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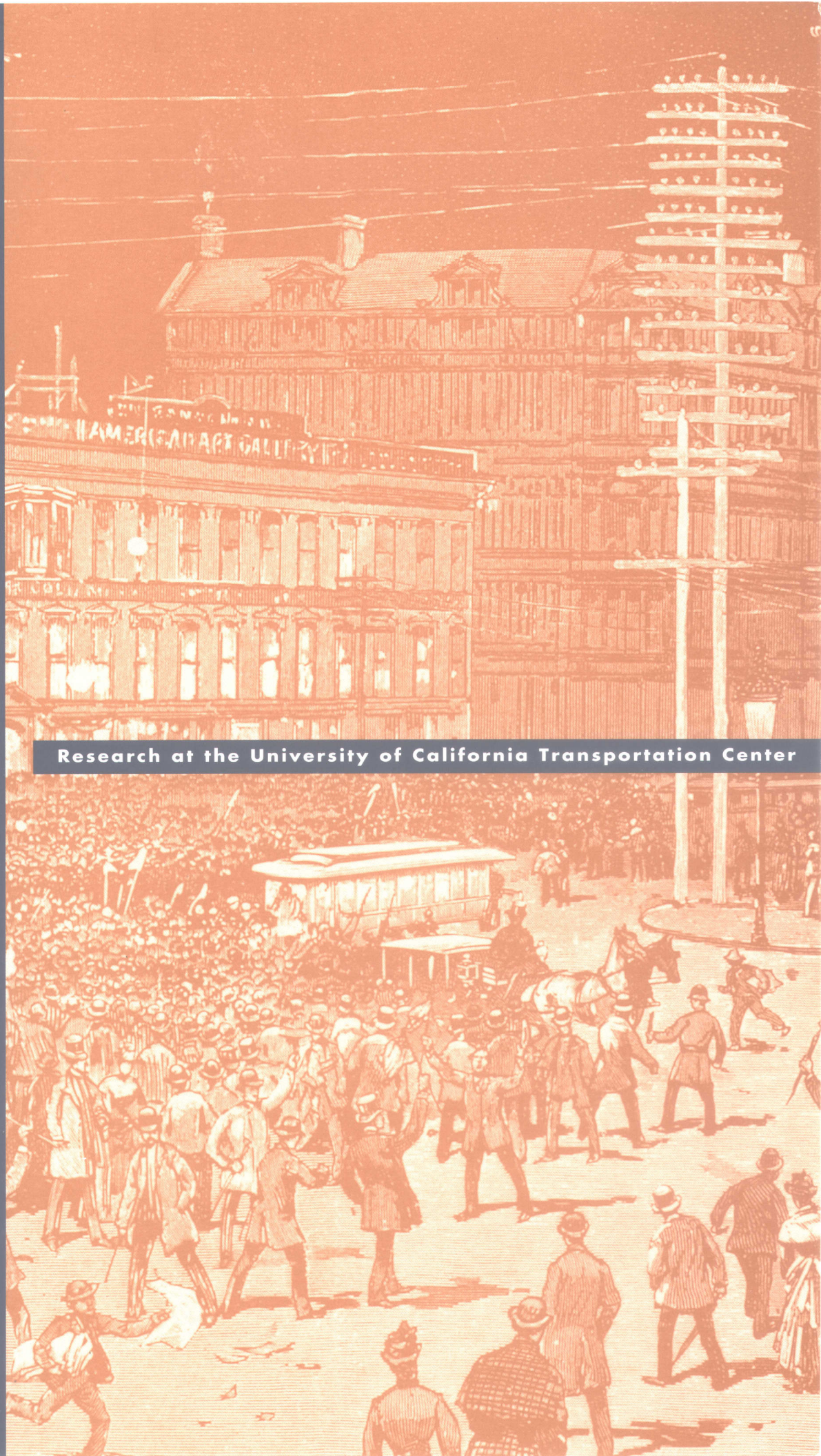

Research at the University of California Transportation Center

SPRING 1997
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CONTENTS

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The University of California Transportation Center, founded in 1988, facilitates research, education, and public service for the entire UC system. Activities have centered on the Berkeley, Davis, Irvine, Los Angeles, Riverside, and Santa Barbara campuses.

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Cover: Madison Square on Election night, 1888

Director's Comment

This is the tenth issue of ACCESS, and the University of California Transportation Center will soon reach its tenth anniversary. Such milestones call for celebration, congratulations, and contemplation of the future.

In the United States the private and public sectors collectively spend over a trillion dollars annually on passenger and freight transportation, exceeding 11 percent of gross domestic product. Yet, compared with other countries and other sectors of the domestic economy, we devote only a tiny proportion of those resources to research. The US Department of Transportation allocates less than 2 percent of its budget to research programs. Since 1980, support for transportation studies has declined steadily, and public transit research now accounts for only 1.1 percent of the Federal Transit Administration budget.

The states and private industry also conduct transportation research, but a recent report by the US General Accounting Office concluded that state and industry studies focus on solving specific operational problems rather than on new policies or long-term approaches to better transportation. The GAO report says that the current mix of transportation research gives far too little emphasis to long-term, high-risk policy studies that may over time fundamentally change the way we transport people and goods. And despite many statements urging intermodal approaches, the Transportation Research Board recently estimated that DOT devotes not more than five million dollars a year to research on intermodal transportation issues and policies.

For the past decade, UCTC has funded policy-oriented research at the University of California. It is a small but important part of our national transportation research program, committed to exploring new directions and to educating the next generation of transportation leaders. We deeply appreciate the sponsorship of the US Department of Transportation, the California Department of Transportation, and the University of California. UCTC has benefited greatly from the support provided by the Intermodal Surface Transportation Act (ISTEA). That law will expire next September, and we hope that those crafting the federal legislation to succeed ISTEA will continue to recognize the critical roles of education and research in the future of the transportation system.

Reference: *Surface Transportation: Research Funding, Federal Role, and Emerging Issues*, United States General Accounting Office Report GAO/RCED-96-233, September 1996.

In this edition of ACCESS, you will find pithy accounts of recent research sponsored by UCTC and carried out at several University of California campuses. There is also a listing of detailed reports that you may obtain if you wish to learn more about our completed studies. We are especially proud that several authors who have contributed to this issue were graduate students when they conducted their projects. There is no line between education and research, between teaching and learning. UCTC is a community of transportation scholars — faculty members and students — working together to address current issues of transportation policy from many perspectives and many fields of expertise. They share a common goal: to improve public policy in transportation and thereby to improve the quality of life.

This edition of ACCESS marks the completion of my first year as Director of UCTC. My transition to this position has been hectic but remarkably easy because of the help of generous and competent people. I thank Elaine Joost of the Research and Special Programs Administration of the US DOT and Pat Cass, who recently retired from the same organization. I deeply appreciate the support and advice of John West and Wesley Lum of Caltrans. They all have overseen our programs with wisdom and sensitivity.

I wish to acknowledge the irreplaceable role played by Briggs Nisbet, UCTC Administrator, who keeps the Center running on an even keel through her patience and judgment. Luci Yamamoto is the adept editor of ACCESS, and Beth Loudenberg, the creative graphic designer. Together they make this magazine both readable and attractive. Melvin M. Webber, the founding Director of UCTC, is the primary reason for the success of the Center and of ACCESS. He has engendered a community spirit and a sense of direction among all working at UCTC, and he continues to hold us to the highest of standards. He brings to our work the clear message that transportation research and education are about fundamental human values as well as technical achievements.

Martin Wachs

The High Cost of Free Parking

BY DONALD C. SHOUP

Ask anyone to define a livable city. Some will say clean air and safe streets. Others will mention good restaurants, affordable housing, pleasant parks, or less traffic congestion. But, chances are, they'll all agree on one thing — plenty of free parking.

Almost everywhere, people *expect* free parking. Urban planners have responded by requiring off-street parking for all new construction. According to the Planning Advisory Service, parking requirements are a major concern among city planners, generating more inquiries each year than any other topic. Parking requirements are a critical link between transportation and land use. To understand this link, I have tried to calculate the cost of minimum parking requirements. The findings suggest that minimum parking requirements seriously distort the markets for both transportation and land. The findings also suggest an alternative policy for improving parking, transportation, and land use.

HOW DO PLANNERS SET MINIMUM PARKING REQUIREMENTS?

Practicing planners use simple empirical methods when setting minimum parking requirements. They count the cars parked at existing land uses and identify "peak demand" as the minimum number of parking spaces "needed."

The only source of data that systematically relates parking demand to land use is *Parking Generation*, published by the Institute of Transportation Engineers. This report calculates the "parking generation rate" — the average peak parking demand observed in case studies — for sixty-four different categories of land use. ➢

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Although the case studies do not refer to the price of parking, most parking must be free, because the 1990 Nationwide Personal Transportation Survey found that parking is free for 99 percent of all automobile trips in the United States. Planning for parking is therefore planning without prices.

Parking generation rates are therefore based on observing peak demand for *free* parking. By using these parking generation rates to set minimum parking requirements, planners short-circuit the price system in both transportation and land markets, ultimately creating many unintended, but not unforeseeable, consequences.

HOW MUCH DOES A PARKING SPACE COST?

To introduce cost considerations into planning for parking, we can start by asking how much a parking space costs. There is no simple answer to this question, but for a parking structure, we can consider both the cost of building the structure and the number of parking spaces it adds. Note that parking structures add fewer new spaces than they contain because the land occupied by a structure could be used for surface parking if the structure were not built.

