TOWARD THE 21ST CENTURY

by Jonathan Gifford

Years before President Bill Clinton came to Washington with his campaign pledge to spend an additional $20 billion annually on America's infrastructure "to develop the world's best communication, transportation, and environmental systems," economists and others were talking about the need to spend more on public works. Their debate has been almost entirely about one question: How much more? Usually overlooked in these discussions is the real infrastructure dilemma of the 21st century—not how much to spend but how to decide what to build and where to build it.

For several reasons, our old ways of deciding these matters simply do not work anymore. Americans today are far more skeptical about the value of new roads, bridges, and sewage-treatment plants—especially when they are located in their own backyard. Their faith that decisions about public works can be safely left in the hands of public officials, engineers, and other technical experts is gone. Reflecting in 1985 upon the final demise of Westway, the proposed interstate along Manhattan's West Side that had been held up for 30 years, Senator Daniel Patrick Moynihan (D.-N.Y.) wrote, "There is a kind of stasis that is beginning to settle into our public life. We cannot reach decisions. Central Park could not conceivably be built today as it was when there was enough power in Tammany Hall to make the decision.... We don't have that capacity."

The persistence of the public-works pork barrel has also contributed to public skepticism. In the same year that Moynihan decried the death of Westway, his Senate colleague, John Stennis (D.-Miss.), celebrated the opening of the $1.8 billion Tennessee-Tomigbee Waterway, recently described by the *Atlanta Journal Constitution* as "a 234-mile broken promise." A classic pork-barrel project, the waterway carries only one-tenth the commercial barge traffic that had been projected.

In an important sense, however, the loss of faith and direction in the way we have built infrastructure in the past is for the better. The methods of the master planner and master builder, the techniques of New York's Robert Moses and his New Deal counterparts, are poorly suited to a dynamic economy whose demand for new infrastructure is unpredictable and constantly changing. In the new economy, the neat but rigid prescriptions of technical experts and planners are as likely to yield expensive and underused projects as improvements in national productivity. There are solutions. Privatization and user fees, touted by many analysts chiefly as ways to raise capital for infrastructure and to streamline operations, have much broader implications than have yet been appreciated. They offer the best guide to creating

infrastructure that can meet the nation's rapidly changing social, economic, and environmental demands.

A growing awareness of the human and environmental costs of roads, dams, and other infrastructure projects brought the public's faith in experts to an end during the 1960s and '70s. Increasingly, Americans came to believe that efficiency, the totem of the experts, is *not* the sole value. People and communities matter; the environment matters. In fact, under close scrutiny the technically objective criteria that engineers and other experts employed turned out to have some rather arbitrary foundations. In some cases they amounted to little more than engineering aesthetics. Why did a new highway have to cut directly through a certain poor neighborhood? Perhaps only because some engineer wanted an extra five miles per hour of speed on a curve. Judging whether that extra margin of speed justified displacing dozens or perhaps hundreds of poor families is not a purely technical question. It is a question of values—and of money and political power.

Because of these concerns, decisions have been opened up to the public, notably with a 1969 federal law requiring an environmental-impact statement and extensive public hearings for any project receiving federal support. This reform and others like it have stopped the worst abuses. It would be unthinkable today to embark on a major infrastructure project without careful consideration of its social, economic, and environmental costs.

An excellent example of how the reformed process works is the Glenwood Canyon project on Interstate 70 west of Denver, one of the only major highway routes west from Denver over the Rockies. The canyon it passes through is a popular recreational spot which has long drawn large crowds of hikers and picnickers during the summer months. Legions of day-trippers once parked along both sides of the old two-lane road, which regularly choked up with heavy truck and recreational traffic, becoming both an annoyance and a hazard. For many years, efforts to improve the road were frustrated by a deadlock between engineers and environmentalists. The highway engineers, led by state highway director Charles "Blacktop Charlie" Shumate, favored a traditional "least cost" engineering design that would have virtually filled the bottom of the canyon with embankments and destroyed much of its scenic beauty. Environmentalists favored a more advanced—and much more expensive—design that would be less destructive. In 1975, after Blacktop Charlie retired, the two sides finally arrived at a compromise. Today, a four-lane divided highway runs through the canyon, much of it in tunnels or elevated. The designers spared no effort. Rock surfaces that had to be blasted were sculpted and then stained to match the surrounding terrain.

