exemplified by Mrs. Garlene Zapitelli, who carries 8-10 coworkers for \$1.60 a day on a 77-mile commuting run from Fountain Valley to Redondo Beach. If eight of her ten passengers are diverted from cars, she spares the 5 million people downwind of her about ten tons of assorted pollutants a year, 80 pounds a day. If another 1,400 like her would carry nine passengers who would otherwise have driven the same route, there would be no need to build the \$600-million Norwalk-El Segundo Freeway. This would permit a saving of about \$240 for every household in Los Angeles County. Far from being praised for her public service, of course, Mrs. Zapitelli was hailed before the Public Utilities Commission to face a franchised carrier's demand that she stop her operation, compensate the carrier for lost business, and pay a \$500 fine for each separate offense. The carrier complained that her charge was much too low for a public carrier, while the PUC was concerned that it might be too high for a carpool. Mrs. Zapitelli fought the complaint, and carpool-for-hire operations like hers have since been dropped from PUC jurisdiction.

This, however, is far short of the public encouragement which would be needed to get many people to follow Mrs. Zapitelli's example. While she no longer faces the \$500 fine for illegal operation, she does face substantial,

unresolved questions of insurance coverage and cost. Picking up riders might make her slightly more likely to have an accident and surely more likely to be sued if she does; at the same time, of course, it would make it less likely that any of her passengers would get into an accident for which they could be sued. Insurance companies encourage carpooling with lower than ordinary rates. Would they want to give such encouragement to carpool for hire? Or would they ask the equivalent of taxi rates, which are three to eight times ordinary rates and prohibitively high for people like Mrs. Zapitelli? Since there is no market for intermediate, carpool-for-hire rates, and no experience with them, insurance companies do not offer insurance tailored to such customers.

Many of these problems could be laid to rest by laws defining qualifications and legal obligations for carpool-for-hire. Qualifications should include basic driver skills, a good record, and some combination of financial responsibility and/or limited liability, perhaps along the lines of workman's compensation system which insures the rider, like the hitchhiking incentives system used in Poland, should be explored. It is conceivable that such a rider-insurance subsidy, if extended to bus passengers also, might be federally funded, despite the prohibition on UMTA to spend any money which would cost any public transit employee his job. The net effect of a package of user charges and deregulation reforms would be to create more public transit jobs. Even without federal funds, user charges could fund mass transit insurance, and, even without user charges, the purchase of such insurance from general funds would probably buy more transportation for less money than existing subsidies to bus companies or hidden subsidies to private drivers. The insurance subsidy is really needed only for carpool-for-hire and might be phased out if commercial insurance could serve the same market cheaply enough. In the meantime, very easy entrance for ordinary drivers with good records into the carpool-for-hire market seems both possible and desirable.

The need for professional jitneys of the Manila variety could be met by

deregulated taxi drivers permitted to charge group fare and, like carpoolers-for-hire, and buslines, to choose their own routes, rates, and hours of service. Taxis are already insured for heavy service. Some operators would move to vans, minibuses, and buses, depending on demand and cost of service. Freedom to set charges would permit higher charges for peak-hour service (when even lightly regulated Washington, D.C. cabs cannot meet costs and disappear from the streets), and for night-owl and deadhead service, and lower charges for more profitable runs and groups.

The net effect of opening up the jitney market and charging road users what they cost would be a sharp increase in the attractiveness of offering, and using, group transportation in the peak hours, much greater efficiency in using the roads and vehicles we now have, and substantially lower overall transportation costs.

The main problems of opening up the jitney market are uncertainty and inertia. The uncertainty involves three questions. Wouldn't many transit lines and taxi companies fold if exposed to free competition? And wouldn't much of the free competition fold for inability to charge fares high enough to meet costs? And wouldn't this leave much of the public with no public transportation?

The answer to the first question might be yes if transit lines and taxis prove unable to match jitneys for price or service. On the other hand, transit companies probably could compete successfully with jitneys for long hauls, and they would profit from the availability of jitneys for feeder service, from their skimming of peak-hour trade, which is very costly for bus companies to provide, and from greater public willingness to use public transportation where more of it is provided. The SCRFD lost no passengers on its Wilshire runs during the life of the Yellow Cab Company's Wilshire jitney service. The extra service generated its own demand. Taxis would undoubtedly lose poor customers to jitneys; on the other hand, they can gain customers by charging group rates, and they will retain some customers who prefer the taxi's speed and privacy

and are rich enough to pay for it. Taxis and bus lines flourish side by side with jitneys in countries that permit them. There is no intrinsic reason why they could not survive here by providing services which jitneys cannot match.

The answer to the second question--wouldn't much of the new competition fold?--is probably yes, especially in the first few months of service, but that does not mean that the public would come out with less public transportation. Absent today's ponderous franchising requirements, entering or exiting the jitney market would not be a momentous public decision but a rather light one. It would be momentous if all jitney operators exited the market at once, just as it would be momentous if all wheat farmers exited the market at once, but such mass defections from a competitive market almost never happen, whereas they happen quite frequently in strike-prone monopoly markets. In Los Angeles' Jitney Era, jitney turnover was high, but all significant demand for jitney service appears to have been met, as it is in countries which permit jitneys today (1,2).

