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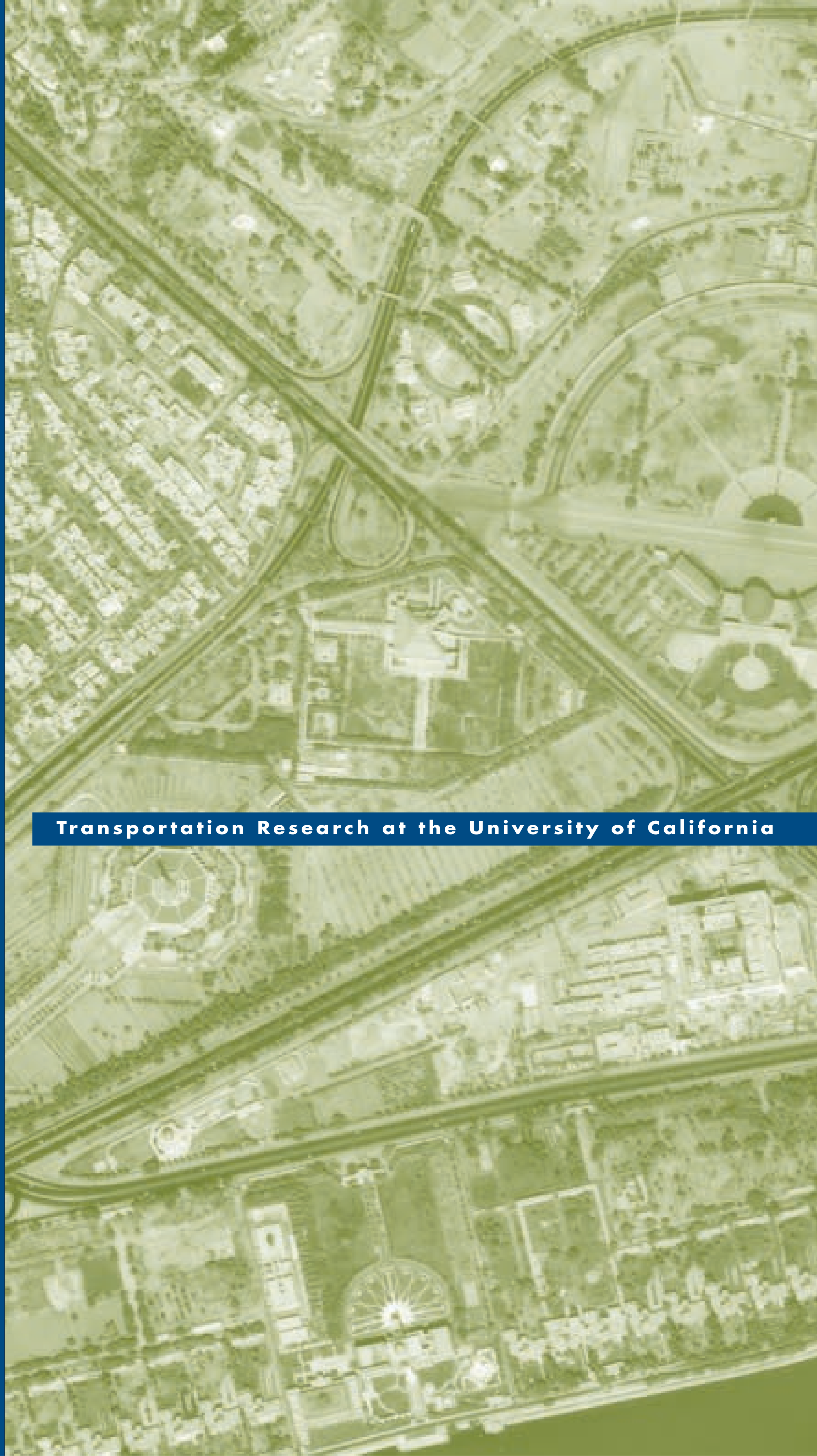

Transportation Research at the University of California

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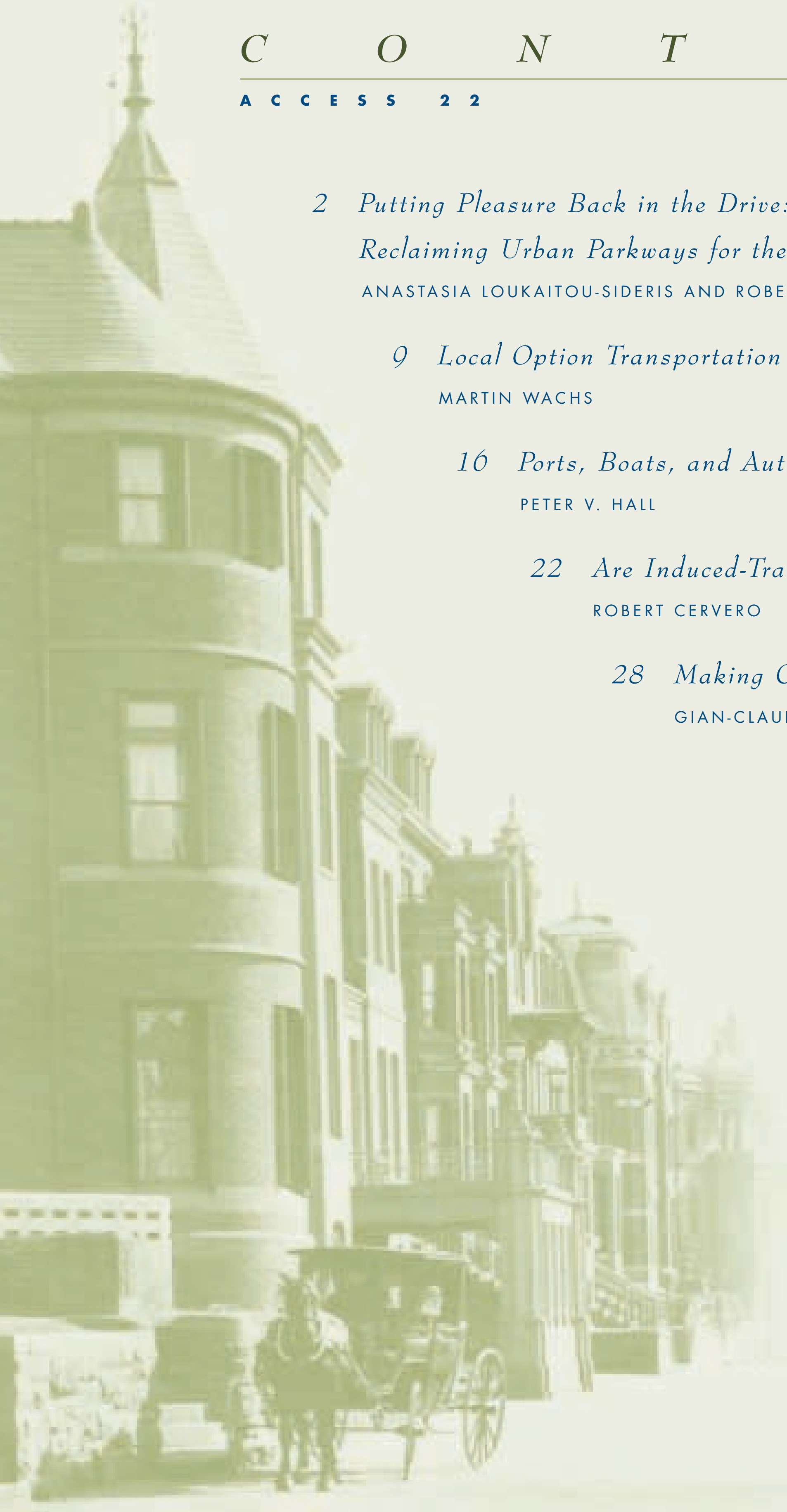

C O N T E N T S

ACCESS 22 SPRING 2003

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Obsolescence Named Progress

CALIFORNIANS ARE likely to approve bonds for a high-speed passenger train system from San Diego to Sacramento, running via Los Angeles and Central Valley cities with extensions to the Bay Area. Promoters say that, as the alternative to air and highway travel, it will help clean the air, save time and money, reduce congestion, and do other good things. Skeptics point to informal construction estimates reaching upwards of thirty billion dollars, to the long history of cost overruns among large public-works projects, and to the political influence of construction interests.

I usually don't complain when folks spend their money as they wish. But, as an old railroad buff and a life-long student of railroading, I'm concerned about the way high-speed trains are being sold to voters and about the potential consequences of this investment. Are we being conned into buying polished-up old technology that reflects a false image of modernity? And might the project later thwart future technological and social advances by absorbing resources and constraining choices?

This should have been a hard sell, because America's long-distance passenger trains were long ago superseded by automobiles and airplanes. According to the 1995 American Travel Survey, trains serve about half of one percent of domestic round trips of over 100 miles one-way—4 million miles by train and 130 million by plane, compared to 500 million by auto. Promoters say high-speed trains will change that. California will use contemporary French TGV or Japanese Shinkansen equipment at speeds approaching 200 mph. But can high speed alone overcome the obsolescence of passenger rails?

The sales pitch had some rough spots, as sales pitches do. I've heard it said that rail subsidies are warranted for "balance" because the feds spend $25 billion or so on highways each year. It's also said they're fair because the aviation system is supported by public subsidies—thus cleverly ignoring airfare surcharges, fuel taxes, and airline landing fees that cover most costs.

Voters are rightly enthusiastic about what new innovations can do for them. Commonly, new technologies improve the ways people do what they were already doing. But the technological advances in transportation and communications have done much more: passenger railroads reinforced the industrial revolution, mass migration from farm to city, and parallel shifts in American culture. They enabled dramatic social and economic development and qualitatively different opportunities for education, work, and play. Development has meant expanded choices, further opportunity for innovation, ways to increase productivity and efficiency, and freedoms unimaginable a century ago. Personal lives have been immensely enriched as a consequence.

That dynamic worked well with passenger railroads from 1825 to about 1920. Rapid technological improvements enhanced all aspects of railroading. Individuals and organizations who used the rail services were discovering new things to do. But later, still-newer technologies and still-newer activities led to declines in the passenger-train market.

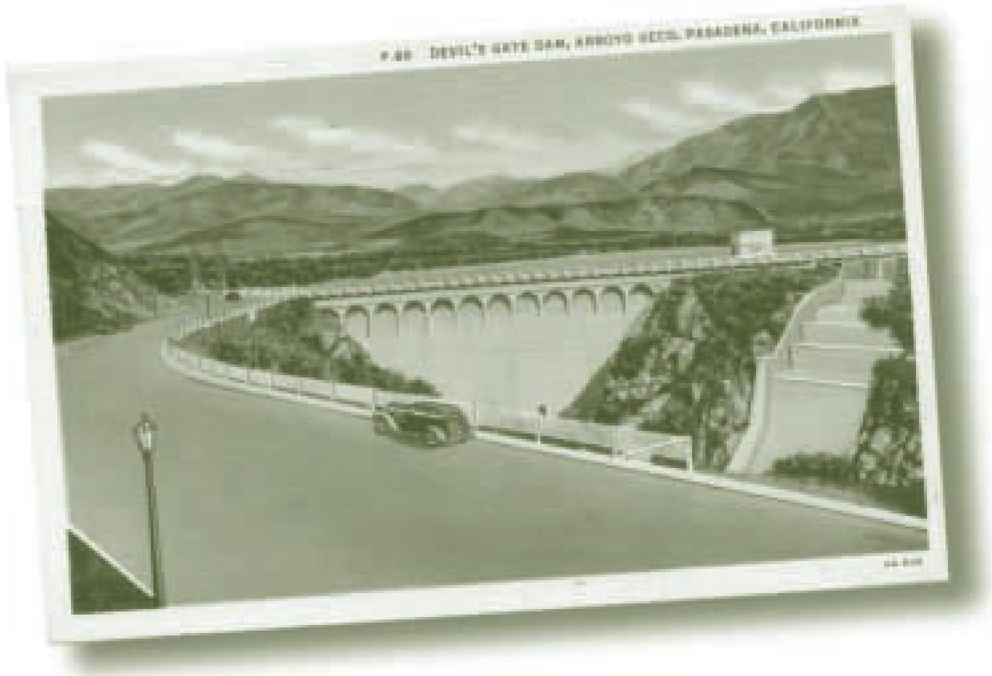
It's no matter now that the proposed trains will run faster and look modern. It's no matter that high-speed trains emerged from slower services in Japan and Europe and that niche markets might emerge from Amtrak services in the US. What does matter is whether speeded-up 19th-century services will contribute technological, economic, and social advances sufficient for the 21st-century world.