The new road is a thing of beauty, a wonderful example of what can be accomplished with genuine cooperation between environmentalists and engineers. But was it worth building? In the end, this 12-mile stretch of highway cost $490 million, or $41 million per mile. (Average costs for rural interstates today are $8–$10 million per mile.) Did the half-billion dollars spent on Glenwood Canyon create a half-billion dollars in benefits to the U.S. economy? That is the kind of question that must be faced in deciding what to build and where to build it.

Unfortunately, the planners and technical experts cannot provide the answers. Cost-benefit analysis, the favorite technique of economists, would seem to offer an obvious solution, but it is a highly uncertain art

even under the best of circumstances, and it is easily manipulated by opponents and advocates of particular projects. Simply estimating how much traffic a new road or rail line will attract, for example, is highly speculative. Some of the worst estimates have been made in mass transit. Miami, for example, began construction of a federally subsidized subway system in 1979 on the basis of an estimate that it would attract enough passengers to drive the cost per passenger trip down to $1.72. But the riders never came. In the end, even after accounting for inflation, it costs Miami (and federal taxpayers) an astounding $16.77 to carry every passenger, an error of almost 1,000 percent. What went wrong? Engineers and planners remain bitterly divided over whether the mistakes in Miami and other cities were the result of honest forecasting errors or efforts to bend statistics to win federal subsidies.

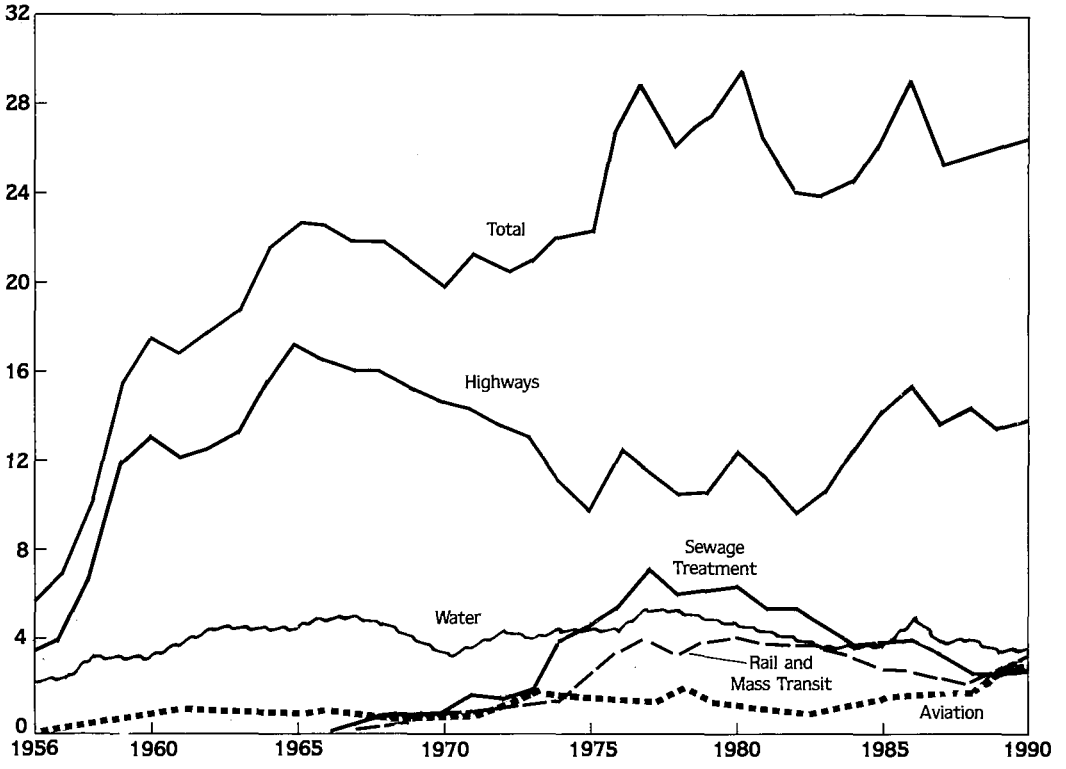
Infrastructure's productivity benefits are likewise very uncertain. Consider a simple example. Each of two towns separated by a river has a concrete-mixing plant and a grocery warehouse. With a bridge, the two towns together might need only one of each. The enlarged facilities would be more efficient than the old ones combined, so grocery and concrete prices could drop accordingly, benefiting the residents of both towns. But estimates of how much they will benefit—how much grocery and concrete prices will drop, for example—are very hard to make and are very easy for interested parties to manipulate and misrepresent. And of course they are subject to endless challenges in today's lengthy process of hearings, court proceedings, and public debate.