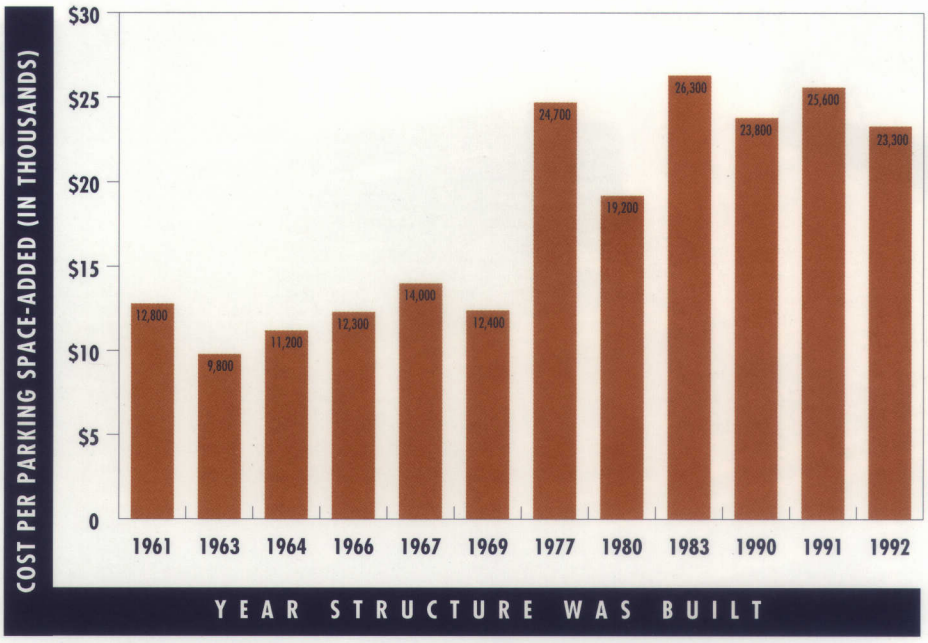
For example, consider a 750-space parking structure built on the UCLA campus in 1980. The structure was built on a surface lot that had provided 200 spaces. Although the structure contains 750 spaces, it added only 550 spaces to the parking supply. The construction cost was $10.5 million (in 1994 dollars). Therefore, each space added to the parking supply costs $19,000 ($10,500,000/550 spaces).

Calculating the construction cost per space-added by a parking structure implicitly accounts for land cost by assuming the structure's site could otherwise be used for surface parking. Using this method, I have estimated the cost of parking spaces added by twelve parking structures built on the UCLA campus between 1961 and 1991.

Figure 1 shows the cost (in 1994 dollars) per space-added by each parking structure, and it reveals a striking pattern. The average cost of structures built in the 1960s was $12,400 per space-added, while the average cost of structures built since 1977 was $23,600

FIGURE 1

Cost per Parking Space-Added for Parking Structures at UCLA (in 1994 dollars)



per space-added. After correcting for inflation, the spaces added since 1977 cost almost twice as much as the spaces added in the 1960s.

The newer structures tend to be more expensive for two reasons. First, five of the six structures built since 1977 are wholly or partially underground, and thus required expensive excavation, fireproofing, and ventilation equipment. Second, the newer structures are smaller. Post-1977 structures have an average of 43 percent fewer spaces, making each space more expensive because the costs for ramps, elevators, and stairwells are fixed.

The high value of land does not *directly* explain the high cost of parking spaces added since 1977. The high value of land *indirectly* explains the high cost of recent parking spaces, however, because in recent years the scarcity of vacant land has prompted underground or small structures, which require more expensive methods of construction.

PARKING REQUIREMENTS RAISE HOUSING COSTS AND REDUCE DENSITY

Suppose a developer must pay $23,600 per space to provide the parking required by a city. How would this affect the cost of real estate development, and should it affect the planning decision about how many parking spaces to require?

The only available research on the topic suggests that parking requirements raise housing costs, reduce urban density, and reduce land values. In 1961, the city of Oakland, California, began requiring one parking space per dwelling unit for apartment buildings. Figure 2 shows that after parking was required, the construction cost per dwelling unit rose by 18 percent, housing density fell by 30 percent, and land values fell by 33 percent.

Why did the parking requirement cause developers to build fewer but more expensive apartments? Because every additional apartment required an additional parking space, but larger apartments did not require more parking spaces than smaller ones.

Oakland's requirement provided more parking, but it also increased the cost of housing and reduced density. The cost of parking a car was incorporated into the cost of ➢

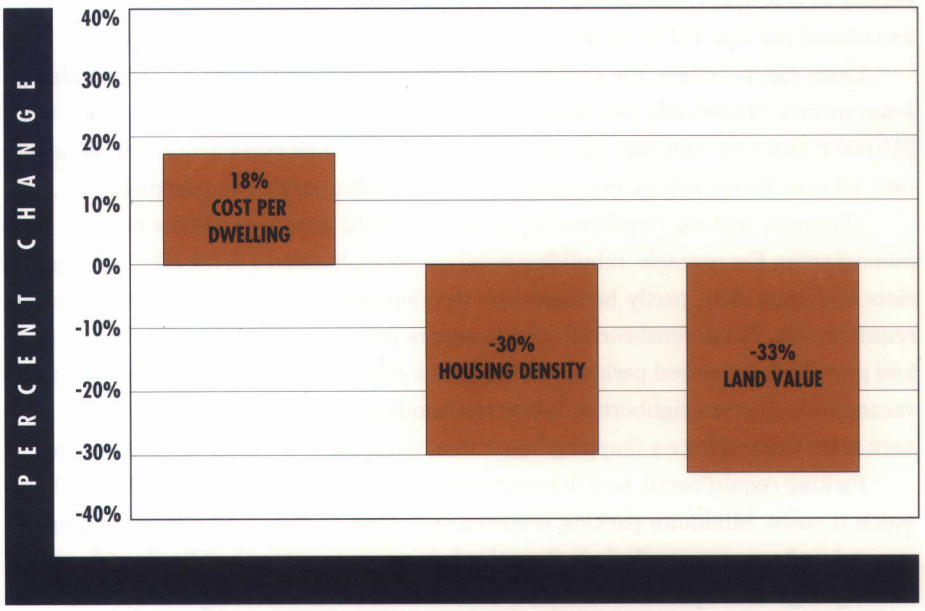


FIGURE 2

Effects of Requiring One Parking Space Per Dwelling Unit in Oakland, CA

renting an apartment, making cars more affordable and housing less affordable. Housing investment per acre fell by 18 percent after the parking requirement was imposed.

Cities rarely reduce the parking requirements for low-income housing, although lower-income households own fewer cars. On average, households with incomes below $10,000 a year own only one car, while households with incomes above $40,000 a year own 2.3 cars. Nevertheless, everyone pays for minimum parking requirements.

Minimum parking requirements create especially severe problems in older commercial areas. For example, rebuilding retail corridors destroyed in the 1992 Los Angeles riots has been slow, partly because new developments must meet the city's parking requirements. These retail corridors have narrow parcels, so it is difficult to build a store *and* provide the required parking on them. As a result, much commercial land remains vacant, and adjacent neighborhoods lack retail outlets, even grocery stores. In effect, planners seem to consider no shopping better than shopping without ample free parking.

Parking requirements now determine what can be built, what it looks like, and how much it costs. Minimum parking requirements have transformed many Los Angeles streets into "garagescapes" where the only obvious way to enter a building is with an electronic garage-door opener. California's traditional courtyard housing has become a his-

toric style that cannot be replicated with today's parking requirements. Form no longer follows function or fashion, or even finance. Instead, form follows parking requirements.

DEMAND FOR MINIMUM PARKING REQUIREMENTS

Minimum parking requirements act like a fertility drug for cars. Why do urban planners prescribe this drug? One explanation is that planners are not exercising professional judgment. They are simply responding to political pressure. People want cars, and they need to park them somewhere.

Minimum parking requirements are a remarkably popular land use regulation. In 1946, a survey of 76 cities found that only 17 percent had off-street parking requirements in their zoning ordinances. Five years later, 70 percent of these same cities had off-street parking requirements or were in the process of adopting them. Has any other land use regulation ever spread so quickly?

Planners require developers to increase the parking supply by as much as they increase parking demand. The problem lies in estimating parking demand. Planners simplify the problem by assuming that parking is free.

Because planners base minimum parking requirements on the peak demand for free parking, there is usually a surplus of parking spaces. That helps to explain why the 1990 Nationwide Personal Transportation survey found that motorists park free for 99 percent of all automobile trips in the United States. Minimum parking requirements provide for subsidies that inflate parking demand, and this inflated demand is then used to set the minimum parking requirements.

Minimum parking requirements have severed the link between the cost of providing parking and the price that people pay for it. The cost of providing parking has therefore ceased to influence most decisions about whether to own or use a car. Because people pay nothing for parking, they own and use cars as if parking costs nothing, thus contributing to traffic congestion. When citizens object to congestion, planners restrict new development to reduce traffic. That is, minimum parking requirements force new development to subsidize cars, and planners must limit the density of development (and of people) to limit traffic. In many places free parking has become the arbiter of urban form, and cars have replaced people and buildings as zoning's real density concern.

Because market prices can easily allocate parking spaces, urban planners have no analytic basis for requiring parking in any fixed proportion to land use. The hapless urban planner who must foretell the parking "needs" for every land use is cast as the Wizard of Oz. At the end of L. Frank Baum's story, Dorothy's little dog, Toto, knocks over the screen hiding the Wizard, who confesses, "I have fooled everyone so long that I thought I should never be found out. . . [but] how can I help being a humbug when all these people make me do things that everybody knows can't be done?"