I fear that over-sold high-speed trains may become a drag on the 21st-century recipe for progress. Having built their institutional form on military and similar models, present-day passenger railroads remain 19th-century industrial enterprises. They run on inflexible rules, are host to management and labor monopolies, and have few options for productivity improvements. This is not a dynamic one would want to buy into.

Who are the villains in this drama? Not the voters. They are right to bet on new technology, and many have been seduced by pay-later bond financing augmented by free money from Washington. Promoters? The world needs such folks.

Perhaps the real villain is our own failure to question the obvious.

William L. Garrison



Putting Pleasure Back in the Drive:

RECLAIMING URBAN PARKWAYS FOR THE 21ST CENTURY

BY ANASTASIA LOUKAITOU-SIDERIS AND ROBERT GOTTLIEB

I've just made a run out to Pasadena on the completed Arroyo Seco Parkway… No brazen pedestrians nor kids riding bikes with their arms folded. No cross streets with too-bold or too-timid drivers jutting their radiators into your path. And no wonder I made it from Elysian Park to Broadway and Glenarm Street in Pasadena in 10 minutes without edging over a conservative 45 miles an hour.

John Cornwell, *Westways*, January 1941

If the engineers wish to rhapsodize over the quaint historic qualities of the Arroyo Seco Parkway, they should scrape up the whole miserable concrete mess and put it in the freeway museum. That highway has been obsolete for 25 years; it's dangerous and inadequate. The transition from the 110 north to the I-5 north is one of the worst freeway bottlenecks in the state.

William Leidenthal, *Los Angeles Times*, July 31, 1999

THESE TWO ASSESSMENTS of Arroyo Seco Parkway (now known as the Pasadena Freeway) are separated by half a century in time and a sea of difference in perception. They encapsulate the rise and fall of urban parkways. Predecessor of the modern freeway and celebrated transportation model of the early 20th century, the urban parkway has fallen on hard times. Designed for uninterrupted, pleasurable driving in park-like settings with views of surrounding communities, parkways were once hailed as marvels of transportation innovation and design—and as safe and efficient alternatives to arterials and boulevards.

By the 1950s, however, the goals of pleasurable driving and visual interest had faded in favor of engineering efficiency and higher capacity. Meantime, parkways like Arroyo Seco, which were originally designed to carry few cars at relatively low speeds, now had to accommodate many more drivers trying to go much faster. The result is that the ten-minute trip of 1941 might take as long as forty minutes today as bottlenecks, traffic accidents, and congestion conspire to delay.

The Arroyo Seco Parkway represents the dilemma of urban parkways today: still in use, it is fraught with problems due to the disjuncture between its original conception as a bucolic roadway for recreational driving and its current incarnation as a major corridor in a freeway-centered transportation system. Given the challenges of modern traffic engineering, it is important to ask whether there is a new vision for urban parkways and whether they can be reclaimed as successful models of transportation infrastructure.

EARLY DAYS: GENESIS AND EVOLUTION OF URBAN PARKWAYS

The term parkway connoted a strip of land of varying width containing a roadway within park-like or landscaped surroundings. Roads curved gently, requiring slower speeds than today's highways, and abutting property owners had no direct access rights.

The first use of the name parkway in the US preceded the automobile. Frederick Law Olmsted and Calvert Vaux, in an 1866 report to the Board of Commissioners of Prospect Park in Brooklyn, New York, recommended a "parkway" in the park plans. Inspired by the celebrated boulevards of Paris and Berlin, Olmsted and Vaux viewed parkways as pleasant tree-lined roads for horse-drawn carriages.

Parkways designed by Olmsted and Vaux were built in Boston and in New York's Central Park. Other landscaped boulevards were built in eastern cities; then the growing numbers of automobiles revived the need for specialized roadways. The first for automobiles was the Bronx River Parkway in Westchester County, New York, completed in 1923. Its great success led to more roads like it, most notably in New York City under the watch of Robert Moses. In the 1930s, the modern parkway movement expanded out of New York with construction of several federal parkways including Skyline Drive in Virginia, Blue Ridge Parkway in North Carolina and Tennessee, and Merritt Parkway in Connecticut. During the same decade Los Angeles planners envisioned "greenbelts across the city"—parkways responsive to the region's increasing traffic that also ➢

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encouraged highway recreation and sightseeing. These ideas were elaborated in Frederick Olmsted Jr. and Harlan Bartholomew's 1930 report for the Los Angeles Chamber of Commerce linking parkway development with opportunities to create open spaces and parklands. Following a series of debates regarding feasibility, finances, and transportation and land use goals, the "first freeway of the west," the celebrated Arroyo Seco Parkway, broke ground in 1938.

Parkway Goals

Parkway concepts incorporated the goals of pleasure driving and efficiency (moving large numbers of cars at continuous speed). A serpentine roadway adjusted to topography and offering views and vistas of both immediate and more distant landscapes created a pleasurable driving experience. In urban areas, considerable grading and planting achieved a park-like effect. Landscaping framed views and provided a reminder of nature along a carefully selected route.

To ensure an efficient flow of traffic, parkways introduced the concept of controlled access. Access from abutting properties was denied, traffic lights were eliminated, and crossings and left turns were prohibited. Grades were separated where parkways crossed other roads. Roadways were divided by wide median strips, and lanes were wide compared to other roads of the day. They were designed for passenger cars traveling at speeds ranging from 25 to 45 miles per hour. Higher speeds were not a goal; rather, uninterrupted traffic flow would bring efficiency and time savings.

Parkway design in the early 20th century was described as bioengineering—a marriage of architecture, landscaping, and civil engineering in three-dimensional design. But times were changing fast. The goal of efficiency came to overshadow that of aesthetic delight as multilane freeway systems moving people and goods at high speeds were superimposed over the land with little or no attention to aesthetics, scenic pleasure, community values, or environmental effects. Parkways became products of a bygone era and lost favor among traffic engineers. Adjusting existing parkways to the freeway era has been a bumpy road at best, as they are now called upon to carry more vehicles moving at higher speeds for purposes like commuting and transporting goods rather than pleasure driving.

Arroyo Seco Parkway

Arroyo Seco Parkway was the first grade-separated, limited-access divided road in the west. Built in three major stages from 1938 to 1953, the 8.2-mile parkway connected downtown Los Angeles to Pasadena (Figure 1). The first segment of Arroyo Seco Parkway, completed in 1939, cost less than $1,000,000 per mile, which, according to then District Engineer S.V. Cortelyou, was "exceptionally low for a freeway of its character." This amount paid for building the Arroyo Seco flood-control channel as well as all the bridge structures, railroad relocations, utility reconstruction, and landscaping. For

FIGURE 1

Peak hour volumes on the Arroyo Seco Parkway

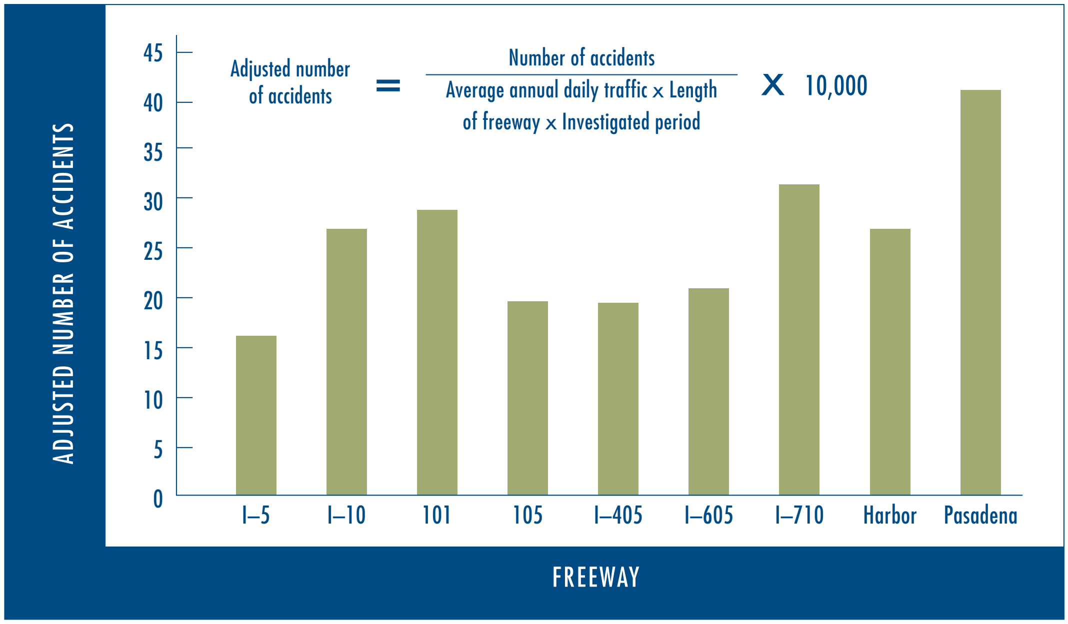
the parkway embankments, engineers saved money by using hundreds of thousands of cubic yards of material excavated from the Arroyo Seco Channel by the WPA and from the Los Angeles River by federal district engineers.

To reduce the possibility of head-on collisions, engineers designed a six-foot median strip and planted it with shrubbery to shield drivers from the headlight glare of oncoming traffic. Fences lined the road to separate traffic from nearby properties and to keep children and animals away. The parkway's traffic lanes were eleven feet wide, which by today's standards are narrow, but were wider than the lanes of contemporary arterials. To encourage drivers to stay in their lane, engineers used different colors of concrete for adjacent lanes. Other safety features included special lighting at all on-ramps and off-ramps, warning and directional signals, and red reflectors installed in curbs. A 1945 study pointed to these safety features to explain the remarkably low ratio of traffic accidents on the parkway compared to other major highways with comparable traffic volumes.

Consistent with the dictums of parkway planning, Arroyo Seco Parkway offered driving pleasure to motorists by providing views of the surroundings. Existing parklands were enhanced by approximately 4,000 plants of various species, selected and placed so that, according to the District Engineer, "a brilliant showing of color would be maintained throughout the year." A program of roadside beautification eliminated billboards, advertisements, and other objects of commercial blight. To enhance the ride's aesthetic pleasure, engineers adjusted the road's contours to fit the landscape and installed rustic rails on rubble parapet walls and decorative wooden railings along on- and off-ramps. ➢

FIGURE 2

Adjusted number of total accidents on freeways in District 7



Contemporary Issues and Problems

In the 1940s, Arroyo Seco Parkway was viewed as a model for roadway design. Sixty years later it is plagued by problems. Originally built to accommodate 27,000 automobiles per day at 45 mph, the parkway today carries daily traffic of over 130,000 cars (at its southern end) often at speeds exceeding the official limit of 55 mph. Average daily traffic has increased consistently since it opened. Congestion clogs the road during many times of the day and evening, not just peak hours. Traffic builds continuously heading south, with a peak of 8,000 cars per hour in the middle of the parkway and about 14,000 cars per hour where it intersects with Interstate 5 (Figure 1). The parkway has only three lanes on each side. Given high vehicle volumes, high speeds, and high accident rates, bottlenecks are a daily occurrence on this main thoroughfare connecting Pasadena to downtown Los Angeles.