The inexactness of cost-benefit analysis creates terrible dilemmas for public officials. How are they to make rational decisions if not on the basis of benefits and costs? Private investors face similar dilemmas when considering an investment. Will it pay a reasonable return? Will a new product or service attract enough customers? Will the costs of producing a service end up exceeding the price it will command in the marketplace? But markets resolve such uncertainties quite differently, by using a tool that is extremely unpopular in the public sector: failure. Markets quickly recognize failure. A subway company that loses its shirt building and operating a system in Miami will not likely repeat its mistakes elsewhere. In the public sector, failure is harder to define, and public officials have every opportunity to delay the embarrassing recognition of costly mistakes by obscuring them in mountains of paper or explaining them away.

Most people are surprised to learn that market approaches have played an important role in the development of American infrastructure. The construction of the railroad system in the 19th century, for example, was largely carried out by private firms. America's $260-billion telecommunications infrastructure of copper and fiber-optic cables, switching systems, and satellites was also built largely through private investment, and in recent years private industry has wired 50 million American households with cable TV. Every year, electric utilities invest $10–$15 billion in new plants and equipment. In each case, government has played a significant supporting role of some kind. Generous land grants

Jonathan Gifford *is assistant professor in the Department of Public Affairs at George Mason University and a Senior Research Fellow at the university's Institute of Public Policy. He is now at work on a book entitled* Flexible Urban Transportation Systems.

FEDERAL INVESTMENT IN 'CORE' INFRASTRUCTURE*
(In billions of 1990 dollars)



*Capital outlays in categories such as energy, NASA, and veterans' hospitals are not included. These totaled some $10 billion in 1990.

Source: Congressional Budget Office

Creating jobs is the perennial justification for spending more on public works, but today's debate has been fueled by a new and more sophisticated argument. As the chart shows, federal investment in infrastructure has been stuck at roughly the same level since the mid-1970s. Measured as a share of gross domestic product (GDP), total spending (including state and local outlays, which dwarf those of Washington) has actually dropped, averaging only 2.4 percent of GDP. David Aschauer, an economist at Bates College, has seized on this decline to help explain the sluggish productivity growth that has afflicted the nation for the past two decades. His "Aschauer Curve" suggests that every $1 spent on public works yields up to $2 of additional GDP—an astounding number that led columnist Michael Kinsley derisively to compare the Aschauer Curve to the Laffer Curve.