AN ALTERNATIVE TO MINIMUM PARKING REQUIREMENTS

Urban planners require land developers to supply enough off-street spaces to satisfy the peak demand for free parking, so that new buildings will not cause parking shortages. But the developer's failure to supply ample off-street parking does not cause shortages. Rather, government's failure to charge market prices for scarce curb parking causes the shortages.

If the government set curb-parking prices high enough to assure that there are always vacant spaces (the way commercial operators price off-street parking), any increase in ➢

INVISIBLE PARKING METERS

Charging for curb parking does not imply a meter at every parking space. Many European and a few American cities have adopted inconspicuous ways to collect curb parking revenue, such as the in-vehicle parking meter ("electronic purse"), which operates like a debit card. New technologies can resolve the aesthetic or practical objections to charging for curb parking.

demand for the fixed supply of curb spaces would increase their price, and shortages would not occur. The government could eliminate minimum parking requirements, and receive the market value of spillover parking as public revenue.

To make this pricing solution politically viable, I have proposed creating "Parking Benefit Districts," which are like existing Residential Permit Parking (RPP) districts except that *nonresidents* would pay to park at the curb. Curb-parking revenue would be used to finance public services for residents in the neighborhood where it is collected. For example, curb-parking revenues can be used to repair sidewalks, plant street trees, or to put the overhead utility wires underground. Even at modest prices for nonresidents' parking, curb-parking revenue could easily exceed the existing property tax revenue in many neighborhoods.

At the simplest level, cities might try Parking Benefit Districts by selling to nonresidents a few daytime permits to park in existing RPP districts. Neighborhoods near commercial developments often establish RPP districts so commuters' cars won't congest their curb parking. An RPP district is a minor but real inconvenience for the residents, who must buy permits for their own cars, and deal with restrictions for their guests' cars. RPP districts create a high vacancy rate for curb parking in residential neighborhoods, while nearby commercial developers must build expensive parking structures for commuters. In this situation, a city might sell two or three daytime RPP permits per residential block to commuters, and use the resulting revenue to eliminate charges for the residents' own permits.

Selling daytime RPP permits to nonresidents can generate substantial revenue. For example, Los Angeles charges residents $15 a year per car for permits in RPP districts. One nonresident permit at a price of $100 a month ($1,200 a year) will replace the residents' payments for eighty cars. One nonresident permit will more than replace the median property tax on a single-family house ($922 a year) in the United States.

Parking Benefit Districts can create a symbiotic relationship between parking generators and their nearby neighborhoods, because spillover parkers will be paying guests. Market prices allocate cars and gasoline, and market prices can allocate parking spaces just as easily. Because parking prices can be set to yield any desired vacancy rate for curb spaces, pricing can eliminate parking shortages.

Eliminating parking requirements will encourage adaptive reuse of older buildings that lack parking, and encourage infill development on sites where providing off-street parking is difficult. Emancipated from minimum parking requirements, land and capital will shift from parking to land uses that employ more workers and pay more taxes. The option to build without providing parking will encourage land uses that rely on pedestrian and transit access, and that offer shopping opportunities to nearby neighborhoods. Finally, residents who (collectively) own and profit from their curb parking will welcome nearby development that has little off-street parking, because it will increase the demand for the curb parking they sell to nonresidents.

The full benefits of eliminating parking requirements will not occur overnight. The long-range benefits will occur only after the supply and demand for parking have adjusted to user-paid prices that cover the full cost of providing parking spaces. But significant benefits can occur quickly if eliminating parking requirements encourages infill development on small sites that are now vacant or are used only as surface parking lots.

CONCLUSION

Minimum parking requirements raise the cost of development and provide large subsidies to cars. They are a hidden tax on development to subsidize parking. If planners want to encourage housing development and reduce traffic congestion, why tax housing to subsidize parking?

Eliminating minimum parking requirements does not imply ceasing to plan for parking. Rather than regulating the number of spaces, urban planners can focus on better regulating the many other dimensions of parking — curb cuts, landscaping, layout, location, pedestrian access, provisions for the handicapped, setback, signage, stormwater runoff, and visual impact. Planners can focus on the quality of parking, not the quantity. Properly pricing curb parking and eliminating minimum parking requirements will improve transportation, land use, and urban life. ◆

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Dividing The Federal Pie

BY LEWISON LEE LEM

This year Congress will draft legislation to authorize more than $120 billion in federal spending for highways, transit, and other surface transportation programs for the next six years. A critical issue is how to divide among the fifty states the Federal Highway Trust Fund revenues, which come from federal gasoline taxes and other transportation-related taxes. For the past forty years, apportioning trust fund revenues has been analogous to dividing a transportation pie among the states. With the Interstate highway program completed, Congress must now determine how much each state should receive from the trust fund, compared to what it pays in.

Dividing the Federal Transportation Pie

The popular image has Congress distributing funds on purely political bases. Amusing stories of "pork-barrel" projects suggest that powerful committee members direct public-works funds to their own districts. Yet, while the number of specifically earmarked federal transportation projects has risen over the past twenty years, these projects are not as significant as popular accounts may suggest. Earmarked funding included in the 1991 surface transportation legislation amounted to $6.2 billion, only 5 percent of total authorized spending.

Congress has historically apportioned most transportation funds among the states not by earmarking but through distribution formulas. These formulas, negotiated during the legislative process, have historically assigned funds to the states based on measurable factors such as land area, population, mileage of federal-aid highways, vehicle miles-of-travel, and cost estimates of highway construction. The funding formulas have determined the size of each state's portion of the transportation pie.

Earmarked projects are like the whipped cream on the top of the pie — they attract much attention (and may taste particularly sweet to some), but they are insignificant when compared to the size of the whole pie. Some states' portions may include much whipped cream covering a relatively narrow slice of pie. Other states may get little or no whipped cream, but receive the largest servings of pie.

From 1956 to 1987, the most active period of Interstate construction, federal transportation apportionment formulas did not consider the geographic sources of tax revenues. The states with the highest proportion of the nation's motor-fuel consumption contributed most to the highway trust fund, but they did not necessarily have the greatest share of either land area or highway mileage. As a result, the share of taxes from each state has differed from the share of funds apportioned to each.

As long as all fifty states and most congressional districts gained new highway construction financing through the Interstate program, legislators focused on the benefits rather than the costs of the federal transportation pie. As the Interstate system neared completion, however, benefits of current funding became less apparent, and legislative concern over tax costs increased. It was as if all states were happy as long as each had some pie to eat. But, once some states had consumed their portions, they reconsidered how much they had to pay out to get their share the next time around.

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Paying the Transportation Bill

When an early version of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) reached the Senate floor in the summer of 1991, disagreements over how best to divide the transportation funding pie threatened to block the bill's approval. Some strong critics of the funding distribution were senators from "donor" states — those that had historically contributed more to the Federal Highway Trust Fund than they had received in federal apportionments.

Figure 1 shows that Federal Highway Trust Fund apportionments resulted in thirty "donor" states and twenty "recipient" states in fiscal year 1991. Since donor state senators held a majority of votes, they could block ISTEA's passage if their criticisms were not answered. The final legislation included an "equity adjustment" that guaranteed each state a minimum annual funding authorization equal to 90 percent of its trust fund contributions. The 90 percent "minimum return" guarantee helped break the 1991 legislative logjam.

Today, donor-state representatives continue to be concerned over the proportion of their trust fund contributions returned as funding authorizations. One group of states known as the "STEP 21" coalition has proposed increasing the guaranteed minimum return to 95 percent. By insuring that states receive almost all trust fund contributions back, the donor states focus attention on payments into the transportation pie. As the minimum return nears 100 percent, a state would need to provide more taxes to the Trust Fund if it is to substantially increase its portion of the federal transportation pie. An extremely high minimum return means each state would receive in apportionments an amount nearly equal to its contribution. Such a financing system would replace the single, unified federal trust fund with fifty federally administered state trust funds. ➢