Today the parkway is probably the most unsafe route in the region, according to reported accident rates (Figure 2). Fast driving along its tight curves often results in collisions. A serious safety issue concerns short on- and off-ramps, where motorists must accelerate or brake quickly due to the lack of merge lanes. The percentage of total accidents on the parkway is greatest near ramps (Figure 3).

Visual delight is certainly greater along this parkway than on other freeways in the region, yet some original intentions have been compromised or abandoned. Concrete median barriers have replaced the older guardrail. Overgrown and untrimmed plants and misplaced bushes and trees have hidden some of the best views of the hillsides. Chain-link fences, barbed wire, and metal guardrails have replaced much of the rustic wooden fencing. On certain segments, sound walls hinder views.

Sixty years after its creation, the parkway is filled with bumper-to-bumper traffic and has become an unsafe and unpleasant place to drive. Is it possible to find a remedy?

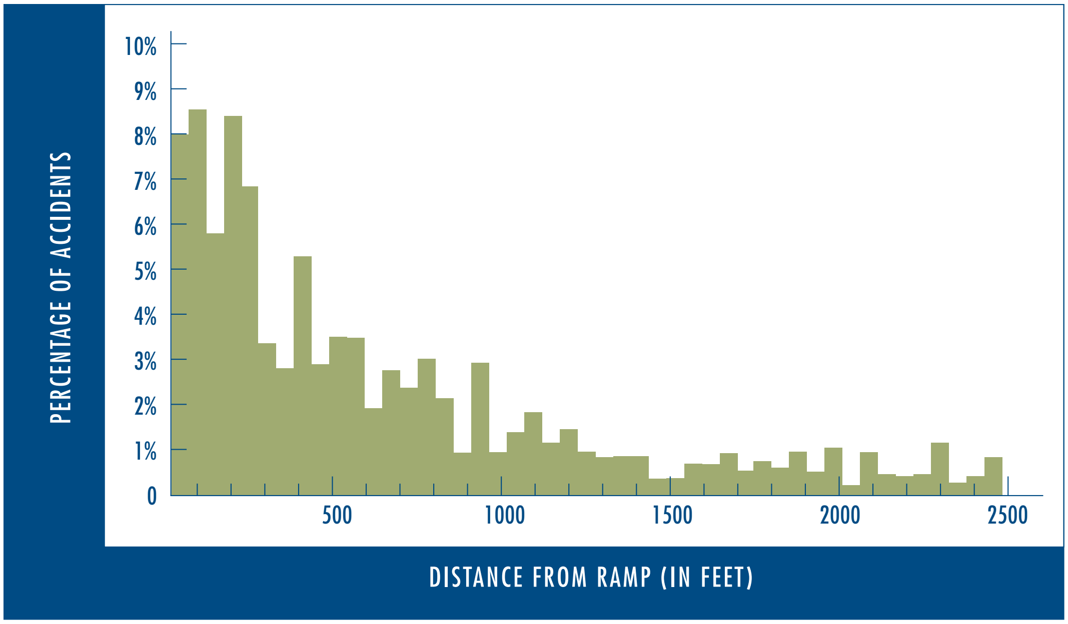


FIGURE 3

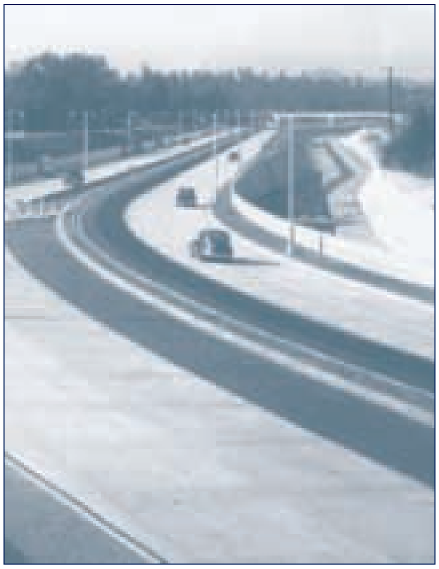
Proximity of accidents to ramps (1996–2000)

Strategies for Change

By the early 1990s, community concerns about congestion, high accident rates, and deteriorating aesthetics were bubbling over. A community task force joined officials from the California Department of Transportation to study strategies for reducing accident rates and enhancing visual quality. Caltrans officials had previously explored re-engineering the roadway and its on- and off-ramps to make the original parkway function more like a high-speed freeway, but they found those ideas blocked by several factors, including legislation that protected adjacent parklands. The community task force sought to focus attention on two core strategies: 1) achieving official historic status and making the landscape consistent with the original parkway concept; and 2) calming traffic by reducing the speed limit to its original 45 mph, thus helping decrease accidents and ultimately relieve congestion.

The efforts of the task force led to designation of the Arroyo Seco Parkway as an American Civil Engineering Landmark and as a National Scenic Byway. At the same time community advocates and residents refocused attention on congestion, accidents, speed limits, and other operational issues. An Arroyo Seco Collaborative was formed in 2000; plans for an unprecedented event called ArroyoFest, involving a walk and bike ride *on* the Pasadena Freeway scheduled for June 2003, could bring renewed attention to those matters. The ArroyoFest collaborators are working towards a broad approach to transportation in the Arroyo Seco corridor that includes light rail, expanded bus service, commuter bikeways, and pedestrian walkways. At the same time, ArroyoFest promises to bring attention to the original parkway concept and its potential role in 21st-century transportation and land use planning. ➢

A short Arroyo Seco on-ramp



Early days on the Arroyo Seco

Prospects for Urban Parkways

Rising community interest in Arroyo Seco Parkway prompts us to reconsider the relevance of other parkways today. In the mid-20th century the emphasis on aesthetics and pleasure driving was sacrificed for the promise of efficiency and speed that freeways seemed to offer. But fifty years later the freeway system is congested. Communities want to keep new freeways out of their neighborhoods and in many places have effectively stopped their expansion. At the same time, debates over parkways and freeways have come full circle. The emphasis on efficiency, volume, speed, and the predominance of single-driver automobiles is giving way to an increasing interest in multi-modal transportation, traffic calming, and a broader set of community, aesthetic, historical, and environmental objectives.

Existing urban parkways such as Arroyo Seco in Los Angeles or State Route 163 in San Diego can be seen as assets rather than liabilities if considered as one piece of an integrated transportation network. Parallel roads, light rail, busways, and bikeways can all help ease traffic along the parkways. To reduce accidents, speed limits should be reduced to their original 45 mph—a change that will add only two extra minutes to the ride from Pasadena to the I-5 intersection. The lower speed limit is more appropriate for the narrow, curved parkway lanes and allows entering cars to merge more easily into parkway traffic.

Motorists would consider parkways as assets if their compromised aesthetics were restored and if emphasis were again placed on making the drive pleasurable. Restoration of design and landscaping features, bridges and overpasses, guardrails, signs, light fixtures, and trees would give back the roadway's human scale.

Community activism and interest in re-envisioning Arroyo Seco Parkway suggest that parkways are valued by adjacent communities if they can be connectors rather than separators of neighborhoods. Modern freeways typically exclude neighboring urban areas, arrogantly soaring over the city or diving below it. In the process they hide and separate neighborhoods with miles of concrete walls. In contrast, the border between parkway and city is soft, consisting of trees, vegetation, and parkland, allowing the motorist wide vistas and an appreciation of the surroundings. This more sympathetic approach to urban context makes today's parkways more palatable to communities than freeways and encourages integration of new neighborhood parks and playgrounds into the landscape plans.

Ultimately, we see a future for urban parkways if transportation planners would stop treating them as if they were freeways. Parkways were built for specific traffic capacities and speeds, and planners should consider this an asset. The lessons from Arroyo Seco can ultimately help turn a "dangerous and inadequate" relic into a more supple and appealing transportation facility. They can indeed put pleasure back in the drive and connect rather than separate communities they pass through. ◆

Further Reading

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Local Option Transportation Taxes: Devolution as Revolution

BY MARTIN WACHS

EVER SINCE THE WIDESPREAD adoption of automobiles, Americans have preferred to pay for highways and bridges with "user fees"—that is, money collected from those who use the roads. Tolls and fuel taxes, which are roughly proportional to travelers' use of roads, have been the most common user fees. However, revenues from user fees have been falling for three decades, as legislators become ever more reluctant to raise them to meet inflation. It has been easier to try new kinds of fees, such as sales taxes, to pay for transportation infrastructure. In the guise of urgent solutions to immediate problems, seemingly modest local tax increases are setting a national trend. Without deliberating or consciously adopting a change in policy, indeed without much discussion at all, we are gradually devolving transportation finance back to local governments and reducing user fees. Without knowing it, we may be experiencing a revolution in transportation finance, and we haven't stopped to ask whether this is good or bad. ➢

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A hundred years ago almost all roads were local facilities. Neighborhood streets and county roads have long been and still are the responsibility of local governments. Neighborhood streets carry a small proportion of traffic by volume, even though they make up most of the system's lane miles. They are critically important because they provide access to residential and commercial properties. In addition to being essential to residents and employees, access imparts value to property by allowing service by postal trucks, fire engines, police cars, ambulances, trash collectors, plumbers, and others. Streets are also the most common channels for electric wires, gas mains, and water and sewer pipes. Local governments have long provided and maintained such roads, financing them primarily by levying taxes on the properties that benefit from them.

Eighty Years of User Fees

Over time, states assumed a different, complementary transportation mission. In the early part of the twentieth century, Americans wanted to get farmers out of the mud and connect them to regional markets. At the same time, rapid growth in automobile use created traffic jams on existing roads. Gradually, states augmented local roads by creating major routes designed for heavy longer-distance traffic. These arterials—the state highways—had to be paid for, which quickly strained state treasuries. In the early 1920s, California was devoting more than forty percent of all its revenue to building and maintaining roads and paying interest on bonds it had issued to build roads. Despite this spending, congestion was getting worse because appetites for road travel were growing.

From this financial exigency came the revolutionary concept of "user fees." Because traffic on state roads imposed costs on the state roughly in proportion to its volume, it made sense to cover the costs of those roads by charging the users. While tolls were considered the fairest way to charge users, they had a major drawback. Toll booth construction and toll-collector wages absorbed so large a proportion of toll revenues that they were sometimes difficult to justify.

The first revolution in transportation finance came when states adopted user fees in the form of motor fuel taxes. Although they charged for road use in rough proportion to motorists' travel, and heavier vehicles paid more because they used more fuel per mile of travel, fuel taxes didn't quite match tolls for efficiency because they didn't levy charges at the time and place of use. However, they cost much less to administer than tolls, so fuel taxes became the principal means of financing America's main roads. Because they were user fees, most states reserved fuel taxes exclusively for transportation expenditures. When the federal government decided in 1956 to expand intercity highways on a national scale, it increased federal fuel taxes and created the Federal Highway Trust Fund, emulating the "user pays" principle that had been so successful in the states.

