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Charles Lave

June 1991
Working Paper No. 33

The University of California
Transportation Center

University of California
Berkeley, CA 94720

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Things Won't Get a Lot Worse: The Future of U.S. Traffic Congestion

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Working Paper No. 33

June 1991

The University of California Transportation Center
University of California at Berkeley

ABSTRACT:

THINGS WON'T GET A LOT WORSE:

THE FUTURE OF U.S. TRAFFIC CONGESTION

Charles Lave

Economics Dept. / Univ. of Calif. / Irvine, CA 92717

Our current alarm about traffic congestion stems in large part from perception of trends: thirty years ago traffic flowed smoothly; today it crawls. If this trend continues, congestion will become gridlock. These perceptions lead to statements such as: "There is no point to building highways, new lanes fill up as soon as they are opened."

I present evidence to show that such trend-based thinking is wrong because it ignores structural shifts in the demographics of auto ownership and use. At this time, auto ownership is effectively saturated: we are very close to the point where all the potential drivers have auto access. The ratio of autos per driver can continue to grow, but since it is only possible to drive one vehicle at a time, the growth rate of auto-use must decline to about the rate of population growth -- a rate which is 2.9 times lower than the rate we have experienced in the period since 1960.

Thus, fatalistic prophesies about future gridlock have overstated the potential growth of demand for auto travel. That growth has already declined and it should level off to a rate which is only one-third as large as we are used to. This is a manageable rate, planning is possible. And, specifically, it is appropriate to think about building new roads to solve our deficiency of highway capacity.

THINGS WON'T GET A LOT WORSE:

THE FUTURE OF U.S. TRAFFIC CONGESTION

Charles Lave* -- February 1990

INTRODUCTION

Thirty years ago traffic flowed smoothly; today it crawls. In 1960 we had 74 million vehicles, today we have 180 million, and it is common to hear planners say: "There is no point to building highways, new roads fill up as soon as they are opened."

But sometimes we rely too much on experience. Generals prepare to fight the last war; urban planners prepare to fight the last trend. On the subject of traffic trends, our experience is especially misleading because it is based on generalizations from a highly atypical period of history. Like all simple trend projections, it runs the danger of ignoring structural change. In particular, the alarmist projections ignore the saturation of vehicle ownership: we are close to the point where all the driving-age population has access to vehicles. The ratio of vehicles per driver may continue to grow, but since it is only possible to drive one vehicle at a time, vehicle travel will grow at a much slower rate than it has in the past.

*Economics Department, University of California, Irvine, 92717. I wish to thank Christopher Fleet, Susan Liss, Jane Mauldin, Alan Pisarski, Martin Wachs, and Edward Wiener for help with data, unpublished reports and interpretations. They are, of course, totally innocent of what I did with their information. Susan Handy, Paul Shirey, and Irene Witt provided invaluable research assistance. The research was supported by the University of California Transportation Center under U.S. Department of Transportation grant DTO-G-009.

HOW WE GOT HERE -- YESTERDAY'S DEMOGRAPHICS

From 1960 to 1986, the vehicle population grew 2.9 times faster than the human population. There are good reasons why vehicles grew disproportionately faster than people:

Changing age structure: The sudden movement of the large baby-boom cohort from being too-young-to-drive into being licensable. Although the overall population grew slowly, the proportion eligible to drive grew quite rapidly. Thus drivers' licenses increased much faster than the population.

Changing sex structure of licensed drivers: A higher proportion of women now want the kind of independence that auto travel provides. Thus women's licenses increased much faster than the population.

Changing sex structure of commuters: The labor force participation rate of women has increased to unprecedented levels. Thus the number of rush-hour drivers increased much faster than the population.

Income growth: A higher proportion of potential drivers can now afford to own cars. Thus the ratio of cars per licensed driver has increased substantially.

That is, while analysts have been preoccupied with the consequences of population growth, many of them have missed the structural shifts in the demographics of car ownership and use. It is these structural shifts which caused the disproportionate growth in the vehicle population.

WHY IT WON'T GET WORSE -- TOMORROW'S DEMOGRAPHICS

We have undergone the transition to a new demographic structure. Vehicle ownership is essentially saturated. The period when vehicles grew three times faster than population is over.

The Transition in Age Structure is Over: The baby-boom ended in 1964; the youngest of them are now 26 years old; there is no more growth in the driving age population from that source.

The Transition in Sex Structure is Nearly Over: Traditional sexual patterns as to who-drives and who-works have changed, and that change is nearly completed. I discuss the change in licensing first.

Licensed Drivers: Figure 1, based on data in Greene, shows the pattern of licensing among women in 1969 (the lower line) and 1983. The 1969 data show a sharp decline in the proportion of women with drivers licenses after about age 40: these older women grew up in a time when it was not customary for women to drive. The 1983 pattern does not show this fall-off. It looks like the 1969 curve simply shifted to the right fourteen years as the population aged.