FIGURE 1

Donor and Recipient States, Fiscal Year 1991

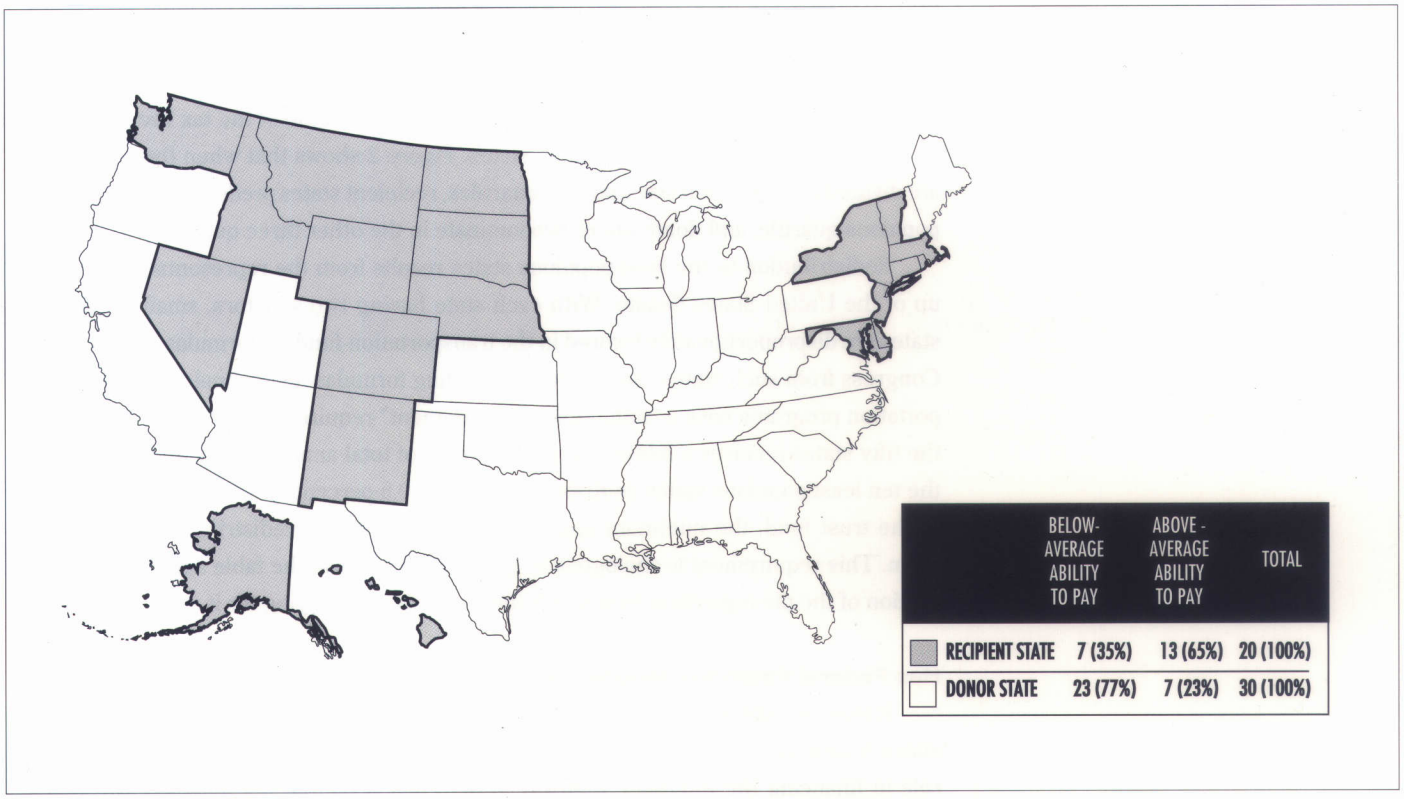
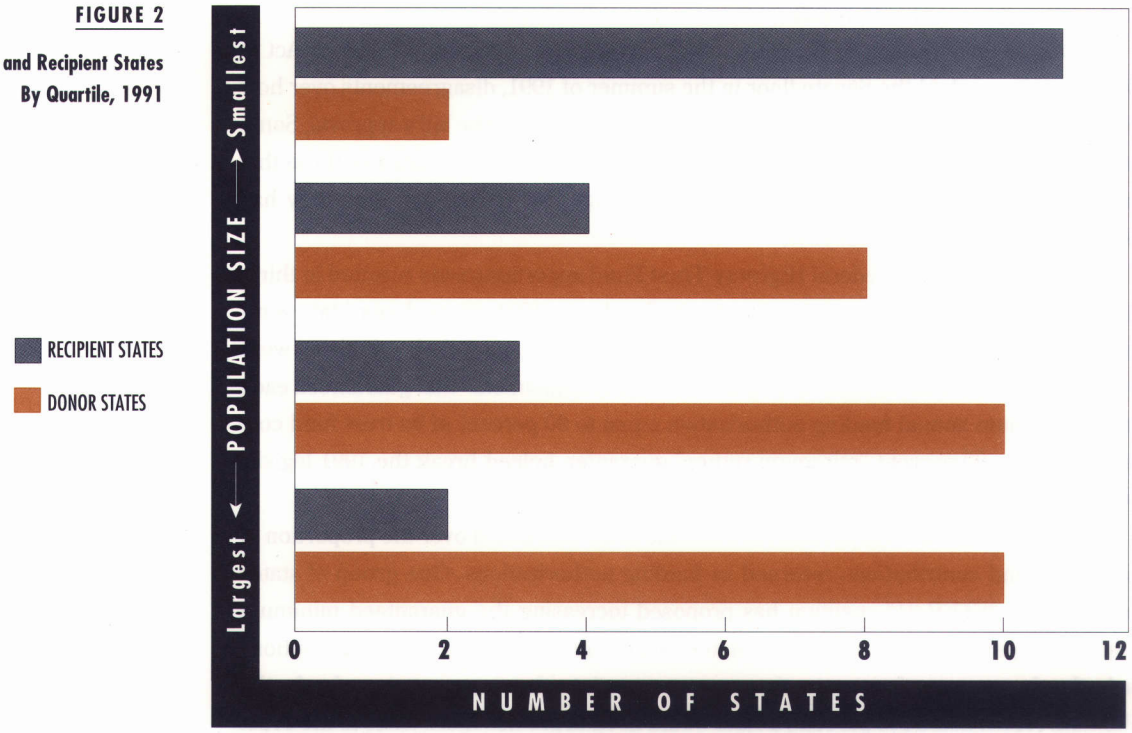


FIGURE 2

Donor and Recipient States By Quartile, 1991



Redistribution to the Least-Populous States

Why would such a system of separate state accounts be preferable to the earlier model of sharing a single federal account? My analysis of geographic redistribution compares state contributions to apportionments and shows which states subsidized others prior to ISTEA. For fiscal year 1991 — the year before ISTEA's 90 percent minimum return went into effect — approximately one in seven dollars (14 percent) of Federal Highway Trust Fund apportionment was geographically redistributed. Redistribution resulted when a small group of the least-populous states received some of the tax revenues paid by a large group of the more-populous states. Figure 2 shows that when the fifty states are divided by population size into four quartiles, recipient states predominate in the least populous quartile, and donor states predominate in the other three quartiles.

Redistribution to the least-populous states results from the representational make-up of the United States Senate. With each state having two senators, small-population states are disproportionately favored in the transportation-funding formulas. Members of Congress from such states can insure that funding formulas for the major federal transportation programs have a "minimum apportionment" requirement, usually that each of the fifty states receives a minimum of 0.5 percent of total annual apportionments. Since the ten least-populous states contributed less than 0.5 percent of the 1991 tax payments to the trust fund, the minimum apportionment requirement redistributes revenues to them. This requirement is analogous to giving all persons at the table a minimum-sized portion of the pie regardless how much they contribute to paying for it.

Has Federal Financing Helped the States Least Able to Pay?

It may be appropriate for the more-populous states to subsidize the least-populous states if funding is used for justifiable national purposes. One justification for the federal role in financing the Interstate highway system has been that the least-wealthy states

would be unable (rather than unwilling) to pay for their Interstate segments without the federal government's assistance. This justification is analogous to having the diners best-able to pay for their own portion of pie help pay for those who can least afford to do so. This may seem reasonable; but, in 1991 federal financing did not help the states least-able to pay.

My analysis of fiscal equalization reveals which states could best afford to pay for a portion of the pie and whether the system of geographic redistribution gives most assistance to those least able to pay. Economists commonly measure a state's ability to raise tax revenues using the Representative Tax System (RTS) fiscal capacity. The RTS measure of revenue-raising ability uses a national average of 100, so states with RTS capacity greater than 100 have above average ability to pay and those with RTS capacity less than 100 have below-average ability to pay.

Figure 3 compares the states' RTS fiscal capacity with the net redistribution of highway trust fund revenues per capita in fiscal year 1991. Two lines divide the figure into four quadrants, the vertical line indicating average (100) fiscal capacity and the horizontal line showing zero net redistribution of funding per capita. The table in Figure 1 summarizes the data shown in Figure 3, and shows that twenty of the fifty states were recipient states and thirty were donor states. Sixty-five percent of the recipient states have higher than average capacity; 77 percent of donor states have lower than average capacity. This means that the states that are most able to pay their own way are more often net recipients of redistribution than net donors. Meanwhile, the states least able to pay for their own shares of the pie are more often donors than recipients. This surprising outcome is analogous to a situation where the diners with below-average income subsidize the pie of the diners with above-average income, because the group has agreed to give everyone some minimum-sized portion of the pie. The generous diners may not recognize that the recipients of their subsidy may have already eaten dessert before the pie was served. ➢

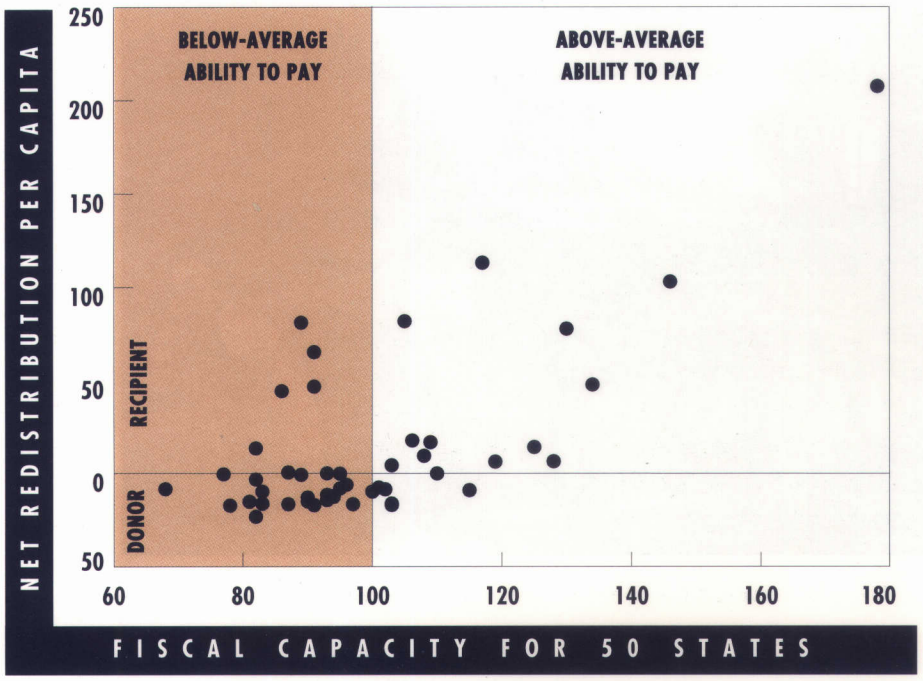


FIGURE 3

Redistribution and Fiscal Capacity in 1991

Conclusion

Proposals to give states a higher "minimum return" — up to 100 percent of their contributions — may appear self-serving, since they reduce the amount of funding available to help states with less fiscal capacity. Moreover they appear to ignore the general benefits that may result from providing transportation-related public goods, such as an increased contribution to national defense. Yet high minimum return can produce more efficient and more equitable results because states would have to raise their own revenues for transportation projects within their borders rather than use subsidies from other states.