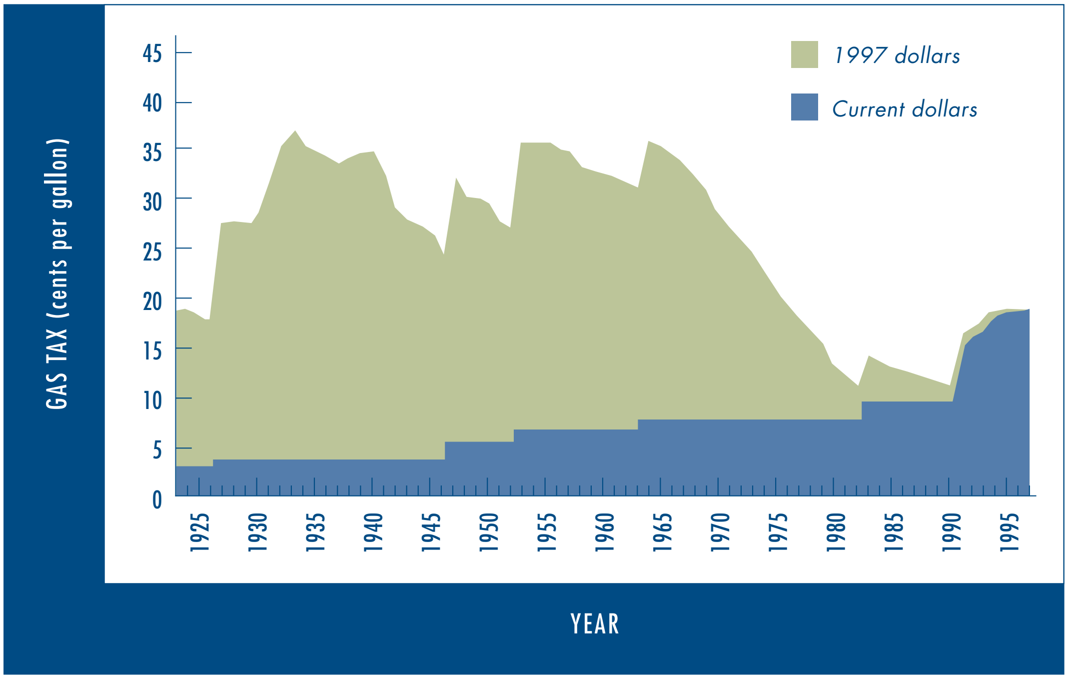
For eighty years, motor fuel taxes have paid most costs of building and operating major roads in the US. As public policy gradually came to favor a transportation system balanced between private cars and public transit, highway user fees also contributed to construction and operation of transit systems. But a major change is now underway, and most citizens are not even

aware it is happening. Federal and state fuel taxes, though still the largest source of revenue for transportation, are rising much more slowly than travel volumes and transportation costs. They no longer cover the costs of building, operating, and maintaining the transportation system. And instead of raising fuel taxes or introducing electronic toll-collection systems, legislators are allowing local governments to raise funds locally even if not through user fees—thus changing the basis of transportation finance. Cities, counties, and transit districts are increasingly turning to "local option transportation taxes" to fund new transportation investments. The most visible examples of these in recent years have been voter-approved sales taxes funding particular roads and rail transit projects.

Shrinking Fuel Tax Revenues

Fuel taxes are generally levied as a charge per gallon of fuel sold. They do not increase automatically when the cost of living rises, as do sales taxes and income taxes. Instead, they must be increased by acts of legislatures. These taxes were in the past enormously popular because many constituencies saw the benefits of transportation investments to be well worth their costs, but this is no longer true. Between 1947 and 1963 the California fuel tax was increased three times, as was the federal fuel tax; but then neither was raised for over twenty years. Since 1982 the California gas tax has been raised only once by the legislature and once again by popular vote when the governor refused to endorse a change without a referendum.

In 1957 the California fuel tax stood at 6 cents per gallon. If it had risen at the same rate as inflation, the state fuel tax would today be set at 32.5 cents per gallon. But it's only 18 cents per gallon, or 14.5 cents below its 1957 buying power. California is not unique; on average, fuel taxes in the fifty states would have to rise about 11 cents per gallon to recoup their 1957 buying power. ➢



California gas tax rate (1923–1997)

While these figures are impressive enough, the situation is actually even worse. Overall new vehicle fuel consumption was about 14 miles per gallon in 1974, and today it stands at about 28 miles per gallon. While we collect fewer pennies per gallon, we drive twice as many miles per gallon—so, when measured per mile of driving, fuel tax revenues are plummeting dramatically.

Big Changes Underway

A surge in local ballot measures has been taking up the slack caused by the drop in fuel tax revenues at the state and federal levels. Before 1980, few states encouraged or even permitted their towns or counties to levy their own transportation fees, except for the property taxes traditionally used for neighborhood streets and county roads. In the '70s, major metropolitan areas adopted permanent sales taxes to support the development of new transit systems; in the '80s, several states authorized local jurisdictions to use ballot measures to raise revenues for transportation purposes. The pace accelerated during the '90s as 21 states either adopted new laws authorizing local option transportation taxes or saw dramatic expansion in their use.

The accompanying table based on data assembled by the Surface Transportation Policy Project shows how dramatic the change has been in just a five-year period. While revenue from user fees increased by eighteen percent from 1995 through 1999, and is still the largest source of revenue, the growth rate in local transportation taxes was several times as great during this time period. Although "borrowing" money by issuing bonds grew at the fastest rate, it remains a small proportion of the total and is not really a source of revenue, since money from other sources is always needed to repay the principal and interest.

During calendar year 2002, American voters considered 44 separate ballot measures to raise money for transportation. Nine of them were state-wide elections, and only a few involved user fees like fuel taxes. Local sales taxes are by far most common in these measures, but some local governments have enacted vehicle registration fees (arguably a user fee, but more accurately a form of property taxation), taxes on real estate sales, local income or payroll taxes earmarked for transportation, and taxes on new real estate developments. ➢

Changes in state and local transportation revenue, 1995–99

	BILLIONS OF DOLLARS PER YEAR		
TYPE OF REVENUE	1995	1999	% CHANGE
State User Fees	36.2	42.7	+18%
Local Property Taxes	5.2	6.4	+22%
Local General Funds	12.3	15.9	+29%
Other State Taxes	6.6	8.6	+30%
Other Local Taxes, Including Local Sales Taxes	4.5	7.1	+58%
State Borrowing	4.3	8.3	+92%
TOTALS	69.1	89.0	+29%

Source: Michelle Ernst, James Corless, and Kevin McCarty. *Measuring Up: The Trend Toward Voter-Approved Transportation Funding.* (Washington: Surface Transportation Policy Project, November 2002). www.transact.org

In California, residents of eighteen counties—containing eighty percent of the state's population—have voted to raise their sales taxes to pay for county and city transportation improvements. Collectively, these measures are producing roughly $2 billion per year for capital investment in new highway and transit facilities and for maintenance and operation of existing ones. These sales taxes are the fastest growing source of money for transportation in California and in many other states.

The popularity of local sales taxes for transportation can be attributed to four important characteristics:

- *Direct local voter approval:* These measures typically result in projects and services near voters' homes and work places, so they personally can appreciate them and anticipate their benefits. In an era of growing distrust of politicians, these measures provide tangible direct local benefits.
- *The taxes have finite lives:* Voters enact transportation taxes that will persist typically for fifteen or twenty years unless specifically reauthorized by another popular vote. Voters thus have a sense of control over their money. If projects don't live up to their expectations or if they fully accommodate growth and reduce congestion, the taxes could end.
- *Specific lists of transportation projects:* The taxes may be used only to build specific projects or fund specific programs, and politicians' discretion to spend the money is severely limited.
- *Local control over revenues:* The money raised locally is spent locally and for local benefit, under the control of a local transportation authority, assuring citizens that the money will not leak into other jurisdictions.

These provisions give citizens more direct control over the transportation investments they pay for than was typical with motor fuel taxes. Sales taxes are also lucrative because they have a broad base. While fuel taxes are paid only when we purchase a single commodity, sales taxes are paid by many more people when they purchase a wider range of goods. So a low tax rate can provide a lot of money. One county, for example, estimated that a one-percent general sales tax produces as much revenue as would a motor fuel tax of sixteen cents per gallon.

What Transportation Sales Taxes Are Supporting

County transportation sales taxes have supported a wide variety of projects, with a fairly even split among highways, local roads, and public transit. Measures adopted earlier generally earmarked revenue for specific projects listed on the ballot; later measures more frequently allocated funds for "program categories," or less explicit groups of uses and projects.

The most consistent trend in sales-tax expenditures across all California counties shows operations and maintenance of existing facilities receiving less funding than new capital projects. However, the content of expenditure plans varies widely from county to county and from measure to measure, reflecting differences in local priorities. Rural counties are more likely than urban ones to put control of sales tax revenues in the hands of local jurisdictions and to spend most of their revenues on highway projects, streets, and roads rather than transit. ➢

Transportation Authorities

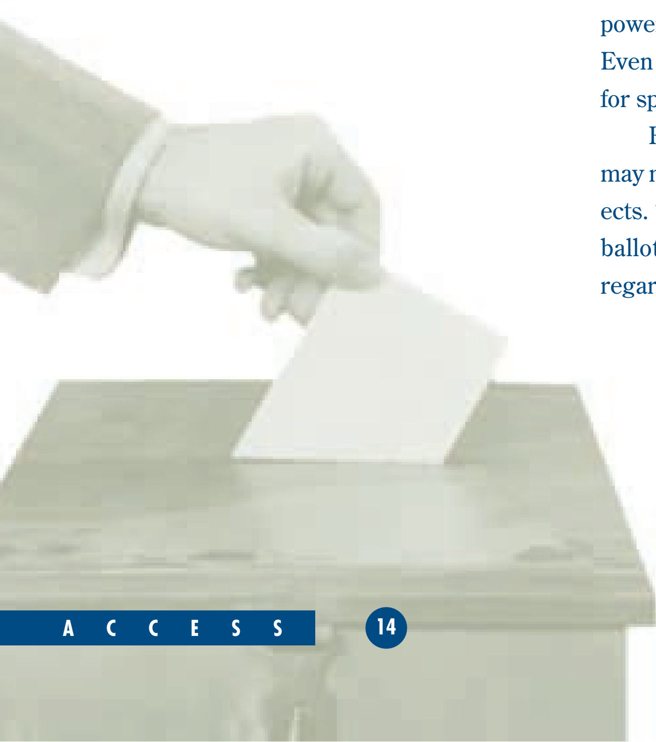
Each county that collects and administers a transportation sales tax has a designated transportation authority to oversee use of the funds. Transportation authorities build improvements themselves, rather than relying on the California Department of Transportation (Caltrans), and proponents cite this shift of authority from state to counties as a major benefit of county-level taxes. Transportation authorities typically claim a number of advantages over Caltrans in developing and delivering transportation projects, including greater sensitivity and flexibility in responding to local needs, less institutional inertia, and flexibility to pursue environmental review and design simultaneously rather than sequentially. The creation of county transportation authorities significantly reinforced planning and delivery of transportation improvements at the county level. But stronger county-level decision-making could be weakening the regional planning mandate of California's multi-county metropolitan planning organizations. State and federal funds, for example, may be diverted to complement county projects, rather than spent on priorities of metropolitan planning organizations. Opportunities to plan regionally also suffer where a large proportion of sales tax revenue is returned directly to local jurisdictions within a county.

The earliest measures envisioned transportation authorities focusing solely on delivery of a few high-profile capital transportation projects, not on planning. Local transportation sales taxes have since evolved into a funding source to serve many ongoing transportation needs, including maintenance of local streets and roads, paratransit services, and transit operations. In California and elsewhere, transportation authorities are playing increasingly central roles in funding the ongoing operations of communities' transportation systems. Because these authorities have evolved without oversight by state or metropolitan planning organizations, their governing boards consider themselves accountable solely to the county voters for implementing their expenditure plans. Integrating land use planning with county-level transportation planning, for instance, is not an explicit transportation authority goal or responsibility.

Limited Spending Flexibility

Supporters tout the benefits of enumerating specific projects in the ballot measures. But voters thereby limit the transportation agencies' flexibility in responding to changes in conditions or needs during the life of the measures. All but five of California's transportation sales taxes earmark some amount of revenue for specific projects, limiting the power of transportation authorities to reset priorities once the tax has been approved. Even when funds are not earmarked for specific projects, the intended uses of revenue for specified program categories are constrained by ballot measures.

Revenue shortfalls, cost escalations, or changing political sentiments about projects may mean that over time agencies will want to deviate from the list of voter-approved projects. Transportation authorities face pressure to expend funds in accordance with the ballot measures and to deliver on the commitments made by local political leaders regardless of changing budgets or shifting political priorities. This pressure can have serious drawbacks. There have proven to be many obstacles to the completion of projects administered by transportation authorities. And the transportation authorities are not required by ballot measures to base their implementation priorities on project cost-effectiveness, nor to spend sales tax revenues on mitigating potentially damaging environmental consequences.