Hence, the answer to the third question--Wouldn't much of the public be left with no public transportation?--is probably no. Some isolated communities, Baldy Village, say, would have very little public transportation, but they have very little public transportation now, essentially nothing but ambulances and taxis from foothill communities. The reforms suggested here would not buy the isolated transit-dependent a bus route, but it might add a once-a-week jitney shopping run, plus sporadic carpool-for-hire, plus taxi fare for those who are both transit-dependent and poor, all net benefits for the most extreme cases of isolation. Less extreme cases might profit even more from a more open, vital transportation market.

The main problem with opening the jitney market, as with road user charges, is not uncertainty whether the reformed system would serve more people less wastefully than the existing one, but uncertainty whether a transition to a reformed system can be successfully accomplished under existing political



constraints. If the market were thrown open completely and abruptly, transition costs could be high, both from the unaccustomed stress of competition on existing carriers, and from unavoidable learning problems of new entrants in the public transportation market. On the other hand, if the market is opened up gradually, it may be opened, as with the Yellow Cab and La France jitneys, with such severe restrictions as to insure the failure of the new entrants.

Since the public transportation market is so small, however, the transition costs of opening it could be less than those of establishing road user charges. The SCRTD strike of 1974, which inactivated most of the public transportation in Los Angeles County, inconvenienced many people, but its overall impact was surprisingly small, or perhaps unsurprisingly small, considering that only 2-3% of person trips are by public transit. One could expect ample warning of a possible impending change from the normal agency studies and legislative hearings which precede such changes, and, once the market is legally opened, it seems unlikely that it would be flooded immediately with new competition. Potential competitors are just as interested in testing the water and minimizing learning errors as any public agency might be. A simple, two-phase approach might start with staff review of market reform alternatives:

- (1) phased elimination transit subsidies, or substitution of subsidies to needy individuals or to companies on a per-rider or matching-fare basis, in place of present subsidies geared to filling company deficits;
- (2) effects of immediate or phased deregulation and demonopolization of the bus and taxi markets;
- (3) alternatives for carpool-for-hire incentives, especially those addressed to the problem of driver liability.

The bus and taxi companies should be fully consulted for these studies, and asked, as they have not been asked to date, to offer their own estimates of the prospective costs and benefits of these alternatives.

The second stage, once the alternatives had been reviewed, would be to address the most accessible ones at once or in stages. It is entirely possible that all three elements--deregulating the taxi market, deregulating, demonopolizing and desubsidizing the bus market, and opening up the carpool-for-hire market--could be done together and soon. Inattention to these alternatives, like inattention to road user charges, has been costly; future inattention may be even more so.

#### REFERENCES

1. Ronald Kirby, et al., PARA-TRANSIT: NEGLECTED OPTIONS FOR URBAN MOBILITY, Urban Institute, Washington, D. C., 1974.
2. Ross D. Eckert & George W. Hilton, "The Jitneys," 15 J. LAW AND ECONOMICS 293 (1972).
3. William Vickrey, "Pricing in Urban and Suburban Transport," AMERICAN ECONOMIC REVIEW 452, (May 1963).
4. Randall Pozdena, ECONOMIC ROLE OF THE STATE IN TRANSPORTATION, California Transportation Plan Task Force Issue Paper 13, May 1976.
5. Theodore Keeler, Kenneth A. Small and Associates, THE FULL COSTS OF URBAN TRANSPORT, PART III: AUTOMOBILE COSTS AND FINAL INTERMODAL COST COMPARISONS, Institute of Urban & Regional Development, University of California, Berkeley July 1975.
6. Ward Elliott, GIVING THE PLAN A BOTTOM LINE: SUGGESTIONS FOR ADDING COST-BENEFIT COMPARISONS TO THE CALIFORNIA TRANSPORTATION PLAN, Rose Institute of State & Local Government, Claremont Men's College, May 1976.
7. Ward Elliott, HIDDEN COSTS, HIDDEN SUBSIDIES: THE CASE FOR ROAD USER CHARGES IN LOS ANGELES, Rose Institute working draft, Feb. 1975.
8. Kiran Bhatt, ROAD PRICING TECHNOLOGIES: A SURVEY, Urban Institute Paper 1212-11, Washington, D. C., August 1974.
9. Port Authority of New York and New Jersey, AUTOMATIC BUS IDENTIFICATION, Report No. DOT-FH-11-7778 TS-7930-ABI, June 1974.
10. Peter Watson & Edward P. Holland, "Congestion Pricing: The Example of Singapore," IBRD Mimeo, Oct. 22, 1975.
11. Office Memo from Peter Watson to Clell G. Harral, "Report on the Introduction of the Area License Scheme in Singapore," IBRD, July 16, 1975.
12. Ward Elliott, "The Case for Congestion Charges on the Golden Gate Bridge," Rose Institute, August 1975.

13. United States Environmental Protection Agency, TRANSPORTATION CONTROL STRATEGY FOR THE METROPOLITAN LOS ANGELES REGION, APTD-1372, TRW Corporation, December 1972.
14. Wayne J. Hoffman, ENVIRONMENTAL IMPACTS: AIR QUALITY, NATURAL ENVIRONMENT, NOISE, California Transportation Plan Task Force Issue Paper 11, May 1976.
15. "Paratransit," CONSUMER REPORTS, Apr. 1975.
16. Sandi Rosenbloom, "Taxis, Jitneys, and Poverty," TRANS-ACTION, February 1970.
17. LOS ANGELES TIMES, 18 April 1975, p. I-24, c.2.
18. George Hilton, FEDERAL TRANSIT SUBSIDIES: THE URBAN MASS TRANSIT ASSISTANCE PROGRAM, American Enterprise Institute, Washington, D. C. June 1974.