Figure 1 also shows some simple projections from aging the population. Each "*" in the upper right hand corner is the extension of the corresponding age cohort from fourteen years earlier. It is easy to see that the projected 1969 data, the *'s, are an excellent predictor of the 1983 observations. I also project the 1983 data seven years into the future using the "X" points. The 1990 age distribution ought to look like the envelope that goes up the 1983 line and then travels through the line of X's. The current data

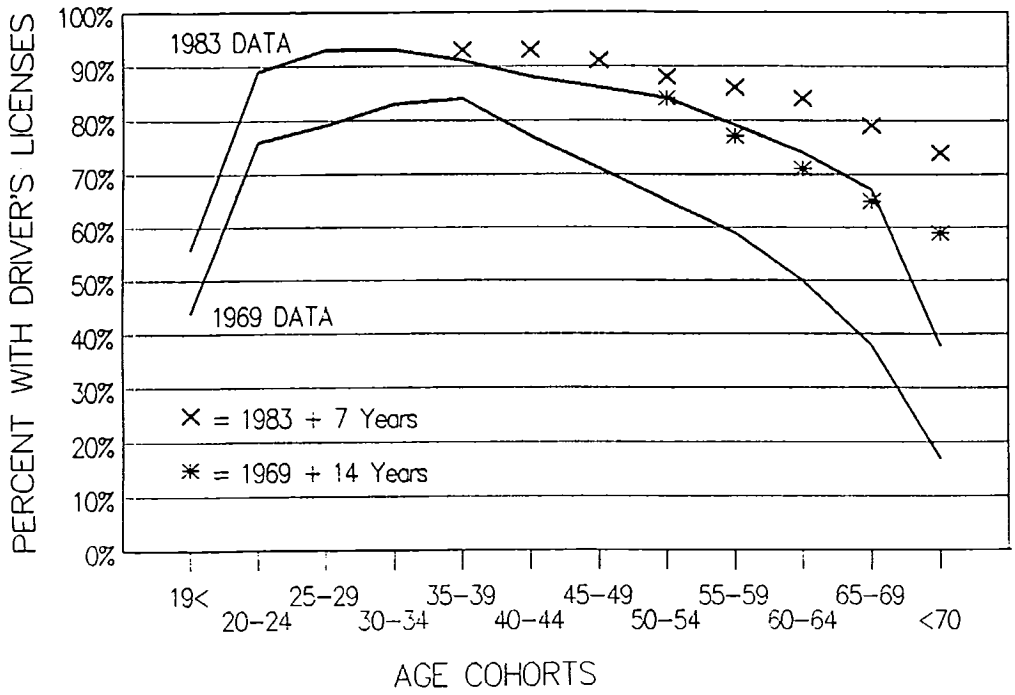


FIGURE 1

TRANSITION OF NON-DRIVING, OLDER WOMEN OUT OF THE POPULATION

would show an essentially flat profile. This demographic transition is almost completed.

Labor Force Participation: In 1988, 56.6% of women were in the labor force (Fullerton, p. 5). This would seem to allow scope for a significant increase in the number of working women. It isn't so. We should not expect that all women of working-age will ultimately choose to be in the labor force, since we know that all men of working-age do not choose to do so. What is the upper bound for women's labor force participation? It seems reasonable to assume that in the limit, women will behave like men. That is, I will

use male labor force as a baseline. Figure 2 shows the relevant ratio: number of working women divided by working men. Women's labor force participation is now 82% of men's. That is, it is getting very close to the male baseline.

It is also obvious that the change in women's labor force participation is slowing. Figure 3 shows the growth rate of the female/male worker ratio. There is a sharp decline: the female/male ratio grew by 25% during the decade of the '70s, but is only projected to grow by 5% during the decade of the '90s (Bureau of Labor Statistics, Fullerton, p. 4). Women's labor force participation seems to be about at its peak.

The Transition to Higher Income: The existing literature shows a strong relation between income and vehicle ownership. The rise in per capita incomes permitted the explosive growth of the U.S. vehicle population, and the same thing happened abroad. The large increase in personal income in Western Europe during the period 1965-82, was accompanied by a 122% increase in autos/person; a growth rate more than three times as great as in the U.S. (Pucher, p. 382). Europe's greater rate of auto growth is not evidence that their incomes were growing faster than ours. Rather it is evidence that our need for automobiles was getting close to the saturation point.

What is the Evidence for Saturation of Auto Demand? We now have about 1.1 vehicles per licensed-driver, but this is not a good measure of saturation. This ratio has always been high (e.g., it was .8 vehicles per licensed driver in 1950). Apparently people don't bother to get licensed until they have the vehicle access to go with it.

To measure vehicle saturation, we must look at the ratio of vehicles to potential drivers, that is, all persons of driving age. On this measure, the U.S. had .989 vehicles per driving-age person in 1986; essentially one vehicle per person capable of being