Where Are Transportation Sales Taxes Taking Us?

Transportation tax referenda around the nation are often assumed to be nothing more than a new and politically expedient way of raising needed revenue; but they are doing much more than that. In addition to raising money, they are gradually but inexorably changing the way we finance transportation systems in four fundamental ways:

1) The growing popularity of sales taxes is shifting the financial base of our transportation system from user fees to general taxes paid by all citizens, regardless of their direct reliance on the transportation system. Economists find that user fees have at least some tendency to induce more efficient use of the transportation system; higher fuel taxes might, for example, encourage motorists to acquire more fuel-efficient vehicles. In contrast, general taxes provide no incentive for greater transportation efficiency of any sort. And, while sales taxes and fuel taxes are both regressive, the effects on the poor of user fees are tempered by the fact that those who pay them always benefit from them, while sales taxes burden non-users as well as users. When fuel taxes were adopted in the '20s they were considered "second best" solutions; tolls were better but administratively complex. Today, we can lessen the problems associated with toll collection by implementing electronic systems like Fastrak or Easy Pass. Ironically, user fees are declining in favor of general taxes just as technology is making them more feasible.

2) The rising use of county sales taxes and the growing role of metropolitan transportation planning are consistent with a national trend toward devolution, but federal policy and the rise of county tax measures are in fundamental conflict. While Congress and many states are devolving transportation decision making to the regional level by enhancing the powers of metropolitan planning organizations, county sales taxes can undermine the influence and authority of those groups by focusing resources and decision making on counties and other smaller units of government.

3) Gradually, local taxes are increasingly limiting the transportation policymaking authority of elected officials by requiring that transportation funds be spent strictly in accordance with the language of the ballot measures over fairly long periods of time. And project lists are gradually eliminating the flexibility necessary to adapt to changing needs.

4) While transportation planners and engineers often apply analytical procedures like benefit-cost analysis to determine which investments should be selected, ballot measures proposing local transportation taxes substitute election campaigns—sometimes called "beauty contests"—for analysis. Many believe that greater reliance should be placed on analysis of project cost effectiveness, but by listing popular projects in the sales tax measures, we are gradually limiting the relevance of systematic analysis in project selection. While local control and direct democracy are American ideals, it is probably not appropriate for voters to preempt the application of technical expertise in the design and management of transportation systems.

Most important, there has not yet been a national debate in which Americans or their elected representatives have deliberately considered the merits and drawbacks of these potentially enormous changes. Instead, a significant shift in national policy is occurring without public notice as one local measure is adopted after another. Drop by drop, we are creating a flood of change which may deservedly be called a second revolution in transportation finance. ◆

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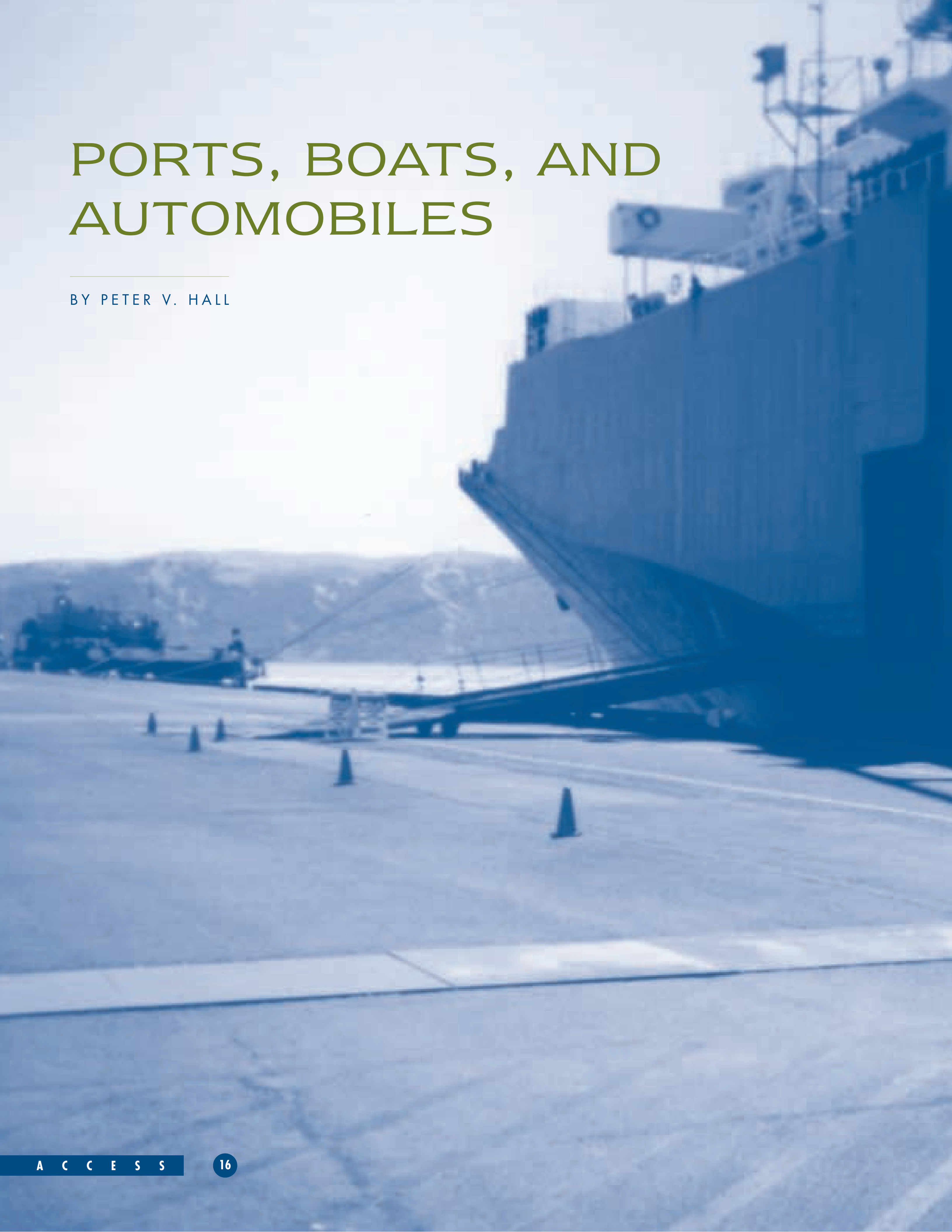
Acknowledgments *: Research at UC Berkeley on local transportation tax measures has been supported by the University of California Transportation Center, the California Policy Research Center, and the California Department of Transportation. Graduate students who have participated in this work include Jeffrey Ang-Olson, Amber Crabbe, Sam Corbett, Todd Goldman, Rachel Hiatt, and Susan Poliwka.*

PORTS, BOATS, AND AUTOMOBILES

BY PETER V. HALL



EVER WONDER HOW new cars get from assembly lines to dealers? Especially those imported cars that have been selling so well in the US? From factory to salesroom, automobiles follow a closely choreographed distribution channel. You've seen car-carrier trucks on the highway and perhaps even specialized rail cars or square-sided ships designed to carry automobiles. Less visible though are the underlying corporate strategies of manufacturers. Although major automobile importers ostensibly do the same thing—make, import, and sell new cars—their overall business strategies make for very different transportation strategies.

These differences are crucial for port authorities and transportation agencies who work with or alongside these firms. A company's logistics system—the way it moves supplies and delivers its product to market—does not simply link factories and salesrooms. It is an integral component of the entire business, reflecting long-established strategic decisions and corporate cultures. An efficient logistics system for one business model may not work well for another.

Consider two firms, Toyota and Honda. Both Japanese-based global automobile manufacturers have been very successful in the US market in the last twenty years. Toyota's share of the US market is now ten percent, and since 1985 Honda has doubled its share of the US market to almost eight percent. Yet they have not reached these successes by the same route. ➢

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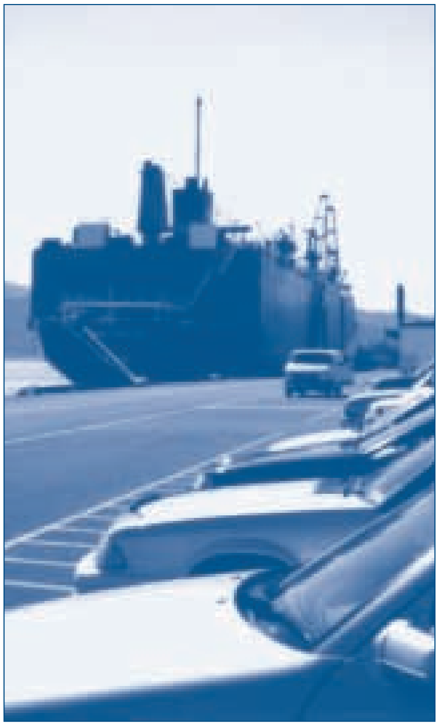


Docks and Dealers

The differences between the firms are immediately apparent at the nation's seaports. Importers like Toyota employ a *dock-based* approach. They use port facilities to receive vehicles from abroad, store them, conduct post-production quality controls, and customize them. They may also combine loads of imports at the docks with models assembled in North America before redistributing these to dealers for final sale. In contrast, for a *dealer-based* importer such as Honda, seaports are simply intermodal transfer points to be passed through as quickly as possible.

Variable approaches to port usage present both opportunities and challenges. Every day, thousands of new cars, pickups, SUVs, and minivans are driven off ships at US seaports enroute to dealers across the continent. According to Maritime Administration statistics, automobiles accounted for about one-tenth of the $670 billion in imports and exports handled at US ports in 1999, while providing many jobs in the port economy. Since 1984, East Asian and European automobile manufacturers have opened assembly plants in numerous North American locations, reducing the overall volume of new imports from a high of over 4 million automobiles and light trucks in 1986 to a low of 1.7 million in 1996. However, the number of imports was just over 3 million in the boom year 2001. This prosperity brings challenges, as automobile-handling facilities compete for scarce waterfront land and for access to congested highways.

Toyota's dock-based system

When a new RAV4 or Prius rolls off the Toyota assembly line in Japan, it is not yet ready to be sold. After a sea voyage of up to several weeks, it arrives at one of Toyota's five US ports of entry. Here it is cleared through customs, cleaned, and, depending on the most recent market trends, customized and fitted with a variety of accessories. It is also joined by Camrys assembled in Kentucky or Ontario and Tacoma trucks built in Fremont. Mixing loads to meet regional preferences, workers then dispatch the imported and domestically assembled vehicles to dealers around the region.

The dock-based approach makes the port facility a key node in the overall production and distribution network. The dock becomes an extension of the factory, with a substantial degree of independence. In Toyota's case, this reflects both the company's internal structure and its overall production strategy. In the 1960s and 1970s, Toyota established a system of multistate regional distributors in the United States that were responsible for arranging port operations and servicing regional dealers. Eight seaports, including the container hub ports of Long Beach and New York, served two company-owned and eight independent regional distributorships.

When Toyota first entered the US market, its imports were low-cost, large-volume models. With low profit margins and the added disadvantage of delay from a long sea voyage, it risked making vehicles that could not be sold profitably. So Toyota created a business model that relies on lowering costs to maintain profitability. By working closely with its suppliers and using just-in-time production techniques, Toyota could be more flexible than the major American automobile firms, while producing at relatively large volumes. The independent regional distributors helped increase the firm's flexibility. They would take standard vehicles and experiment with different accessories to meet specific regional tastes, such as adding air conditioners to vehicles sold in southern states. In this way they helped Toyota more closely match supply and demand.