Indeed, some of Aschauer's most vocal critics have been centrist and liberal economists. Henry Aaron of the Brookings Institution, for example, reluctantly dismisses Aschauer's findings as "just too good to be true." Aaron and others raise a host of technical objections to Aschauer's work. And they point out that even if his correlation between public works and productivity is correct, his conclusion is probably wrong. Public-works spending likely dropped *because* productivity growth (and thus economic growth) slowed, not the other way around. Moreover, while there was a momentary infrastructure "crisis" during the early 1980s, there is scant evidence today that many needs are going unmet, except in a few locales such as New York City. George Peterson of the Urban Institute, for example, notes that voters now approve nearly 75 percent of all state and local public-works bond referenda. While *certain* public-works projects can yield great benefits, the critics seem to agree, a massive program that raised the federal deficit and thus squeezed out private investment would do more harm than good.

aided the railroads, for example, and telecommunications giant AT&T was shielded by a federally sanctioned monopoly until 1984. The private sector provided the funds and did the construction, and the government set the framework for investment and return—and retained the right to alter the framework, as it did last fall when it re-regulated the cable-TV industry after numerous complaints about price-gouging. These are the models that should guide us in the 21st century. In such hybrid public-private efforts, government establishes the rules of the game, such as requiring that all environmental costs be factored into a project's price, and the private sector figures out what can be done within them. We must use market principles and information both to select projects to be built and to discipline infrastructure use. That means relying upon market prices.

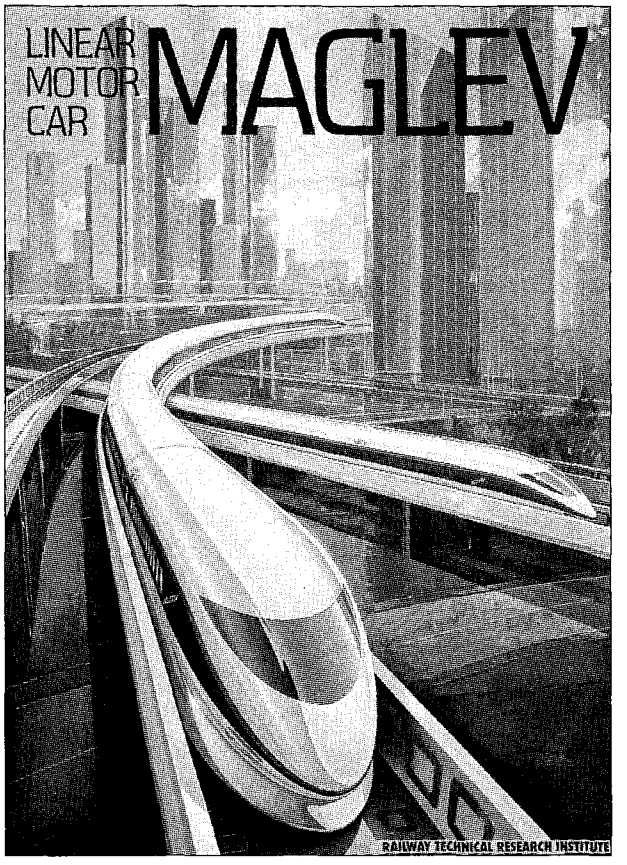
Highways offer some of the most exciting opportunities for the application of these principles. For centuries, tolls have provided a practical means of paying for roads, bridges, and tunnels, but in the automotive age their use has been restricted because toll booths are expensive to staff and operate and because they create intolerable traffic bottlenecks. New technology is beginning to overcome these disadvantages. Thanks to innovations in communication and computer technology during the past five years, tolls can now be collected without requiring cars to stop or even slow down. The vehicles are equipped with identification devices the size of a credit card, and sensors overhead or embedded in the road register the information and charge the toll electronically to the owner's account, just as if he or she had made a purchase with a credit or debit card. Such electronic toll-collection is now being used on the Oklahoma Turnpike and in several other locations in the United States and Europe. (Some old-fashioned toll booths are left in place to handle cars that lack the new technology.) In the New York metropolitan region, the major bridges and tunnels are being outfitted with similar equipment, as are four new highways in California.

These innovations may sound unexceptional, but the implications are enormous. Not least, the extinction of the congestion-inducing toll booth removes a major objection to more privately financed roads, tunnels, and bridges. And the ability to collect user fees efficiently opens up major new opportunities to address environmental and other problems. One of the four projects now being planned in California, for example, is a four-lane expressway to be built in the median of the Riverside Freeway with an intriguing state-mandated feature designed to increase carpooling and thus reduce the number of polluting vehicles on the road. The new road will be free to three- and four-person carpools, but cars carrying only one or two people will have to pay a toll. A variation on this scheme allows tolls to be based on tailpipe emissions, so that economic incentives can be focused on the small number of older cars that contribute disproportionately to auto air pollution.