During the year Congress passed ISTEA, many recipients of redistribution were states that could better afford to pay for their highways than could nonrecipients. Proposals to increase the level of minimum return above 90 percent are consistent with recognizing that federal financing is not helping those states that most need assistance. Such proposals also recognize that incremental general benefits provided by continued federal involvement have declined substantially from the years when construction of the Interstate highway system began.

Today the fifty states seem to want the federal government to continue taxing gasoline and other transportation-related products. As a result, the states will probably continue sharing a federally administered trust fund pie. However, they're less willing to subsidize each other's portions of the nation's transportation system. The logical solution is to have each state receive a portion of the pie that accurately reflects the amount of its tax bill. ◆

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Can Welfare Recipients Afford to Work Far from Home?

BY EVELYN BLUMENBERG AND PAUL ONG

In 1995, 13.6 million people nationwide received welfare benefits totalling $22 billion. Critics have considered this sum unnecessary and the welfare program inefficient. With the passage of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, welfare reformers established time limits for receiving benefits, hoping to speed the transition from public assistance to employment.

But for welfare reform policies to succeed, welfare recipients must be able to find jobs. Given their financial, educational, and geographic limitations, that is often not easy. Many poor people find it difficult simply getting from home to work. In part that's because they may live in "job-poor" neighborhoods far from places with jobs they're qualified to fill, including jobs at restaurants and stores, at temporary agencies, and as classroom and cafeteria aides in schools.

Our research examines how commute distance affects the employment prospects for low-wage workers. We asked whether welfare recipients can afford to keep jobs that are relatively distant from their homes, given the time and monetary costs of commuting. Then we asked whether increased numbers of neighborhood jobs would improve the likelihood that welfare recipients work close to home.

EARNINGS AND COMMUTE DISTANCE

By combining data for Los Angeles on the geographic locations of welfare recipients and their places of employment with demographic data from the 1990 U.S. Census, we find welfare recipients with long commutes earning less than those who find work near home. In addition, we find improved access to local jobs increases the likelihood that recipients will find employment there.

Our findings differ greatly from the usual research results comparing earnings and commute distance. In most cases, high-wage workers are more likely than low-wage workers to live far from their work sites. Many high-wage workers prefer suburban homes, where large homes are available at tolerable cost, where there is less crime and better schooling, but where commutes are long. Also, jobs for skilled workers are few and dispersed around the metropolitan area, increasing the likelihood that skilled workers have long commutes and high incomes. ➢

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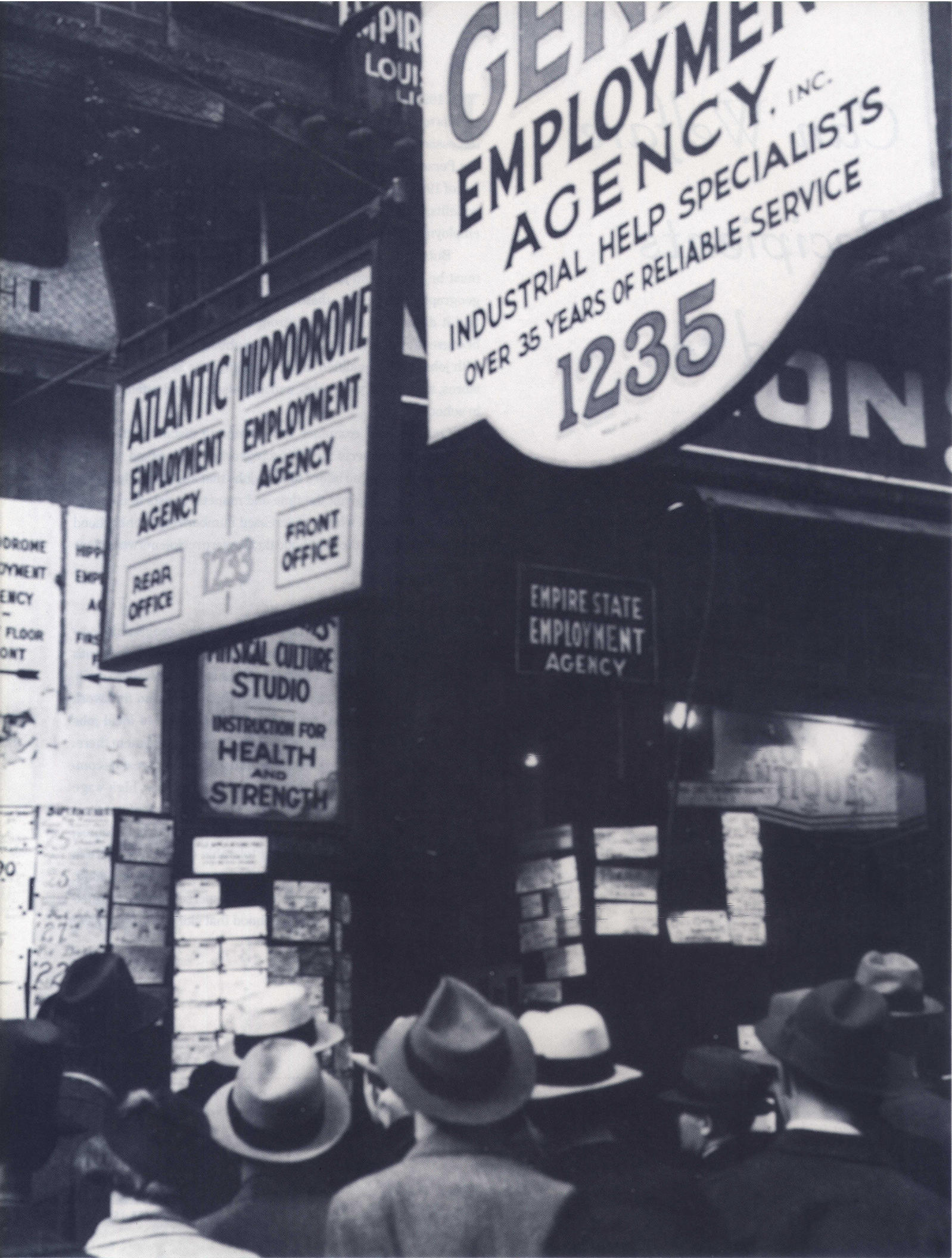
This report is abstracted from a forthcoming article in Urban Studies, *"Job Access, Commute, and Travel Burden Among Welfare Recipients."*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HEALTH
AND
STRENGTH

For high-wage workers, a long commute tends to be an acceptable and manageable burden. Their commutes are alleviated by access to reliable transportation, such as a dependable automobile. Their higher wages compensate them for some of the nonpecuniary costs of long-distance travel.

What about low-wage workers? People with earnings at or near the minimum wage do not receive similar compensation for long commutes. For them, working far from home can be counterproductive — it may cost more for a welfare recipient to keep a distant job than to quit, retain welfare payments, and continue searching for a job nearer to home.

We examined a random sample of participants who were receiving benefits under the Aid to Families with Dependent Children (AFDC) program, and who worked in 1992. We compared their welfare payments with information on quarterly earnings at Los Angeles firms enrolled in California's unemployment and disability insurance programs for the same year.

We found that AFDC recipients are not compensated for relatively long commutes. The median earnings for welfare recipients who work within four miles of home is $634/quarter; the median earnings among welfare recipients who work between four and ten miles from home is $620; and recipients who commute over ten miles earn only $433.

Next, we studied the relationship between commute distance and earnings, holding constant both recipients' personal characteristics (age, sex, race) and the characteristics of their employment (industrial sector, firm size, firm payroll). Once again, we found that, for welfare recipients, longer commute distances result in lower earnings.

We conclude that net wages of low-wage workers who commute relatively long distances are reduced by both out-of-pocket expenses and opportunity costs associated with commuting, such as travel time. Therefore long commutes may discourage employment and result in higher turnover rates and lower net earnings.

The net wages of low-wage workers who commute relatively long distances are reduced by both out-of-pocket expenses and opportunity costs. Therefore, long commutes may discourage employment and result in higher turnover rates and lower net earnings.

COMMUTING AND JOB ACCESS

One policy for helping welfare recipients with long commutes may be to encourage increased numbers of low-wage jobs in neighborhoods lacking such opportunities. Research on "spatial-skills mismatch" shows that as jobs requiring little education are disappearing from inner-city neighborhoods, minorities living in those areas suffer increased economic hardship, especially those without private automobiles. Further, it appears that low-income residents are less likely to rely on welfare if they live in job-rich neighborhoods.