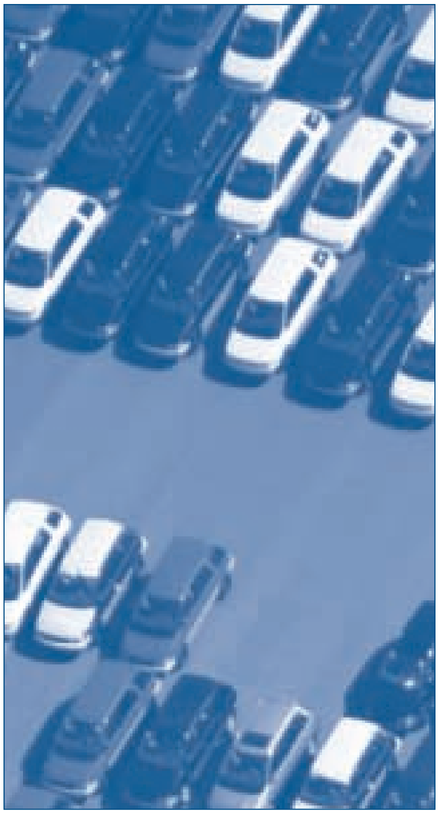
Despite advances in market forecasting and production planning, this problem of matching supply and demand has not vanished. Hence Toyota's port facilities continue to act as storage, accessorization, and customization facilities serving what are now integrated regional distributorships. Since the mid-1980s, the number of Toyota imports has halved, but the imported range has become both more valuable and more diverse. Today, the large-volume models tend to be assembled in North America, while higher-cost and lower-volume vehicles, including those in the Lexus luxury range, are imported.

Port facilities, instead of being closed, continue to play an important role as nodes in this production and distribution system. All but two of Toyota's independent distributorships have been absorbed back into the parent company, but the regional distribution structure remains. Eleven company and two private regional distributorships are responsible for servicing dealers and for collecting and communicating the market information required for production planning. Each regional distributor works closely with one of the dock-based logistics centers.

Honda's dealer-based system

In contrast, Honda uses a *dealer-based* model, which means that port operation is no more than a link in the firm's overall distribution chain. Like Toyota, Honda sells a combination of Japanese- and North American-assembled vehicles. However, shipments of imported CR-Vs and Preludes are not combined at the port of entry with Accords, Civics, and Odysseys from Ohio, Ontario, and Alabama. Instead, the automobiles are shipped directly to dealers from wherever they are assembled. Honda's dealerships form a decentralized network with substantial independence. Vehicle accessorization and customization, such as they exist, happen at the dealerships.

Honda's overall production strategy accounts for its approach to port usage. Honda continually redesigns and rapidly reorganizes its assembly lines for new products. Flexibility in design and assembly at the plant allows the manufacturer to bring new vehicle models into production very quickly; these capacities, more than scale economies, make it profitable. However, this production strategy makes sense only if the firms' distribution system gets the product to market quickly. So Honda does final assembly at the factory and ships automobiles that are ready to be sold. ➢



Not only does Honda use ports differently from Toyota, it uses fewer of them. In 1980 American Honda used seven ports on both coasts, but today it uses only two west coast ports: San Diego and Portland. The differences are not explained by volume alone. Honda and Nissan import approximately the same number of vehicles per year. But, like Toyota, Nissan maintains five import operations on both coasts in the context of a dock-based logistics system.

Similar variation can be found among the major European importers. Mercedes maintains facilities at three US ports—Los Angeles, Baltimore, and Brunswick GA—serving dealers across the continent. This dealer-based approach is consistent with the company's production strategy of using one assembly site per model. Conversely, Volkswagen has adopted a dock-based approach in which it conducts post-production checks at five port facilities, including the Gulf port of Houston. It even chooses to import a substantial portion of its Mexican production by sea, and thus through its port facilities, rather than overland.

Different infrastructure requirements

Both dock-based and dealer-based port users have certain minimum port-infrastructure requirements, which—compared to the container trade—are relatively modest. Channels for ships that carry automobiles typically need be no deeper than 35 feet, so ports that may not be able to handle container ships can manage cars. Both types of port users, of course, are concerned with reducing damage during vehicle discharges, since the smallest scratch to a new vehicle is costly.

But there the similarities end. Key differences between dock-based and dealer-based approaches concern on-dock or near-dock land requirements, surface transportation arrangements, and the nature and duration of contractual relationships between port users and port authorities. Dock-based approaches, for example, require larger amounts of permanent land for storage and processing activities. This can be a problem where land is scarce and valuable. Dealer-based approaches typically require less land on a permanent basis, although they may require temporary storage space to accommodate shifting demand and supply.

Most important, the dock- and dealer-based approaches imply large differences in relationships between automobile importers and public port authorities. To secure the port facilities integral to their overall logistics system, firms using a dock-based approach will make direct, long-term commitments to port authorities. Toyota typically signs leases of up to 25 years. Like the largest container steamship lines, it has been willing to provide significant minimum annual rental guarantees. Commitments of this nature are highly desirable to port authorities, since they shift a significant portion of the risk of port development from the public to the private sector. They are also good for the overall port economy; firms using a dock-based approach are more intimately tied to the local economy, and so provide more opportunities for local employment and other economic spin-offs. On the other hand, agreements of this nature can tie up valuable port land for an extended period, precluding alternative development options.

Firms employing a dealer-based approach typically do not enter into a direct contractual arrangement with public port authorities. Instead, they make use of independent vehicle-processing firms for customs clearance, damage surveys, and other essential import-related functions. These intermediary firms are generally unwilling to enter into

long-term contractual arrangements with port authorities, because their contracts with the automobile manufacturers tend to be limited. Nevertheless, independent processors aggressively compete for new contracts, and so may attract business to a port.

The challenge to port authorities

It behooves public port authorities to avoid policies that dissuade current and potential users. It is clear that only some ports offer operating models compatible with both dock-based and dealer-based approaches, and we have seen selective displacement of automobile importers from some of the largest container ports. For example, whereas in 1980 eight automobile importers had significant presence in the Port of Long Beach, today only one firm uses this port. It is no accident that the remaining firm, Toyota, employs a dock-based approach, since the Port of Long Beach demands long-term commitments from its tenants.

Ports such as Portland, New York, and Baltimore have achieved compatibility with several automobile importers using both dock-based and dealer-based approaches. Other, smaller ports facing an uncertain future in the container trade and seeking to diversify their commodity mix could learn from their experience. Not only do these ports have to meet the basic infrastructure requirements of the trade, they must also provide compatible institutional arrangements. For public port authorities this may mean active involvement in nontraditional port activities like training longshoremen and marketing directly to automobile importers or independent processors.

Port authorities—and indeed other transportation agencies—need to recognize the importance of corporations' overall strategies, as well as variations among them. Anticipating, and indeed shaping, the demands of users requires consciously built relationships with the private sector. Although focus on specific firms may seem to challenge notions of detached public-sector neutrality, relations between automakers and port managers are necessarily collaborative.

Whether your new car gets its final parts at the factory or at the dock depends on whether or not the company and the port have become close partners. But then, in the end, it probably doesn't matter which strategy is chosen. Either approach seems to work well. It all depends on each firm's history, tradition, and culture. ◆

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Are Induced-Travel Studies Inducing Bad Investments?

BY ROBERT CERVERO

MARK HANSEN'S 1995 ACCESS article presented compelling evidence on induced travel demand. Titled "Do New Highways Generate Traffic?" it drew on eighteen years' worth of data for fourteen California metropolitan areas and concluded that added road capacity unleashes new travel. The article showed that added trips quickly fill up an improved roadway, bringing it back to its original congested condition. On average, Hansen found, every ten percent increase in road capacity spurred a nine percent increase in traffic volumes within three or four years. That is, around nine-tenths of added road capacity was absorbed by new trips.

Hansen's study made an immediate splash. Environmentalists and anti-highway groups used it as evidence that building roads provides only ephemeral congestion relief. Other studies soon followed that largely supported Hansen's numbers. Quickly, clichés like "you can't pave your way out of traffic congestion" and "build it and they will come" were leveled against any and all road proposals. In the San Francisco Bay Area, a lawsuit filed by environmentalists held up the region's five-year Transportation Improvement Program, arguing that it failed to account for induced demand. Untold numbers of other road projects nationwide have been delayed as disputes over claims of induced demand are mediated through the environmental impact review process.

Many induced-demand studies have suffered from methodological problems that, I believe, have distorted their findings. I review two here. The first pertains to *causality*: Are rising traffic volumes caused by more road capacity? Or, might added road capacity be even more strongly caused by historical growth in traffic? Most studies have dealt inadequately with the two-way relationship between road supply and demand. The second methodological issue concerns *attribution*: Have past methods properly specified the chain of events between added road capacity and traffic growth? I contend that most have not and that they have typically overstated induced-demand effects. I recently headed a research project that tried to overcome past methodological problems. The results, I believe, more accurately gauge the magnitude of induced demand in California.

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Causality

Past induced-demand studies have confused, or conflated, cause and effect. Basic economics tells us road supply and road demand influence each other—low prices (i.e., swift speeds) made possible by generous capacity encourage travel, and high volumes spur road investments. Over decades, road supply and demand are continuously shaping each other, seeking market equilibrium. Yet very few induced-demand studies have tried to express traffic levels as products of this jointly dependent, two-way relationship.

A recent study at the Urban Transportation Center of the University of Illinois Chicago campus highlighted this causality issue. Using sixty years of data, the study showed that highway investments in metropolitan Chicago could be better explained by population growth rates a decade earlier than vice-versa. For both the Tri-State Tollway (I-294) and East-West Tollway (I-88), the study found that "major population gains occurred in proximity to the expressways over a decade before the construction of the respective expressways." The high correlation between road supply and demand in these two corridors, it was suggested, was more a product of supply chasing demand than demand chasing supply.

The Chicago experiences point to an "induced investment" effect. The transportation planning and capital programming processes are designed to forecast, anticipate, and respond to growing traffic. Thus, the correlation between road supply and traffic could reveal nothing more than that these processes are working well. One might just as well argue that the positive association between highway demand and supply is a reflection of good planning.

Modeling the Two-Way Relationship

Most induced-demand studies have been based on a single mathematical equation that predicts travel (usually expressed as vehicle miles traveled, or VMT) as a function of capacity (usually expressed as lane miles). That is, the demand curve alone is estimated. Nothing is said about the supply curve. Failure to account for the co-dependent relationship between supply and demand produces what economists call ➢

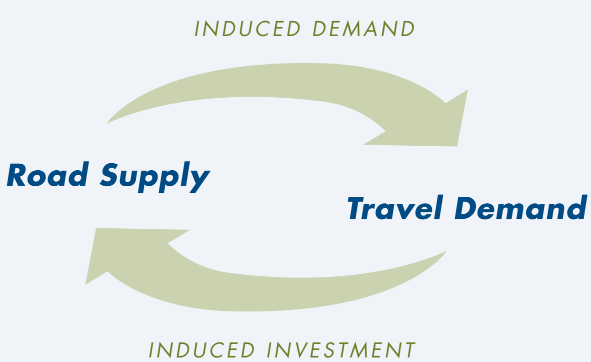


FIGURE 1

Jointly modeling induced demand and induced investment "simultaneous equation bias." This means the calculations that tell us the importance of road investments on travel are thrown off.

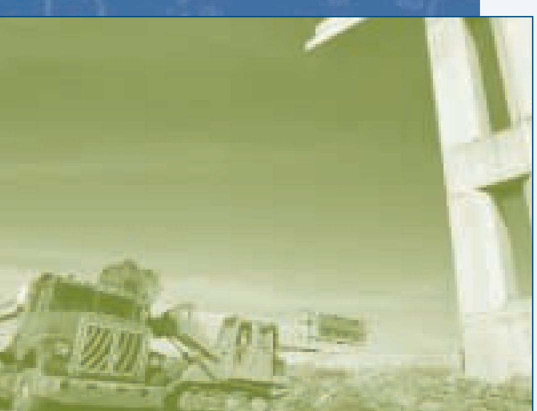
Mark Hansen and I recently tried to redress this problem by estimating how, over time, road investments and demand jointly influence each other. Specifically, we simultaneously estimated *induced demand* and *induced investment* (Figure 1). Similar to the earlier Hansen study, we pooled supply-demand data over a twenty-year period for 34 California counties. Like most previous studies, ours used county-level data, because highway improvements reverberate throughout a network, adding traffic to feeder roads. Examining trends on a specific highway stretch does not capture this, but studying a larger geographic area, like a county, can. The downside is that the resolution of analysis becomes coarse and thus statistically less rich.