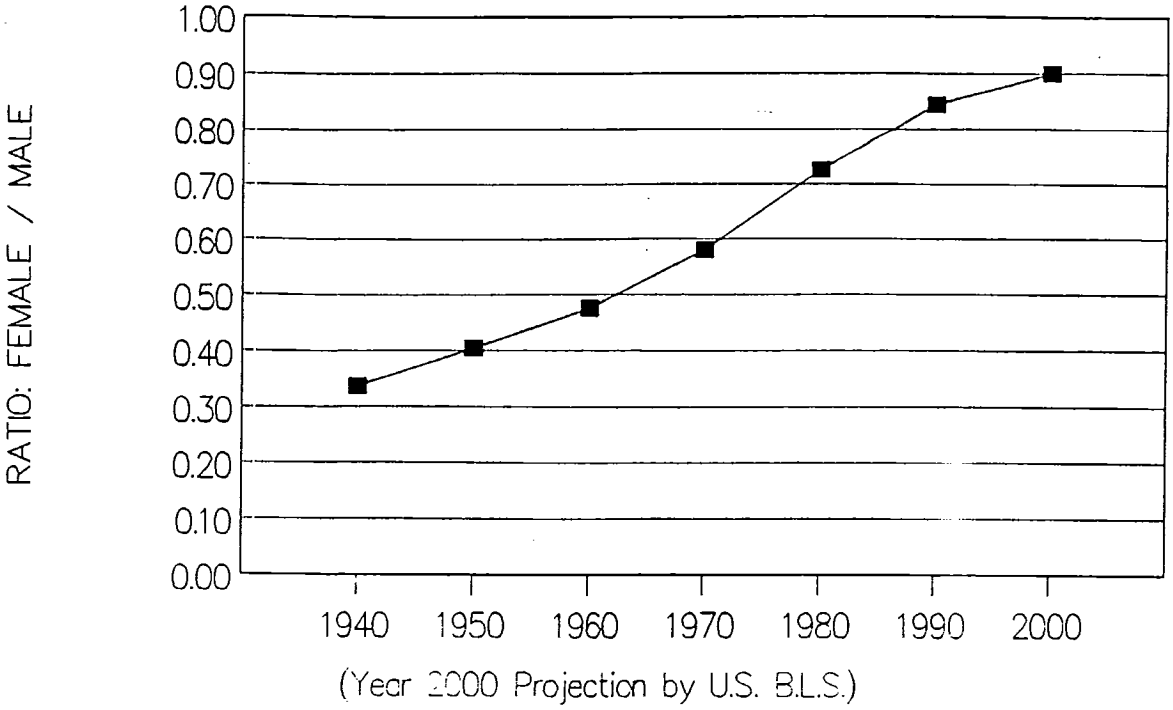


FIGURE 2

RATIO: FEMALE LABOR FORCE
DIVIDED BY THE MALE LABOR FORCE

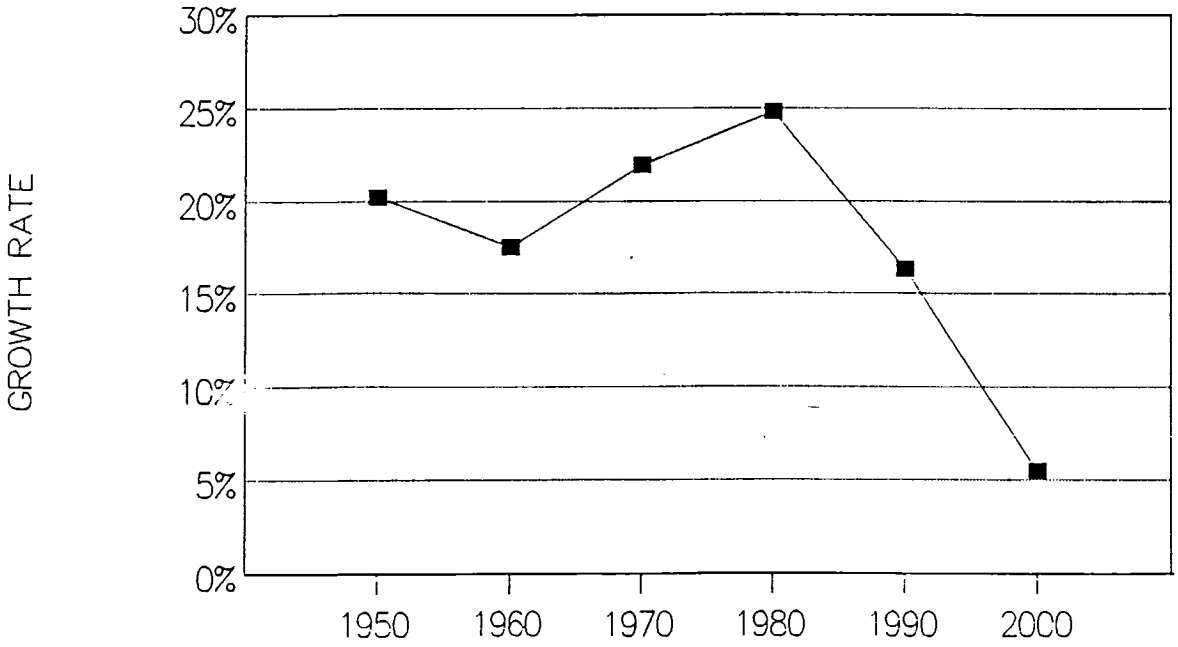


FIGURE 3

GROWTH RATE OF FEMALE/MALE
RATIO DURING THE PRIOR DECADE

licensed. Absent distribution effects, such a number seems a good indication of vehicle saturation. (I explore distribution effects later.)

I will begin by analyzing California as a sort of worst case example since it is commonly characterized as the most auto-dependent state. My postulated trends show up quite nicely there. I will then check these results for the sub-regions of the U.S.