However, only a tenuous correlation can be shown in Los Angeles between geographic access to jobs and improved employment opportunities for the poor. Previous research has not shown whether welfare recipients with numerous neighborhood job opportunities are likely to actually find employment near home.

Thus we have studied the commuting patterns of welfare recipients who live in neighborhoods of varying job richness. The data in Table 1 show that AFDC recipients who reside in job-rich neighborhoods in Los Angeles are somewhat more likely to work within two or four miles of home and to commute short distances than are welfare recipients living in job-poor neighborhoods. Job access (column 1) is an index that reflects the relative number of low-wage jobs available within a three-mile radius of a census tract. The median commute distance for welfare recipients in our sample is 7.5 ➢

TABLE 1

Commute Patterns by Job Access Among AFDC Recipients

INDEX OF JOB RICHNESS		NUMBER OF AFDC RECIPIENTS	% COMMUTING 2 MILES OR LESS	% COMMUTING 4 MILES OR LESS	MEDIAN COMMUTE DISTANCE
0.0-0.5	JOB POOR	626	13.7	28.0	8.0
0.5-1.0		1,082	14.0	26.9	7.7
1.0-1.5		420	14.3	32.9	6.4
1.5+	JOB RICH	460	15.4	30.2	6.9
ALL		2,588	14.3	28.7	7.5

miles, which is considerably shorter than the average commute distance for all Los Angeles workers — 16 miles. On average, therefore, welfare recipients are confined to labor-market areas that are one-quarter the size of the labor-market areas available to the entire Los Angeles labor force.

We further examined whether commute distance is related to job access regardless of the personal characteristics of recipients (sex, race, age) and the characteristics of their neighborhoods (job access, population density, employment density). We found that average commute distance does decline with increased job access.

JOBS, MOBILITY, AND THE POOR

Better geographic job access has both direct and indirect effects on welfare recipients. Improved geographic access to jobs directly affects recipients by shortening their commutes and thus reducing out-of-pocket expenses and opportunity costs associated with traveling to and from work. Further, since the labor market does not provide compensating wages for the longer commutes made from job-poor neighborhoods, improved access to jobs indirectly affects recipients through increased real earnings.

These findings emphasize the importance of local economic development and of improved access to housing and transportation as a means of increasing employment opportunities for the poor.

To increase economic opportunities in areas of concentrated poverty, many local governments have instituted policies and programs such as financial incentives, regulatory relief, and social services targeted toward preserving, attracting, and creating jobs in those poor neighborhoods. However, although local economic development programs should strive to increase jobs for as many welfare recipients as possible, an equal distribution of jobs across all urban neighborhoods would be virtually impossible to achieve and economically undesirable. Even in the most job-rich neighborhoods in Los Angeles, a sub-

stantial number of AFDC recipients living there work far from home. It is unrealistic to try to generate jobs for all recipients close to home.

Additionally, transportation-related policies have great potential for increasing job access among low-wage workers. Since employers do not compensate welfare recipients for long-distance commutes, special programs to ease their commutes may help them keep jobs far from home. For example, car ownership is a significant factor in helping recipients find employment. Yet federal regulations prohibit individuals from receiving benefits if they own cars valued at over $1,500.

Finally, policies that improve housing mobility can enable the poor to find homes outside low-income, central-city neighborhoods. The most prominent example of this strategy is the Gautreaux Assisted Housing Program in Chicago, in which low-income African-American families receive assistance to move from public, central-city housing to suburban, mostly white neighborhoods.

While none of the three policy areas — local economic development, transportation, and housing — can cure the lack of jobs for low-income workers, each has the potential to increase the employment rate of the poor. Improved geographic job access for those in poverty would lower their reliance on public welfare programs and, ultimately, give them greater opportunity for economic mobility. ◆

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Telecommunication Vs. Transportation

BY PNINA OHANNA PLAUT

The functions of transportation and communication systems overlap. Both bridge the gaps between geographic locations, the one by moving physical objects, the other by moving information. In recent years, as the roles of communication have expanded, many people expect they'll come to preempt those that transportation has traditionally performed, with messages substituting for travel and shipping. Or, is it more likely that communication and transportation are mutually reinforcing — that each induces expansion in the other?

Over the past two decades, communication costs have plummeted relative to transportation costs, reflecting advanced electronic technology and changing prices of some commodities, such as energy. For those industries and markets where communication and transportation coexist, the comparative advantage of communication has been rising.

Relations between these systems have significant implications for regional economics and regional planning because transportation costs play a dominant role in locational decisions and in land development, infrastructure investment, and the conduct of industry. Locational advantage (or disadvantage) is based on the costs (including time costs) of gaining access to various destinations and services. Early theory of location was based on transportation costs, but pertinent access costs nowadays are frequently costs of communication instead. ➢

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Stockbrokers trade across continents and time zones.

Relationship between Transportation and Communications

Two basic hypotheses have shaped thinking on the relationship between transportation and communication: substitution and complementarity.

Substitution, the more common hypothesis, is usually defined as the elimination of travel, such that a physical trip or shipment is entirely *replaced* by a transmitted message. This hypothesis predicts that as communication technology becomes more advanced and cheaper, communication will replace some travel. Underlying the substitution hypothesis is an assumption that the total volume of interactions, whether by travel or communication, is constant.

Although the substitution hypothesis has a large following among both academics and the general public, its scientific basis is not clear. Casual observation suggests that persons who work at home can effectively substitute electronic communication for commute trips. Similarly, a telephoned inquiry to determine whether a needed commodity is available can save a fruitless trip that finds it's out-of-stock. And, surely, in the absence of an effective telephone system, a lot of cars would be circulating, each carrying a single piece of paper for delivery to an office somewhere in town. Sadly, this may be what's behind much of the traffic congestion in some less-developed countries. So, there can be no doubt that some degree of substitution does occur. The common speculation among transportation professionals in recent times predicts substantial displacement of trips by telephone and Internet contacts. The smart money has been behind smart communication systems and the substitution hypothesis.

Anecdotal evidence suggests that the total volume of interaction is increasing, in part as reflection of the increased ease of both movement and discourse. A telephone call may conclude with an agreement to meet for lunch, and that of course involves at least one round trip. Or it may lead to an agreement to get together to draft a contract. In turn, the

Better communication may increase the number of freight trips and their efficiency.

draft could lead to extended further negotiation calling for additional meetings. Then, following the contract, shipment of physical commodities will be made in response to electronically transmitted purchase orders. Under these circumstances, it appears that more communication makes for more transport, and that more transport leads to more communication. Certainly the volume of electronic information exchange has been rising, but at the same time that the volume of freight has been as well. Thus the counter hypothesis, the complementary hypothesis, suggests that communication and travel can be mutually stimulating.

Complementarity can follow when at least one of two phenomena occur: *enhancement,* i.e., more telecommunication causes more travel than otherwise would have occurred, and *efficiency,* i.e., each contributes to reduce the resource requirements, and hence the costs, of the other.

To date, most research has focused on travel behavior of individual commuters or households, concentrating on a single communication mode (teleworking, teleconferencing, teleshopping, domestic telephone habits, etc.), trying to discover how it affects travel and commuting. However significant, the conclusions of these studies are limited, because the analyses have been confined to the household sector. In reality, most transportation and communication is not used by households but by industry. In the European Union, about two-thirds of all transportation and communication services are used by industries. In the US, the proportion is about the same.[1]

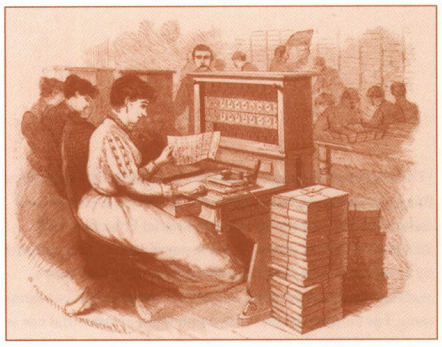
Since the consumption of transportation and communication services by households, including commuters, represents less than half the entire output of the transportation and communication sectors, a comprehensive understanding of the relationships between transportation and communication requires analysis of their industrial uses. ➢

[1] The comparable numbers for the US in 1992: 54.5 percent of the gross output of the transportation service sector is used as intermediate inputs by other industrial branches. Only 26.8 percent of the gross output is purchased as final product by consumers (the rest is purchased by other final users, such as capital investment, exports, or government consumption). For communication, the domination of industrial use is less overwhelming: 41.3 percent of the gross output of communication services is purchased as intermediate input by industry; consumers purchased 45.4 percent as final product. The balance (13.3 percent) is purchased by other final users, including government, exports, and capital investment.

The Fed Ex communication system maintains a constant check on the location of each parcel from door to door.

I questioned the common presumption of substitutability between the two services among industries. I chose Europe for my case study because of the important roles played by the transportation and communication sectors in European integration. Understanding of these roles should shed light on the processes and consequences of economic unification and integration there. Analysis of economic input-output data should clarify industrial uses of transportation and communication services. These data measure the flow of products and services from one industry to another, throughout a national economy.

Input-output flows can reveal whether each industrial sector uses transportation and communication together or as substitutes. Since different industries have different sizes and levels of output, I analyzed normalized units of output for each sector. The relationship of course varies from one industrial sector to another, but overall national patterns can be evaluated by treating dollar-outputs from all industrial users of transportation and communication as comprising a "sample," then applying specially adapted sample statistical analytic tools. My basic questions: Do industries use transportation and communication together as complements or as substitutes for each other, where using more of one is associated with using less of the other? How significant are these relationships?