Toll financing offers a number of other opportunities. One of the major expenses in almost all infrastructure systems is the provision of enough capacity to meet peak demand. Highways, for example, must be built with enough capacity to serve the morning and evening rush hours, even though they are usually underused the rest of the day and on weekends. Electric utilities, similarly, are forced to build enough power plants to meet the surge of demand that occurs on summer weekday afternoons when the use of air conditioners surges. This peak-hour capacity is the most

expensive to provide because it is used only at the peak. The rest of the time it must be serviced and maintained but lies idle. The improved control and fee-collection technologies now emerging from the laboratories will allow prices to adjust accordingly, making peak-time users bear their fair share of the costs and holding demand in check. For example, motorists who use urban expressways during rush hour will pay higher tolls. Some motorists will be deterred, thus lowering the demand for new roads. Those who still insist on driving during rush hour will wind up paying tolls that more accurately reflect their fair share of the road's true costs.

The peak-pricing principle has already been put into operation by some electric utilities and water companies here and abroad. The Potomac Electric Power company (PEPCO), which serves Washington, D.C., and its Maryland suburbs, has started a program called Kilowatchers that permits residential customers to save $7–$9 per month during the summer. PEPCO installs a radio-activated device that allows it to turn off the customer's air-conditioner compressors for 13 minutes out of each half hour on up to 15 summer afternoons. The program has been extremely popular; some 125,000 of PEPCO's 585,000 customers have signed up. PEPCO says that the ability to control peak demand has spared it the need to build a small $100-million generating plant.



A Japanese company's futuristic pitch for "bullet trains." Such trains, magnetically suspended above their tracks, now operate in Japan but are heavily subsidized.

The flip side of using pricing and user fees to regulate demand for infrastructure services is that the revenues they yield can be used to increase the supply of infrastructure—and to indicate where new infrastructure is not justified. During the economic boom of the 1980s, for example, the state of Virginia authorized a private corporation to build a $300-million toll road from the congested outer suburbs of Washington, D.C., near Dulles Airport to the growing town of Leesburg, 14 miles to the west. If built, the road would be the longest privately owned highway in America. The developers painstakingly assembled the needed right of way from private property owners, but in the interim, of course, boom has turned to bust, and the project has not yet attracted the needed financing. Would the toll road's failure show that private roads are not viable? On the contrary, it would illustrate one of their virtues. If it ap-

pears that there will not be enough future traffic to pay for the road, then the market will show that it should not be built. Capital is best invested elsewhere.

A host of other privately financed infrastructure projects are currently on the drawing boards or underway. In Orlando, Florida, a corporation has been granted a state franchise to build a magnetic levitation (maglev) "bullet" train line running from the city's airport to Disneyworld. Maglev trains, suspended above their tracks on a magnetically maintained cushion of air and capable of speeds approaching 300 miles per hour, may prove feasible in the United States for passenger transportation between cities up to 500 miles apart.

Bullet trains, along with fiber-optic "information superhighways" to link every computer in the nation, are a pet project of Vice President Albert Gore, Jr. His statements leave his intentions unclear. Gore says that he is "sensitive to avoiding any distortion of the marketplace," but he has also declared that Washington should intervene "when the marketplace seems to be ignoring essential facets of the infrastructure." To promote information superhighways, he has spoken of using federal money to start demonstration projects. "Once we find a technologically superior alternative, we have confidence that the market is quite capable of recognizing the opportunity and moving in that direction."

Relying on private capital in these and other areas would not magically resolve all of our conflicts over infrastructure projects. But a market approach allows a relatively quick and direct test of whether a project is financially feasible. In the Glenwood Canyon case, a market approach would have told us if the $490 million necessary to build an environmentally acceptable project was worth it. Maybe it was. Or perhaps it would have made more sense to ban trucks from the old road and ship container trucks over the Rockies by rail.