First, we need some definitions. Driving-Age Population: I define driving age as 15-64 for several reasons: A) The common retirement age is 65, so this divides the population that contributes to peak congestion from the population that does not. B) Average yearly vehicle miles traveled (VMT) for people over 65 is only about half as much as for the 40-49 age group ("America's Challenge ...", p. 37). C) People in this cohort accounted for 91% of all VMT in 1983.

"Commute" Vehicles: My primary interest is congestion, and so I focus on vehicles that might be on the road at rush hour. Though this will include some commercial trucks, the primary contributors are personal-use vehicles. Twenty years ago, one might have defined "commute" vehicles as automobiles, but the market share of personal-use light trucks has increased enormously, and they are now a substantial proportion of the total vehicle fleet. What proportion of trucks should be counted toward commute vehicles? The 1982 TIUS (Truck Inventory and Use Survey), showed that 57% of truck users drove their trucks for personal use. So I define "commute" vehicles as the sum of Autos plus Vans plus 57% of Light Trucks. These commute vehicles amount to 90% of the entire vehicle fleet.

Figure 4 shows the disproportionate growth rate of vehicles per driving-age population in California. The decade of the 50's had a 30% growth in the ratio of vehicles

to people, followed by a 15% growth rate in the 60's, down to a 5% growth for the 80's. The period of rapid growth is over; vehicles and population are moving toward equal growth rates. The figure uses two separate definitions of driving age: 15-64 and 15-74; the two curves are essentially the same.

Figure 5 is a further illustration of vehicle saturation. It is easy to see that the growth of vehicles/person has begun to turn down and flatten out. Again, two definitions of driving age are used to show that the patterns are independent of the precise definition used.

Figure 4 shows that vehicle growth has slowed dramatically, and Figure 5 explains why: the ratio of vehicles to drivers is about saturated.

Analysis by U.S. Regions Is California typical of the United States? Figures 6-13 report data for the Western region, the Midwest, the South, and the North-East. All of them show essentially similar patterns of growth and saturation for vehicles per driving age population.

Figure 6 shows the decade growth rates for the West: Arizona, Colorado, Washington, and California. All of them show growth rates increasing rapidly until 1960 and then declining steeply to the present. Figure 7 shows the vehicle/person ratios, and all seem to be flattening out, though Washington is doing so at a slower rate.

Figures 8 and 9 show the patterns in the Mid-West: Illinois and Michigan. They also include a plot of the data for the total U.S. to show that the results do apply broadly. Again, the patterns resemble the California results.

Figures 10 and 11 show the patterns in the South: Florida, Georgia, and Texas. Georgia and Texas show the expected pattern. Vehicle growth in Florida has not yet