No Substitution: Communication Complements Transportation

The results from my analysis of the European data are unambiguous and surprising: The evidence is overwhelmingly in favor of the *complementarity* relationship. In every European country examined, industrial users tend to use transportation and communication *together* and not as substitutes for one another. Moreover, the pattern carries over when one disaggregates the transportation sector into three or six transportation subsectors, such as road transport, air transport, and marine transport. For almost every subsector, the pattern of complementarity with communications emerges as statistically significant.

Finally, complementarity prevails in nearly all cases for both direct and total purchases of transportation and communication. Total purchases take into account the direct and indirect use of transportation and communication through intermediate purchases. For example, if the farm sector purchases transportation directly, but also indirectly through farm machinery and equipment whose production also used transportation in their own production, then all these "remote," indirect uses of transportation enter the "total use" measurement. Complementarity is almost as clearly evident for total uses of transportation and communication as it is for simple, direct uses.

No Substitution for Transportation in Industry

If communication doesn't serve as a substitute for transportation, at least in European industrial uses, we must ask why not? Some argue that telecommunication will probably induce both additional travel as well as reduced travel, so the net effect is likely to be indeterminant. But, in either case, it is not clear how travel-time saved due to telecommunication will then be used. For households, communication and transportation both act as means for maintaining social ties over distances, and so they may be substitutes for each other.

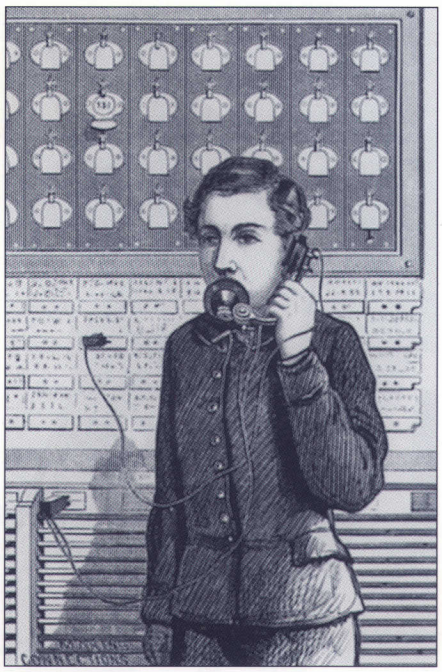
For industry, especially the freight sector, communication and transportation may be complementary because of the more intensive use of communication in logistical support for transportation. Better communication has led to increasingly efficient freight movement, indicated by greater productivity and the rise of the five "Olympic zeroes" — no stock, no time lag, no fault, no breakdown, no paper. In the early 1990s new information-management technology sharply increased railroad productivity in the United States.

The freight industry is conserving resources with the following changes, to name a few: (1) introducing data-sharing among railroads through an electronic data-interchange network; (2) reducing delays through timely coordination of pickups; (3) improving load factors, routing, and back-haul planning; (4) more efficient warehousing, shifting toward a smaller number of larger depots serving larger areas; and (5) real-time scheduling of shipping containers from ship, to truck, and rail for just-in-time delivery at destinations.

Enhanced efficiency may create greater demand for transportation, for example, in cases where a smaller fleet of electronically scheduled vehicles can make frequent deliveries to meet no-stock and just-in-time production. Efficient scheduling of freight movement will rely increasingly on the precision permitted by real-time communication. The success of Federal Express and other courier services is partly based on their capacity to keep tabs on the location and status of every parcel at every moment — to use the electronic media for tracking physically transported objects.

Thus we find a genuine interdependency and mutual reinforcement between communication and transportation. As foreign and domestic trade expand, as personal social relationships become more extensive and intensive, so too will the transmission of messages and the movement of people and goods.

The relationship seems clear: more communication means more transportation, and more transportation means more communication. ◆



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Why Don't You Telecommute?

BY ILAN SALOMON AND PATRICIA L. MOKHTARIAN

Telecommuting promises to benefit everyone. Employees can avoid time-consuming trips to work, permitting a more flexible, family- and community-oriented lifestyle. Employers can reduce their costs of expensive office space, while drawing on a larger and more diverse labor pool. Air quality may improve with reduced automobile trips.

But chances are you aren't telecommuting. There are far fewer telecommuters than enthusiasts have predicted. In California, only 1 to 1.5 percent of the workforce telecommutes on any given day. One consultant estimated there will be 25 million telecommuters in the US by the year 2000. But since there are currently only about 8 to 9 million, that's unlikely.

Why is there such a gap between predicted and actual telecommuting? It may be the result of the forecasting method. Predictions are often based on simple answers to simple survey questions, such as: "Would you like to telecommute?" People impulsively respond positively, assuming they'll prefer working at home. Most end up not telecommuting, suggesting that few conclusions can be drawn from such surveys.

To understand the potential for telecommuting, we studied how individuals decide whether to do it. We did not address related questions, including employers' permission to telecommute, government policies on telecommuting, and so on. Our research focused on the ramifications of technology for individual and societal behavior.

MOTIVATION TO TELECOMMUTE

The option to telecommute is not enough to entice employees into doing it. It's necessary that persons be motivated to change their work behavior, so employees who are content with their situation have little incentive to change. ➢

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Some people will always prefer the office environment. Jobs involving manipulation of physical objects require physical presence. It seems that telecommuting is an option for a segment of the workforce, but certainly not for all workers nor for the majority at the same time.

A long commute is the most commonly cited inducement. The economic rationale is simple: save costs and time by avoiding car or transit trips. Other motivations include the desire to spend more time with family, to get more work done, or to help reduce air pollution.

Before people choose telecommuting, however, they typically consider other options. For example, people who dislike long commutes may choose to travel at off-peak hours, to relocate closer to the work place, or to change jobs. People who want more family time may adjust by working part-time. Telecommuting is just one option when one is dissatisfied with some aspect of life.

Of course, every option is not available to all people. Just as accepting part-time work may reduce household income too much to be feasible, telecommuting may not work for everyone. Thus telecommuting choice is dependent not only on motivations for change, but also on constraints.

CONSTRAINTS ON TELECOMMUTING

To study people's decisions to telecommute, we asked 628 employees of the City of San Diego about their familiarity with telecommuting, their current commuting patterns, their perceptions of the advantages and disadvantages of telecommuting, and constraints on their ability to telecommute. While our sample is by no means representative of the larger population, we learned a lot about telecommuting motivations and constraints, and thus why there are so few telecommuters out there.

The desire to telecommute seems to be triggered by at least the following: by family needs (such as caring for someone with a disability); by work- or commute-related stress; by expected personal benefits, such as more free time; and by lessened commute time. For most respondents, however, telecommuting is a "preferred but impossible alternative" — although people say they'd prefer to telecommute, they don't do it because they can't.

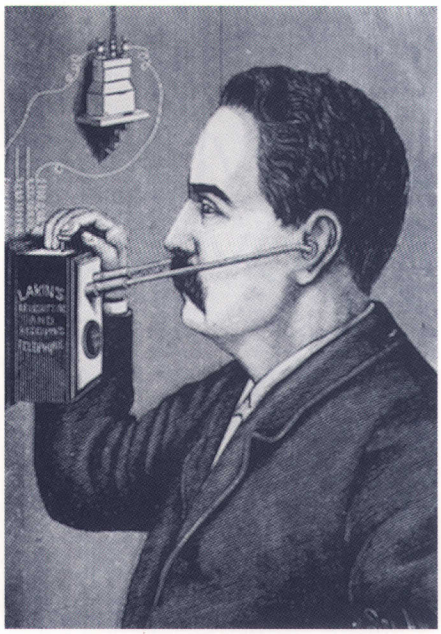
Some constraints are decisive, preventing telecommuting absolutely: (1) if a person is ignorant of the telecommute option or thinks that telecommuting is an option only for computer programmers or for women; (2) if the job is fundamentally unsuitable, e.g., an assembly-line operation; or (3) if management does not approve, reflecting the stereotype among some managers that it's too difficult to supervise employees working at home.

Most of our survey respondents were affected by more than one such constraint. Only 32 percent of the sample indicated that none of these constraints inhibited them and thus that they might be able to telecommute. So at least 68 percent of the sample could not telecommute, although the majority of them stated a preference to do so, making telecommuting the preferred but impossible alternative.

Even without decisive constraints, people may choose not to telecommute because of deterrent constraints: insufficient space at home, potential distraction by household members, high equipment costs (e.g., computer, modem, fax machine), lack of self-discipline, desire to use commute time to unwind between home and work roles. Two-thirds of potential telecommuters in our sample could not or did not do it because of some deterrent constraint.

These limitations keep telecommuting from increasing to its predicted frequency. Some constraints will likely dissipate as telecommuting becomes more common and

acceptable and as technology becomes more available. However, other factors appear more permanent. Some people will always prefer the office environment. Jobs involving manipulation of physical objects require physical presence. It seems that telecommuting is an option for a segment of the workforce, but certainly not for all workers nor for the majority at the same time.



CONCLUSION

People often react to technology-based options differently from the way those options are perceived by their promoters and advertised in the popular media. There are no simple one-to-one connections between technologies and human behavior. The links are inherently complicated by institutional arrangements, personal habits, and of course by individuals' preferences.