Among the people who make and analyze public policy, however, the virtues of market-based infrastructure development are not widely appreciated. Even those who accept the idea of user fees find it hard to resist the tempting notion of diverting the revenues to other projects—using toll receipts, for example, to underwrite mass transit. Experience shows, however, that users tend to regard such diversions as a new form of taxation, a perception that undermines the popular support needed to put user fees into practice.

The emphasis in the public sector is still mostly on expanding public control, and the latest trend is toward "demand management"—new regulations restricting the demand for infrastructure. This approach is seen in measures requiring utility companies to promote conservation among their customers, laws that make new housing construction contingent upon the availability of new roads and sewage-treatment plants, or outright bans (especially in the West) on using water to wash cars or water lawns. Advocates of this approach argue that there is too much gratuitous use of infrastructure, and they are right to a degree. Accurate pricing would provide the best solutions to such problems, but government agencies still often prefer to resort to traditional command-and-control techniques. The illusion is that these methods yield benefits without costs. In Los Angeles, for example, employers are now being encouraged to regulate the commuting habits of their employees by new laws that impose financial penalties on those that have "too many" employees driving solo to work. Employers are expected to organize carpools and take other steps to discourage

individual commuting. This idea may have a superficial appeal, but the hidden costs are considerable. The employer must divert resources from other productive uses to organize the car pools—perhaps hiring a coordinator—while workers must sacrifice either leisure time or work time to fit into the inflexible pool schedules. A pricing strategy that charged employees or their employers the full cost of transport would let people sort out these trade-offs for themselves, arriving at solutions that are more efficient—and freely chosen.

What market approaches have in common is flexibility. Whether the challenge is building new infrastructure or controlling demand for existing infrastructure, the market not only recognizes and adapts to changing needs but lets individuals and businesses find the best way to use what we already have. The reign of the expert has ended in public infrastructure, but our thinking remains firmly rooted in Enlightenment concepts of prediction and order, reflected in master plans and 20-year forecasts. Even the best laid plans have miscarried. The New Deal's Tennessee Valley Authority has done many things, but it has failed to transform the Tennessee Valley into a prosperous region. The interstate highway system, rightly celebrated for its contribution to national productivity, also did much harm. Many critics have blamed it for speeding the decline of American cities, but few have recognized that generous federal subsidies for interstates also stifled the building of the smaller urban highways that could have eased the gridlock that afflicts cities today.

It is not that government has no role to play. America has a long history of successful hybrid efforts. The public sector has been most effective when it has established a framework in which suppliers and users can figure out how a particular technology can be used productively. This may require creating a market, regulating rates, or some other effort to set the context for the private-sector response. Alice Rivlin, former director of the Congressional Budget Office, suggests a useful rule of thumb: If government must be the builder, responsibility should be left whenever possible in the hands of state and local governments. Not only can they muster the local political support needed to get projects underway, but with their own money at stake they are less likely to choose projects that do not make economic sense.

Building flexibility into our infrastructure will be one of the key challenges of the next century. The age calls for adaptability rather than adherence to rigid standards, a yielding of immutable hard rules to a recognition that in order to prosper one must quickly adapt to circumstance. The hierarchical corporation has evolved into the decentralized business; mass production is giving way to flexible manufacturing of customized products; one-industry cities such as Pittsburgh have been transformed into diversified regions. The character of the entire national economy is shifting, as manufacturing yields to the rising service sector, and as computers and advanced communication technologies revolutionize the production, consumption, and distribution of goods and services. It is difficult to predict exactly what kinds of infrastructure will be needed to provide the "technological sinews" of the future. But to be guided by nostalgic ideas about reconstructing the infrastructure of the past would be a terrible error, just as trying to employ the methods of the past would be. Only a flexible system that responds to changing market signals can effectively provide for this new era.