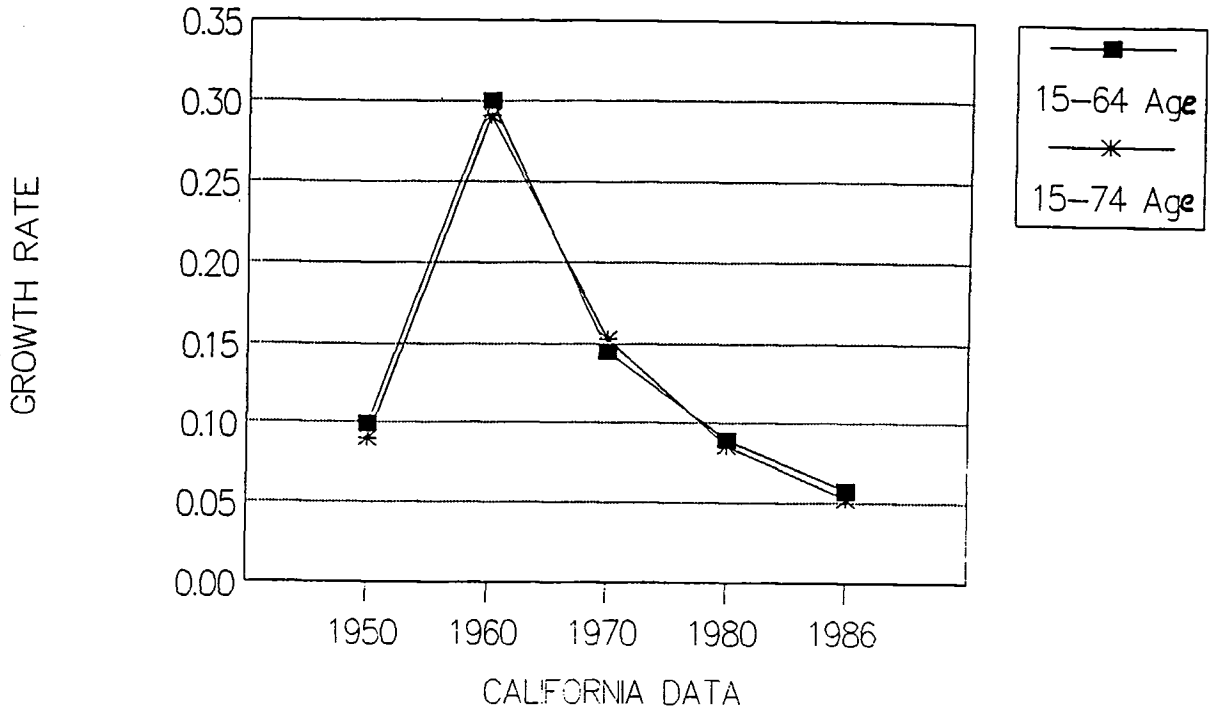


FIGURE 4

GROWTH RATES, BY DECADES, OF
"COMMUTE VEH."/DRIVING-AGE POPULATION

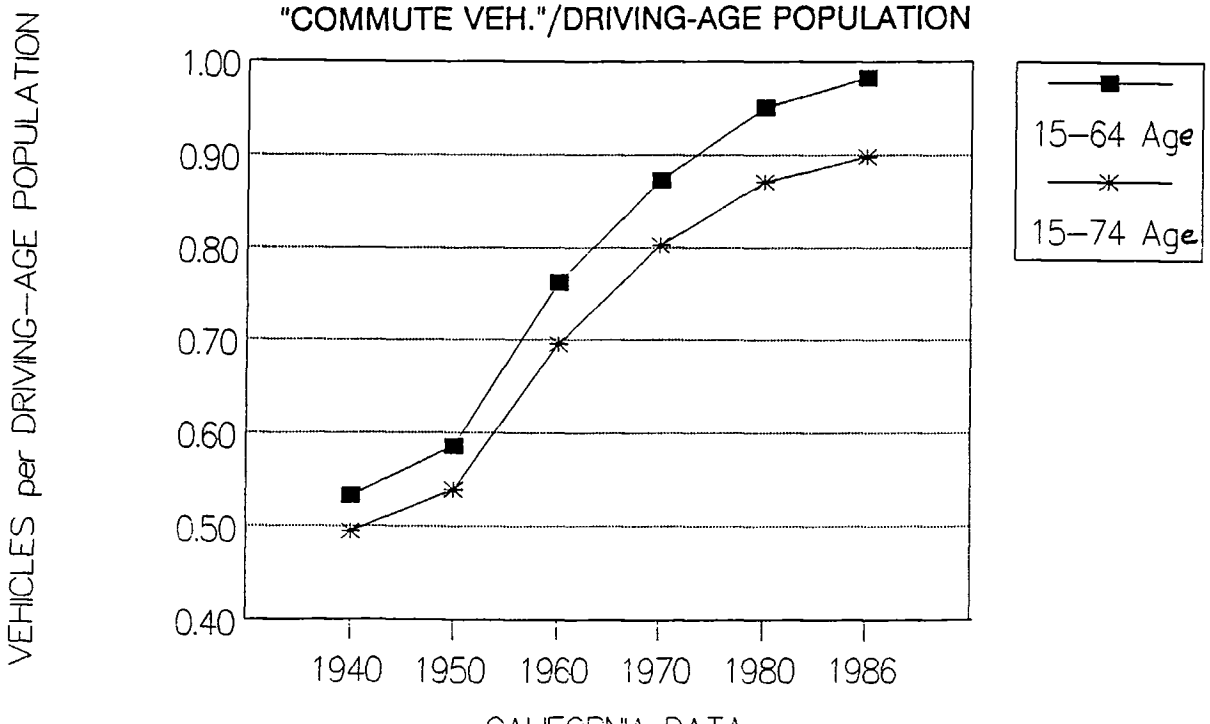


FIGURE 5

RATIO:
"COMMUTE VEH."/DRIVING-AGE POPULATION

FIGURE 6: Growth Rates, by Decades, of

"Commute Veh." / Driving-Age Population

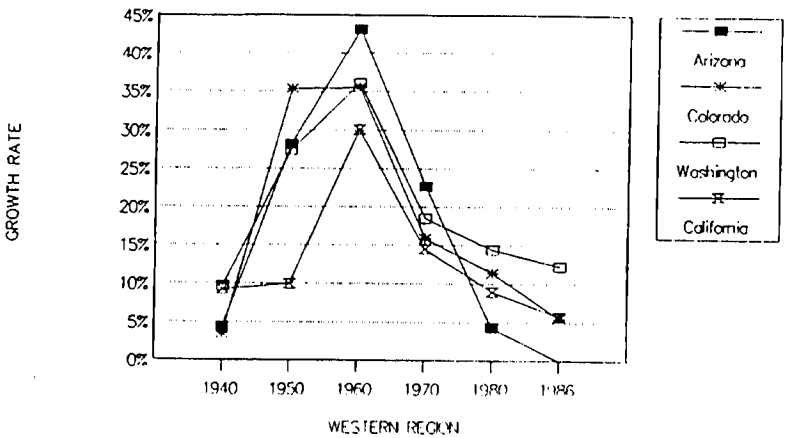


FIGURE 7: RATIO:

"Commute Veh." / Driving-Age Population

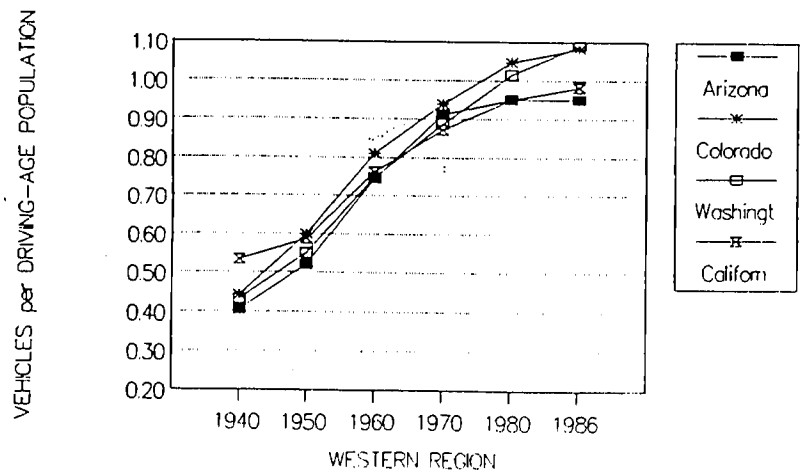


FIGURE 8: Growth Rates, by Decades, of

"Commute Veh." / Driving-Age Population

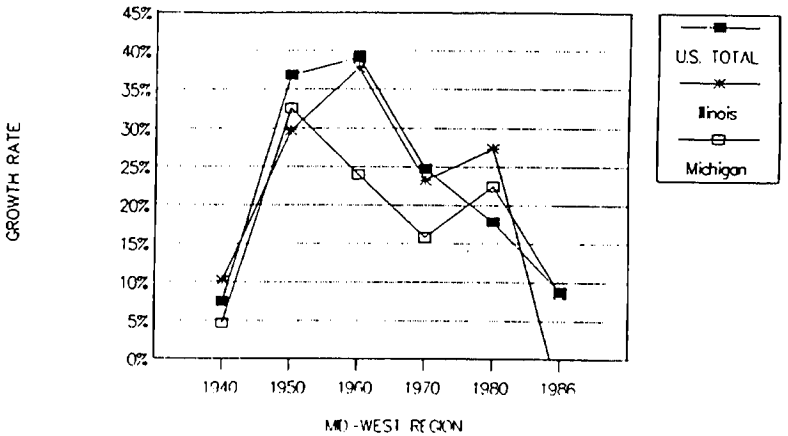


FIGURE 9: RATIO:

"Commute Veh." / Driving-Age Population

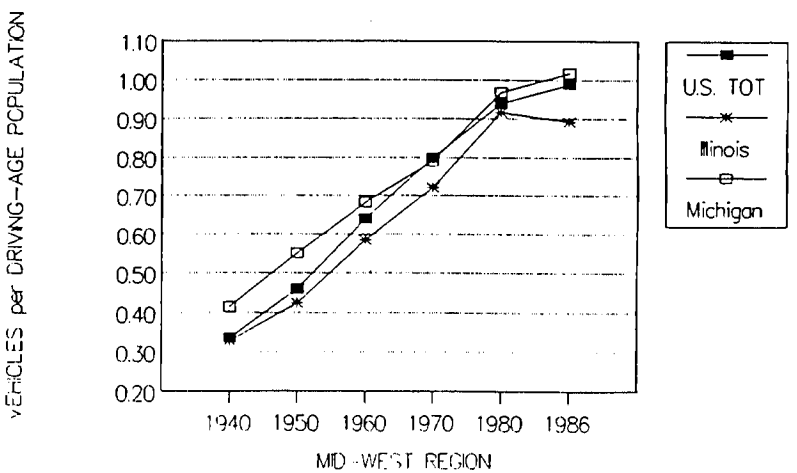


FIGURE 10: Growth Rates, by Decades, of

"Commute Veh." / Driving-Age Population

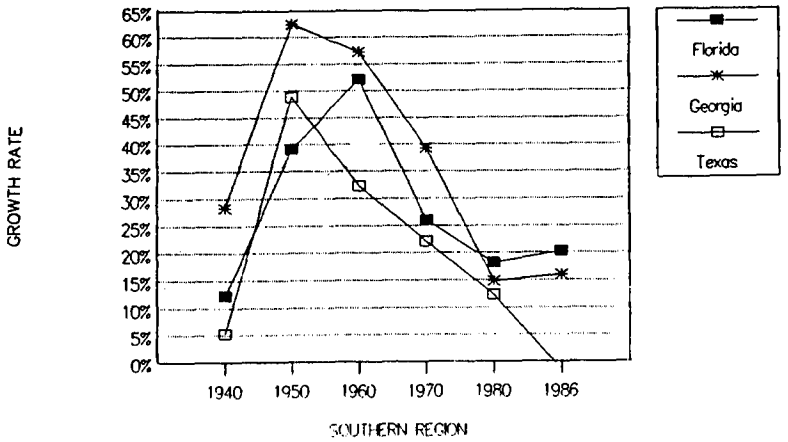


FIGURE 11: RATIO:

"Commute Veh." / Driving-Age Population

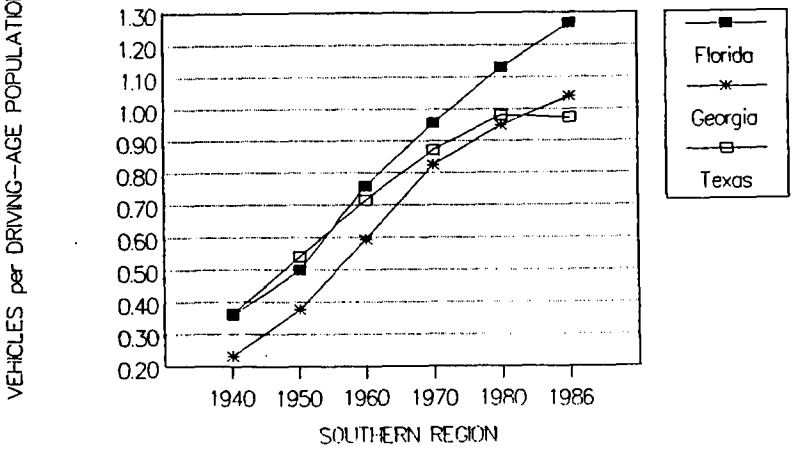


FIGURE 12: Growth Rates, by Decades, of

"Commute Veh." / Driving-Age Population

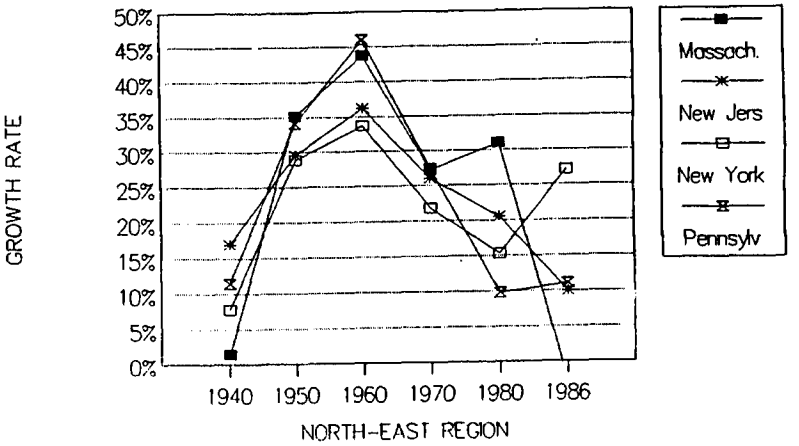
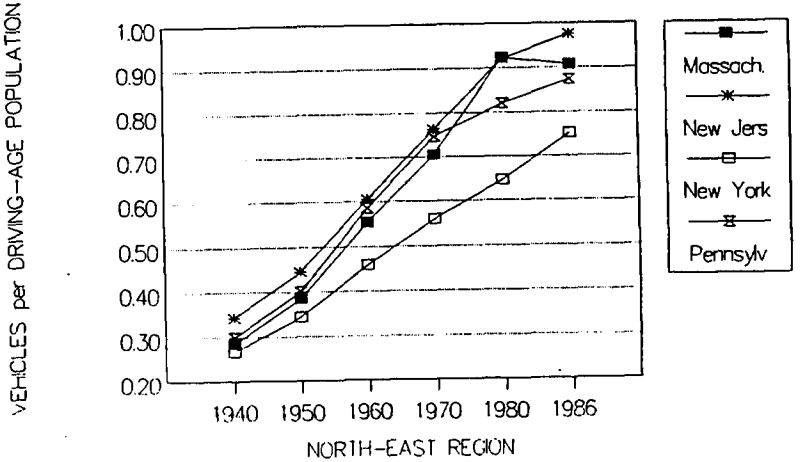


FIGURE 13: RATIO:

"Commute Veh." / Driving-Age Population



flattened, though it is much lower than it was during the '60s peak.

Figures 12 and 13 show the patterns in the North-East: Massachusetts, New Jersey, New York, and Pennsylvania. With the exception of New York, they do show the expected results. New York State shows a different pattern because of the overwhelming influence of New York City: its unusually high density produces a pattern of ownership which is unique in the United States.

Overall, the regional patterns confirm the California results. And the plot for U.S. total data lend further support. We have moved from an era where vehicles grew three times faster than the human population into an era where vehicle ownership is close to saturated; an era where the vehicle growth rate will slow down to the population growth rates.

WHAT MIGHT GO WRONG -- WHY THE IMPLICATIONS MAY BE INCORRECT

Alright, vehicle growth will be much slower in the future. So what? After all, it is travel that creates congestion, not the simple fact of vehicle ownership. What can we say about the likely growth of vehicle-use?

Historical Patterns: Throughout our data series, the growth of VMT has tracked the growth of vehicles. In general, these series went up together, and they came down together; though, of course, there are more yearly variations in vehicle use than there are in vehicle ownership.

Historically, average VMT per vehicle has been quite steady. The best data we have on this are from the Nationwide Personal Transportation Studies. They show annual miles

of usage per vehicle:

11,600 VMT/vehicle in 1969

10,678 VMT/vehicle in 1979

10,315 VMT/vehicle in 1983 (1983 NPTS)

If anything, these data indicate a slight decline in use per vehicle, rather than any possibility of an increase.

But what might uncouple this relationship? One possibility is that people might decide to drive more. This seems unlikely given the expected increase in congestion -- congested highways make driving less attractive. And a good deal of literature, from Tanner to Zahavi, has given credence to the notion of a limited daily time budget for travel.

Is there any change that might cause people to alter what has been a remarkably steady pattern of yearly vehicle usage? Perhaps women will drive more.