Our findings suggest that telecommuting still promises to improve the welfare of some employees and some employers, while benefiting the environment. But, if it is to attract enough commuters to reduce congestion appreciably, much change has to occur first, both at home and at the workplace. Despite the triumphs of the telecommunication revolution, there's no telecommuting revolution in sight. ◆

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The ACCESS Almanac:

DÉJÀ VU ALL OVER AGAIN

Speed Limits Raised, Fatalities Fall

BY CHARLES LAVE

Despite opposition from many national safety groups, in November 1995 Congress gave the states permission to raise speed limits. Opponents had testified that raising speed limits would cause an additional 4,400 to 6,000 deaths per year. Fortunately, it didn't work out that way.

Year	Total Number of Traffic Fatalities	Change
1993	41,893	
		+1.9%
1994	42,700	
		+2.8%
1995	43,900	
		-0.7%
1996	43,593*	

LIMITS RAISED →

"Accident Facts," National Safety Council, February 1997. 1996 data are preliminary: January to November from the NSC, December from NHTSA.

Fatalities did not increase. They did not rise by the 10 to 14 percent expected by the opponents of the change, nor even by the 2 to 3 percent that would be expected from recent trends. Instead, fatalities fell by 0.7 percent. This surprising outcome was not the result of a decline in travel: Total vehicle miles rose 1.8 percent between 1995 and 1996.

Although Congress gave permission to raise speed limits in November 1995, it took the states a while to create and pass new legislation, and only half of those that did react had done so by May 1996. The graph shows what happened as the new speed limits were phased-in during 1996.

A drop in fatalities following an increase in speed limits is not unprecedented. The 1987 change in speed limits produced similar results. In 1987 Congress gave the states permission to raise speed limits on portions of their Interstate highways. Some states raised speed limits, some did not. Comparing the subsequent fatality rates across these groups, holding constant a number of other factors, the states that raised speed limits experienced a 3.4 to 5.1 percent drop in fatality rates compared to the states that did not raise speeds.

Why didn't fatalities increase in 1987 and 1996 as had been widely expected? My research cited three possible factors. Part of the answer is contained in testimony given to Congress by senior highway-patrol administrators. They said that pressure from the federal government to enforce compliance with the 55-mph limit had forced them to take patrol officers away from other safety activities and move them to the task of speed-limit enforce-

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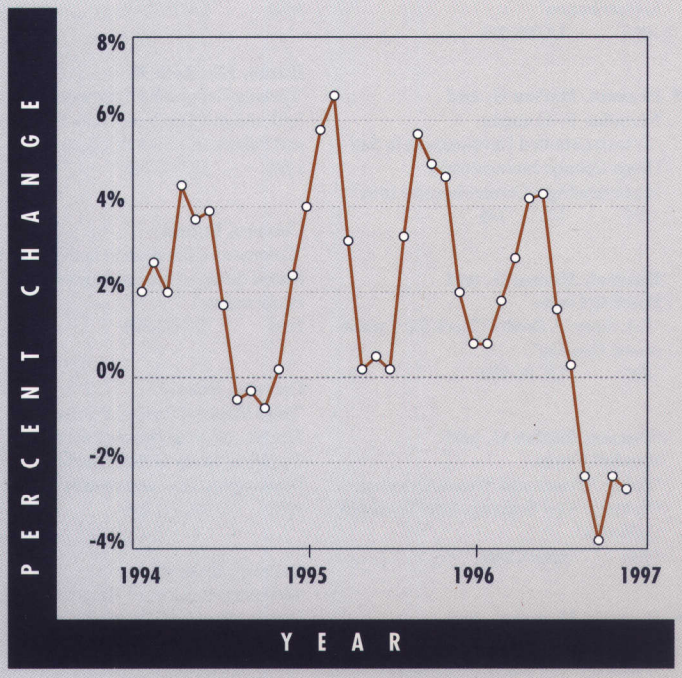
CHANGE IN TOTAL U.S. HIGHWAY FATALITIES COMPARED TO ONE YEAR EARLIER



Points in the graph are determined as follows: The National Safety Council computes the percentage change in total US highway fatalities for each month compared to the same month one year earlier. Then, to smooth out random events, they compute the four-month moving average associated with each month. The graph plots these four-month moving averages.

ment on Interstate highways, even though they did not believe that action was the best use of their patrol resources. This opinion was widely shared among the state highway-patrol chiefs. In 1988 their national organization passed a resolution that stated: "[Federal demands to enforce the 55-mph limit] force the over-concentration of limited resources for the express purpose of attaining compliance rather than application of resources in a manner most effectively enhancing total highway safety."

Thus relaxing the speed laws eased the highway patrols' enforcement burden, allowing them to reallocate patrol resources to activities they considered more important for promoting safety.

There might also have been a reallocation of traffic when speed limits were raised. Previously, if a driver wanted to go faster than the limit on the heavily policed Interstate highways, he might have moved to one of the parallel two-lane roads. Though much more dangerous, these roads had very little speed enforcement. Raising speed limits would lure such drivers back to the Interstates, thus reallocating traffic from dangerous roads to safe ones.

Finally, speed variance among cars may have decreased when speed limits were raised. Speed variance is highly dangerous because it produces more overtaking and passing and hence more chances for collisions. Thus when setting speed limits, it is critical to choose a limit that drivers are willing to obey. Suppose most drivers wanted to go faster than 55 mph: some obeyed the limit, some ignored it. Raising the limit would give the law-abiding drivers a chance to speed up, hence reducing speed variance and increasing safety.

These results do not imply that we should raise speed limits even further as a quick and easy way to increase highway safety. But it should be clear that the conventional wisdom — "speed kills" — is not a complete picture of the world. Highway safety is a much more complex matter, and should be analyzed as the outcome of a system of interdependent behaviors. ◆

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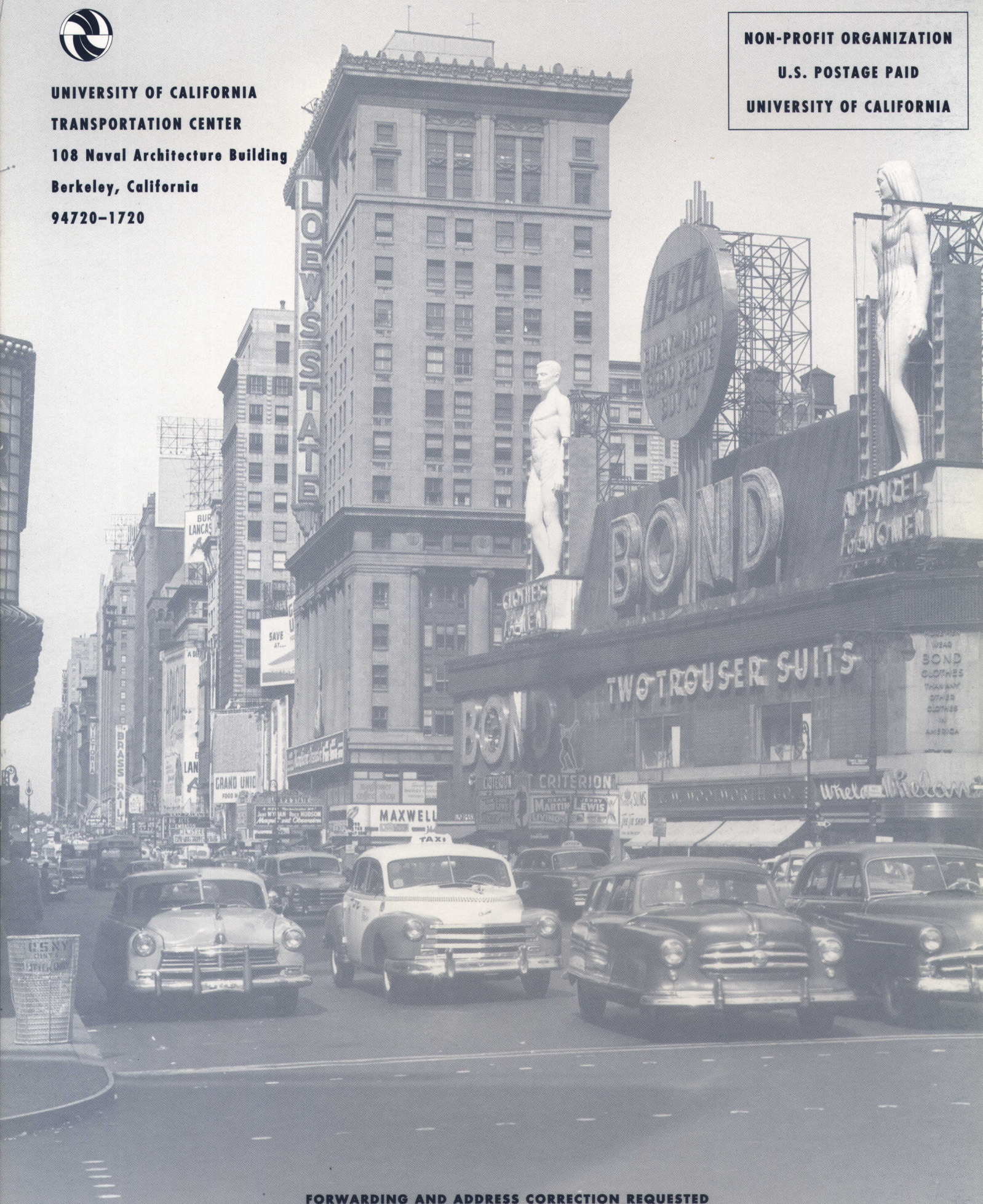

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