Examining simultaneous effects, and controlling for the influences of many other factors that shape both travel demand and road investments over time (e.g., population and income growth), Hansen and I found a moderate degree of *induced demand* in the near term. We found that every ten percent increase in lane-mile capacity across these 34 counties was associated with a six percent increase in VMT. We also found evidence of *induced investment*—every ten percent increase in traffic over time was associated with a three percent increase in road capacity. By examining how current traffic volumes responded to road capacity up to five years earlier, we found even higher levels of induced demand and induced investment.

These results suggested that induced demand is alive and well in California, even when accounting for the joint, two-way relationship between road investments and travel. So is induced investment. Hansen's earlier findings, as well as successor studies, appear to be pretty much on the mark.

Tracing the Causal Chain

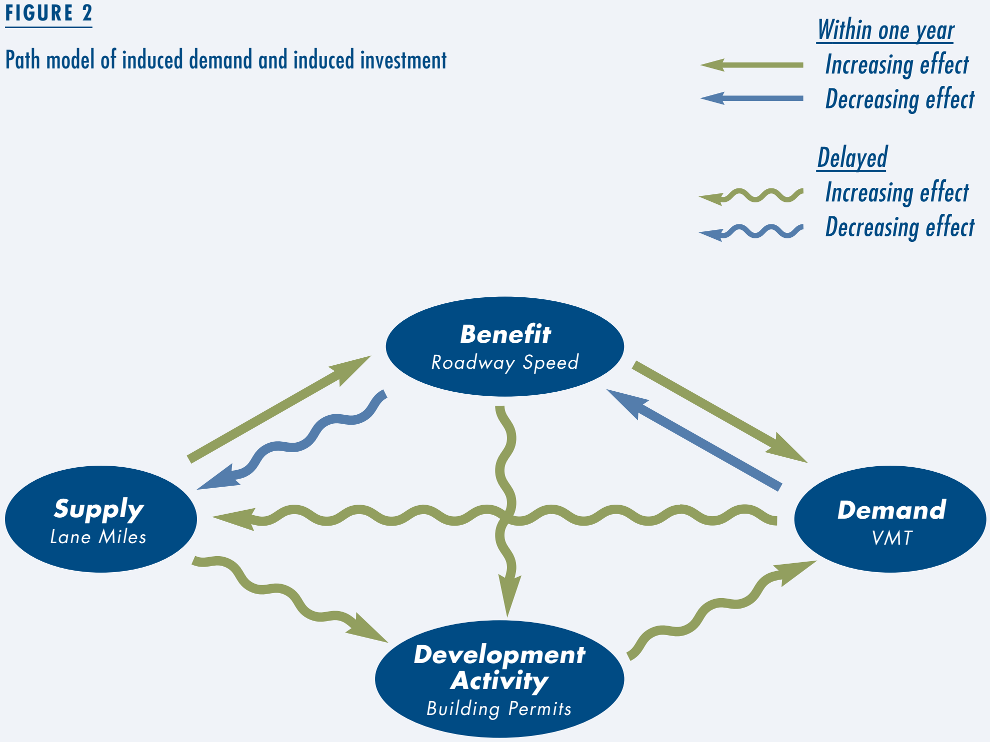
I was not convinced that this recent Cervero-Hansen study told the whole story, however. Using county-level data to study travel on individual roads did not seem right. More appropriate units are transport *corridors*. Equally troubling was the incomplete nature of the analysis—both ours and those of virtually all prior studies. Road investments by themselves do not increase volumes. Only by conferring a benefit, like faster speeds, will traffic increase. Adding a twelve-foot lane along a congested urban corridor matters; adding one in a lightly trafficked exurban stretch does not. We need to determine how lane-mile additions affect speeds and how speeds, in turn, influence demand. We will then see that traffic growth is tied to a benefit (as opposed to an innate or inane factor like new asphalt).



Past studies have also failed to expose the effects of road expansion on land development. Their focus instead has been on changes in travel behavior soon after a road is improved. Some who previously did not travel because of traffic tie-ups now drive—the "latent demand." Others switch routes. Why keep traveling on a parallel roadway when the newly expanded, once-congested freeway is now free-flowing? Still others switch mode. For example, trips once made by vanpool (e.g., to use a carpool lane) are now taken alone. Trips people once took just before or after the peak are now made in the heart of the peak. And some people will opt for longer trips—replacing the two-mile hop to the pricey neighborhood convenience store with a ten-mile jaunt to WalMart—now that traffic's flowing smoothly.

FIGURE 2

Path model of induced demand and induced investment



But over the longer run, behavioral shifts are only part of the story. Real-estate developers know they can make handsome profits building along improved highways. Within a few years of a roadway's opening, fast-food restaurants and gasoline stations pop up near interchanges; office parks and shopping centers open nearby; and new residential subdivisions break ground still farther out. Since such activities add traffic, they should also be part of the induced demand equation.

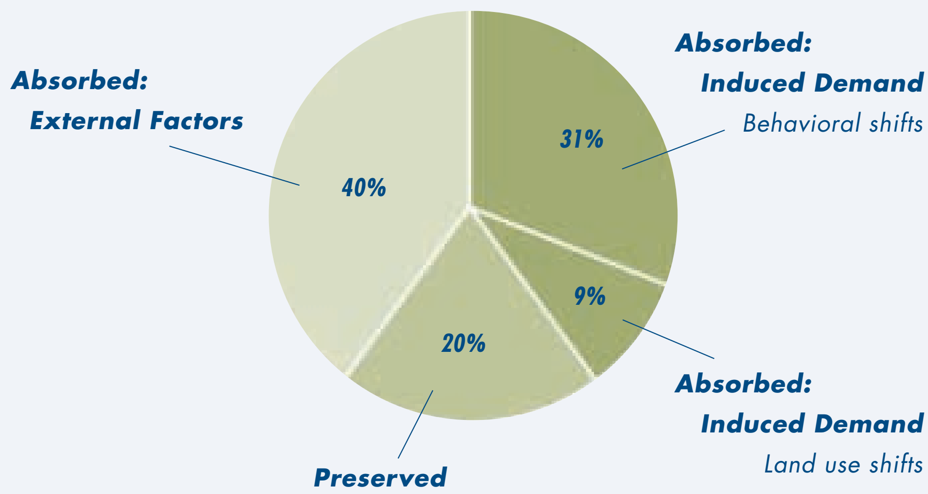
To account for these factors, I recently completed a follow-up study that applied the technique of Path Analysis—a systematic approach that traces the chain of events between an intervention (e.g., road expansion) and outcome (e.g., increased traffic) over a number of years. Using data on VMT, lane miles, and other variables for 24 freeway-expansion projects in California between 1980 and 1994, I estimated both induced demand effects and induced investment effects. Key inputs were building permits for residential, commercial, and industrial developments in four-mile buffers along improved freeway stretches. This allowed accounting of both short-term *behavioral* and longer-term *structural* (i.e., land use) factors to explain induced-demand effects.

Figure 2 outlines the path logic. The effects of lane-mile additions are translated into travel speeds. Higher speeds in turn increase VMT. Handled this way, roads do not directly affect demand; rather their influences are channeled through the mediating variable: travel speeds. Short-term increases in travel (owing to behavioral shifts) can quickly erode speed gains, however. Equilibrium will eventually be reached as speeds and travel volumes adjust to each other. I estimated these simultaneously.

Over the longer run, Figure 2 shows that the combination of added capacity and higher speeds increases floor space and numbers of housing units along an improved freeway corridor. Developers often know about highway projects well before they ➢

FIGURE 3

Apportioning the effects of freeway expansion on traffic growth



are built, and many begin securing building permits and entitlements early on. Thus, they respond directly to the variable "lane miles" in the path analysis. Building activities also respond to performance (i.e., higher travel speeds). All else being equal, suburbanites prefer to live near fast-moving corridors than snarled ones.

Figure 2 also accounts for induced investment (the long arrow going from right to left). By studying the chain of events over an eighteen-year time period, I was able to capture the influences of VMT growth on road investments.

The path analysis showed that for every 100 percent increase in capacity there'd be an eighty percent increase in travel, reflecting increased travel speeds and land use shifts along improved corridors. However, only around half the increases in speed and growth in building permits was due to the added capacity. Factors like employment and income growth accounted for the other half. Accordingly, the traffic gains that one can attribute to the added capacity is actually around half of eighty percent, or forty percent. This is substantially less than reported by past induced-demand studies.

This method also yields useful policy information. By tracing chains of events, one can apportion the share of induced travel due to short-term speed increases and long-term land use shifts. Figure 3 shows that over a six- to eight-year period following freeway expansion, around twenty percent of added capacity is "preserved," and around eighty percent gets absorbed or depleted. Half of this absorption is due to external factors, like growing population and income. The other half is due to induced-demand effects, mostly higher speeds but also increased building activities. These represent California experiences from 1980 to 1994. Whether they hold true elsewhere is of course unknown. We need more studies adopting a similar path-analysis framework carried out in other areas if we're to generalize about forces shaping induced travel demand in contemporary America.

Roads and Decision-Making

There's still a lot we don't know about the induced-demand phenomena, although recent research has filled some knowledge gaps. Nonetheless, highway critics have taken fairly firm positions on the issue, using past research to shoot down any and all road proposals. To the degree past studies have been problematic, so has policy advice.

Over the last several decades and in many corners of America, claims of induced demand have stopped highway projects in their tracks. This is wrong-headed. Highway investment decisions should be based on a full accounting of costs and benefits over the service life of a facility. Induced-demand studies have told us only that some benefits of new or expanded highways get eroded over time. This is important to know, for it gives us a handle on the numerator of the benefit/cost ratio. However, induced-demand studies say nothing about other benefits conferred by highways—e.g. increased economic productivity or satisfaction of one's preference for suburban living.

It is exactly because induced demand erodes travel-time savings that we need better research into travel-demand forecasting. Today's large-scale forecasting methods give little, if any, attention to induced demand. They typically ignore induced investment altogether. Yet, every year, billions of dollars in proposed highway projects rest on these models' outputs. Until we get a better handle on induced demand, the validity of forecasts will always be in question.

Although I personally sympathize with the aims of many environmentalists, fighting highway projects, regardless what benefit-cost numbers say, is misguided. The problems people associate with roads—e.g., congestion and air pollution—are not the fault of road investments per se. These problems stem from the *use* and *mispricing* of roads, new and old alike. They also stem from the absence of careful land use planning and management around new interchanges and along newly expanded highways. Better road pricing and land use planning are more likely to achieve the aims of environmentalists than *carte blanche* bans on any and all road construction. ◆

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MAKING COMMUNITIES SAFE FOR BICYCLES

BY GIAN-CLAUDIA SCIARA

TO THOSE WHO USE a bicycle for transportation, it's a simple but important machine—cheap, flexible, reliable, and environmentally friendly. Moreover, bicycles are convenient. Someone traveling by bike can usually make a trip door to door, choose among various routes, and easily add stops along the way.

In addition to practicality for local trips, bicycles yield measurable health benefits. Public health professionals are beginning to see bicycles and bicycle-oriented community design as part of the remedy for Americans' inactive lifestyles, obesity, and related chronic diseases. Yet despite their obvious advantages, and despite federal statutes that promote bicycle planning, bicycles account for but a tiny percentage of trips in the US, even in "bicycle friendly" communities. Less than half of one percent of Americans bicycled to work in 2000. Estimates of personal and recreational bicycle use suggest that somewhere between 65 and 100 million Americans cycle sometimes. Even so, bicycles are scarcely used for everyday trips.