Increased Driving by Women: From 1969 to 1983, the average female driver has driven about half as many miles per year as the average male driver. Might this pattern change?

To answer that question, we must first ask: Why does yearly VMT differ between men and women now? One possible explanation relies on the effect of social custom: in general, when a man and women are in a vehicle together, the man is the driver. Since VMT accrues only to the driver of the vehicle, men will get credit for more VMT than women. Table 1 offers some support for this theory. It shows the average vehicle occupancy for different kinds of driving. Work trips, when a woman is likely to be driving alone, amount to only about a third of total VMT. The other two-thirds of travel, family

and social travel, have average occupancies of close to two persons per vehicle, and presumably are more likely to have both a man and women on board.

TABLE 1

AVERAGE OCCUPANCY BY TRIP PURPOSE
(PERSONS PER VEHICLE-MILE)

Trip Purpose	Average Occupancy	Percent of VMT
Earning a Living	1.3	34.3
Family/Personal Business	1.8	30.4
Civic/Educational/ and Religious	2.1	4.1
Social/Recreational	2.1	30.0
Other/Unknown	1.9	1.2
AVERAGE, ALL PURPOSES	1.7	100.0

Source: 1983 NPTS, Vol-I, p. 8-2.

Table 2 lends additional support. It shows the daily person-miles traveled (PMT) by men and women: you get credit for a person-mile whether you are driving or not. Notice that daily PMTs are almost equal for men and women. That is, it looks like most of the yearly VMT gap between men and women is nothing more than an accounting quirk. If social norms were to change, and women were to do more of the driving when a man is present, this would increase female VMT, but it would also decrease male VMT. There will be no overall increase in travel, only a reallocation of "blame" for the existing travel.

A Possible Cautionary Note: Although my conclusion of vehicle- saturation, and hence relatively slow VMT-growth seems well supported, there is one piece of contradictory evidence. Starting in 1983, VMT growth began to increase substantially.

This increase is so much at variance with past experience that we must ask whether it is a real change or just a statistical error. The VMT-growth data all come from the

TABLE 2
AVERAGE DAILY PERSON-MILES PER PERSON (PMT)

TRAVEL MODE	Age: 16-20 Men	Age: 16-20 Women	Age: 21-35 Men	Age: 21-35 Women	Age: 36-65 Men	Age: 36-65 Women	Age: 66 Men	Age: 66 Women
Privately Owned Vehicle	18.4	17.6	29.5	25.4	25.1	21.2	13.4	9.0
Public Transportation	1.2	1.4	.8	.9	.8	.5	.7	.4
Other Transportation	1.8	1.0	1.7	2.5	6.6	2.5	.5	.7
TOTAL PMT	22.9	21.4	32.8	29.5	33.6	25.1	14.8	10.2

Source: 1983 NPTS, "Survey Data," p. 51.

yearly VMT tables published by the Department of Transportation, and are based on state-supplied estimates. These estimates were not highly reliable in the past, though a substantial program to improve their accuracy was completed about five years ago, and they ought to be relatively accurate now. The most accurate VMT measurements come from the Nationwide Personal Transportation Surveys (NPTS). The next NPTS will be run this year. The new data ought to settle this issue, one way or the other.

Distribution Effects: Does a U.S. average of one vehicle per driving age person indicate vehicle saturation? Perhaps some families have many more vehicles than drivers, while other families have none. Such a hypothetical situation would leave plenty of scope for future vehicle growth. I cannot make a direct evaluation of this possibility with the

available published data. But I can show that the unequal distribution effect is not large.

Table 3 shows the distribution of vehicles per worker (not vehicles per driver). Of households that have 1 worker, 90% have 1 or more vehicles available. Of households that have 2 workers, 82% have 2 or more vehicles available. This falls to 70% for 3-worker households, but these are much less common. Clearly, almost all households have at least as many cars as workers. Alan Pisarski comments specifically about

TABLE 3

DISTRIBUTION OF VEHICLES PER HOUSEHOLD

90% of 1-worker HHs have 1 or more vehicles
82% of 2-worker HHs have 2 or more vehicles
70% of 3-worker HHs have 3 or more vehicles
52% of 4-worker HHs have 4 or more vehicles

Source: Pisarski, p. 48.

those households that have no vehicles:

> "...households without vehicles tend to be households without workers. Two-thirds of households without vehicles also have no workers in the household and another 28% have only one worker. Zero-vehicle households tend to be very small households located in larger central cities. In fact, the New York area alone has 20% of the nation's households having no vehicles." (Pisarski, pp. 6-7).

That is, we do not expect much additional vehicle growth because of vehicle-purchases from zero-vehicle households.

CONCLUSION

The fatalistic gloom and doom prophesies about future gridlock are wrong because they overstate the possible growth of demand for vehicle travel. That growth rate has already fallen and should level off to a rate which is only one-third as large as we are used to. This is a manageable rate, planning is possible. And, specifically, it is appropriate to think about building new roads to solve our deficiency of highway capacity.

My conclusions also have major implications for the auto industry. Domestic firms have been preoccupied with the threat from imported cars -- a threat that steals only a third of their market. But the real threat is the downturn in overall vehicle growth rates -- a downturn that will reduce the total market demand by a much greater amount. The danger is not the Japanese, but the impending saturation of the domestic market.

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