Bicycles do not belong to mainstream transportation culture here as they do in places like Holland. Today's planners and engineers inherit a legacy of transportation infrastructure built exclusively for motor vehicles. Design, redesign, and construction of bicycle-oriented infrastructure have only recently been acknowledged as public goals. Dispersed land use patterns put many trip origins and destinations too far apart for bicycle travel. But one of the biggest reasons bicycles are underused may be safety: fear of being struck by a motor vehicle discourages many would-be bicycle commuters.

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Thinking Big: Facility Design and Routine Accommodation

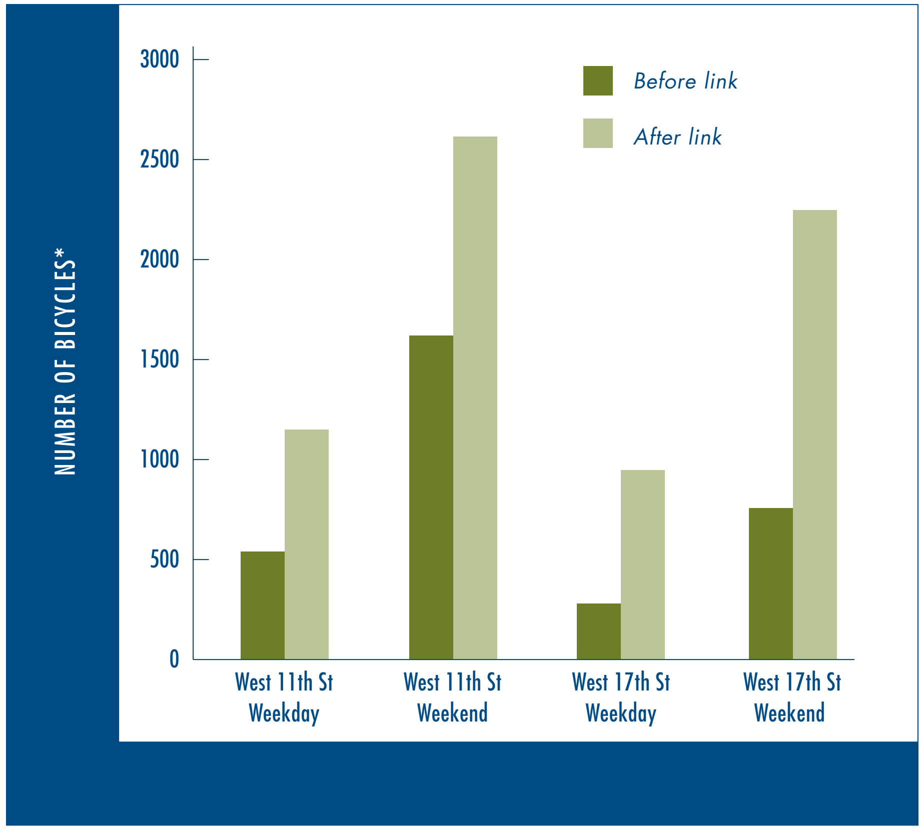
A policy of "routine accommodation" is one sweeping change that could effectively increase bicycle use and, potentially, safety. In *Accommodating Bicycle and Pedestrian Travel: A Recommended Approach,* USDOT acknowledges that "ongoing investment in the nation's transportation infrastructure is still more likely to overlook … than integrate bicyclists." In response, DOT encourages transportation agencies "to make accommodation of bicycling and walking a routine part of planning, design, construction, operations and maintenance activities."

Whether with wide curb lanes or separate bicycle facilities, corridors that accommodate bicyclists will attract potential riders. New York City's Hudson River Greenway is one example. An off-street facility, this path provides a north-south route paralleling Route 9A (locally known as the West Side Highway). Opening a key connection in spring 2001 exposed the latent demand for continuous bicycle facilities among New Yorkers. As seen in Figure 1, the number of cyclists jumped dramatically after the link between 55th and 72nd Streets made the facility continuous from 125th Street in Harlem to the Battery. Already one of the most-used bike routes in the US, the Hudson River Greenway provides a direct, scenic, and virtually auto-free route to downtown Manhattan.

Bicycle facilities—whether dedicated off-street paths, on-street lanes, or bicycle-friendly shoulders—can be controversial, even among bike advocates. Indeed some bicycle planners have argued for decades against separate bicycle facilities. Most notable among them, John Forester argues that "cyclists fare best when they act as and are treated as drivers of vehicles," and that they "can travel with speed and safety almost everywhere a road system goes." He rejects the proposition that "special, safer facilities must be made for cyclists so they can ride safely." However, his position ignores ➢

FIGURE 1

Route 9A Bikeway (Hudson River Greenway): Growth in bicycle use before and after Riverside South Link (2000–2001)



*Total bicyclists during peak periods: Weekdays (7:30–9:30am; 12–2pm; 4:30–6:30pm); weekends (10am–4pm).

Source: NYC Bicycle Lane and Trail Inventory Phase II, NYCDCP, October 2001

the range of ability and experience among cyclists. New bicyclists are more likely to ride where roads are designed with bicyclists in mind, and improvements designed to make potential bicyclists more welcome can have dramatic results. The city of Portland, for example, attributes steadily increasing ridership from 1991 to 2001 to continued investment in its comprehensive citywide bicycle network. Portland also reports that, even with increased ridership, numbers of bicycle-motor vehicle crashes during the 1990s remained constant, which suggests a drop in the collision rate.

As policy, "routine accommodation" promises a middle ground between inflexible requirements for specific bicycle facilities and complete neglect of bicycle improvements. Bicycle design manuals (e.g., AASHTO's *Guide for the Development of Bicycle Facilities*) and professional planners throughout the country have identified numerous bicycle-facility designs for a range of circumstances. But designs must be duly considered and implemented, not just cursorily reviewed and shelved. Routine accommodation implies a deliberate approach to bicycle planning and safety.

Thinking Small: Bringing Planners' Tools Up to Speed

Transportation professionals are often at a disadvantage when trying to identify bicyclists' needs, particularly with regard to safety. When asked to plan for motorized traffic, they can tap authoritative sources with detailed information about roadway volumes, network models, travel habits, collisions, etc. However, data on bicyclists, bicycle trips, and bicycle collisions are sparse. To understand how best to serve bicyclists and reduce the number and severity of bicycle collisions, it is essential to have better data than currently exist about who rides, how often, how far, how long, on what routes, etc., and especially about the causes of collisions.

Bicyclists themselves are a latent source of valuable information. Regional travel surveys and revisions to transportation demand models should routinely draw on data solicited from them. In many places bicycle advocacy groups have grown increasingly involved in local planning efforts. Planners may find cyclists to be effective partners when seeking appropriate facilities and safety measures.

Planners should be able to consult motor-vehicle collision data to identify causes—and remedies—of bicycle collisions. However, collision data are collected in a system geared toward motor vehicles. Collision report forms often do not separately identify "bicycle" as a possible party to a collision. Also, damage thresholds keep police from reporting many bicycle collisions. Although $500 may truly represent minimal damage to a motor vehicle, equivalent damage to a bicycle could render it useless. One potential remedy would require officers to report any traffic collision involving a bicycle. We might then better understand nonfatal bicycle collisions. (Fatal collisions, as a rule, are well documented.)

Sensors in the pavement can make crossings safer for bicyclists

Education and Enforcement

Analyses of vehicle collisions have led to safety improvements through vehicle redesign, driver education, targeted enforcement, and modified vehicle codes. At the 1993 World Conference on Injury Control, Michael Brownlee pointed out that "over the last ten years, the accomplishments in highway safety have overshadowed all other periods in our history. About 40,000 people are alive today because of the progress made in preventing drunk driving . . . An additional 30,000 lives were saved due to increases in safety belt use." What if the safety of bicyclists were accorded comparable priority? What if bicycle and motorist education campaigns were pursued on a scale equivalent to aggressive drunk driving and seatbelt campaigns? Since 1932, the first year when estimates were recorded, over 47,000 cyclists have been killed in traffic collisions, according to the National Highway Traffic Safety Administration (NHTSA). From 1995 to 2000, cyclist fatalities trended downward; nevertheless, an average of over 750 bicyclists were killed each year. NHTSA data do not capture crashes not involving a motor vehicle or not occurring on a public roadway, but experts estimate an additional 80 bicyclists die each year, an annual total of 830 bicyclist deaths. Also, 51,000 cyclists were injured in *reported* traffic collisions in the year 2000, accounting for two percent of all reported vehicular crash injuries.

Some researchers suggest that most bicycle crashes involve only one bike and its rider, but that is not reason enough to ignore bicycle-motor vehicle conflicts. Collisions with motor vehicles can result in serious injury. And because we know many causes of bicycle-motor vehicle collisions, we also know what specific behavioral changes can reduce these conflicts. For example, at intersections and driveways, bicyclists and drivers need to make eye contact with each other. As bicyclists and motorists learn to coexist, each should be on guard for the other's bad habits. Motorists should learn to anticipate bicyclists coming from unexpected locations and directions. Also, bicyclists can actively prevent dooring (i.e., colliding with a vehicle door opening into the bicyclist's path) by riding a safe distance to the left of parked vehicles. A novice bicyclist might ➢

understandably be reluctant to do this, as it means moving into ("taking") the lane; and many motorists do not recognize the danger from dooring.

Safety instruction for bicyclists is important. Bicycle-safety education efforts, where they exist, most commonly target bicyclists. Essential rules of the road for bicyclists are to obey traffic signals and stop signs, be careful entering roadways at midblock, and ride with the flow of traffic. However, motorist education is also important, though often more difficult and costly. In some states, driver education doesn't even mention bicycles. Aggressive public service campaigns are not within reach of many bicycle-planning budgets. Understandably, planners would rather use bicycle dollars to improve and build facilities than to fund costly and marginally effective advertising. Nevertheless, motorist education could save lives by emphasizing caution when pulling into the street and opening doors, consistent use of turn signals, safe speeds, and obedience to traffic signals and stop signs.

Making routine enforcement of traffic laws a priority would help. However, law enforcement officers who are knowledgeable about motor vehicle laws may be less informed about bicyclists' rights and responsibilities. Moreover, some officers are unfamiliar with the infractions most often associated with bicycle-motor vehicle collisions. Some bicycle advocates contend that police are quick to assume the bicyclist caused the collision, or that officers are prone to cite bicyclists illegitimately because they themselves don't know the law. One bicyclists' attorney notes that bicyclists are often cited for speeding when they are not traveling any faster than motor vehicles in the same situation. A study of Los Angeles collision data found most bicycle citations were issued for failure to ride as close as practicable to the right-hand curb, suggesting ignorance of vehicle code provisions entitling cyclists to take the lane in circumstances where curb-hugging is unsafe or inadvisable.

Where to Go From Here

Bicycles are here to stay. Current trends suggest more commuters and recreational riders will turn to bikes for travel, particularly where the design of local transportation networks accommodates bicycles. So planners and policy makers face a choice. They can continue as they have, focusing on cars and considering bicycles only when compelled to. If so, we can expect things to remain as they are, with little support from law enforcement, marginal bicycle facilities, many bicycle injuries, and frustrated bicyclists and motorists.

Or, planners, engineers, and policy makers can acknowledge the benefits of bicycle riding and adopt a policy of routine accommodation. A 1995 survey conducted for Rodale Press queried respondents first about their current primary means of travel and second about their preferred means of travel, "all things being equal, and if good facilities [for each mode] existed." The percentage of people who chose to walk or bicycle increased from 5 to 13 percent under those hypothetical circumstances; those who chose driving alone dropped from 76 to 56 percent.

More and better facilities would enhance safety and encourage riding. More bicyclists might accustom motorists to sharing the road and in turn might encourage still more cyclists. Both factors would increase bike safety. Enhanced bike safety might encourage some motorists to try riding; more people switching to bicycles might mean fewer cars on the road, less congestion, better public health, and safer conditions for bicyclists and pedestrians—and even less competition for parking. ◆

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