



Coming Together: The Importance of Integrating Surface Transportation

By Joseph M. Giglio

Do we really need another treatise about transportation problems in the United States? The answer is “yes, if”—if recent changes have made things significantly different in our industry from what they were only a few years ago.

One obvious recent change is the use of transportation vehicles as terrorist weapons. This is a wild card we still need to come to terms with, along with other changes, as well. These changes present opportunities and challenge us to think about highways, public transit, and goods movement as components of an integrated transportation network rather than as an unconnected group of separate modes. Several compelling issues especially command attention:

- New evidence suggests that inadequate highway funding, public-transit shortfalls, lack of track capacity on freight railroads, and obsolete technology in ocean shipping ports are symptoms of our inability to treat the various components of our national transportation network as an integrated whole. This has begun



to place worrisome limitations on how fast the U.S. economy can grow in an increasingly competitive world where national borders mean far less than they once did.

- The arrival of new technology enables us to finance, manage, and integrate various transportation modes in new ways that promote safety, economic efficiency, environmental friendliness, and other social benefits to an extent that we couldn't even dream about just a few years ago. The key to achieving this is a stronger focus on management guru Peter Drucker's classic dictum that the main goal of any enterprise should be to create customers. Doing so means establishing an environment where customers make their travel decisions in the context of time, cost, and value (which is how the world really works most of the time anyway).
- Substantially more money has to be made available in an integrated fashion if these transportation problems are going to be addressed in a timely manner. Comparing cumulative highway and transit needs with actual cumulative highway and transit revenues, one can foresee several gaps over the next 20 years. (Cumulative needs and revenues are calculated by summing the needs and revenue estimates for each year from 2005 to 2025 based on data from the Federal Highway Administration and the American Association of State Highway and Transportation Officials.) The gap between estimated needs and expected revenues ranges from a low of almost \$400 billion to a high of almost \$1.6 trillion. Simply rearranging the same old deck chairs under the mantle of "innovative financing" is a bankrupt approach. We must find ways to add net new dollars to the transportation funding pot beyond what has been available from traditional funding sources in the past.



Another Fine Mess You've Gotten Me Into

In March 2004, United Parcel Service had to shift its hot-package New York-to-Los Angeles containers to trailer trucks from the high-speed daily train service it had worked out with Union Pacific (which likes to bill itself as "the World's Largest Railroad"). The reason? Union Pacific's growing commodity freight business had saturated its available track capacity to a point where it could no longer accommodate special UPS trains.

From one perspective, this represents a symbolic triumph for the privately owned U.S. freight railroads in their half-century campaign to boost shareholder profits by shrinking their rail infrastructure. Less track reduces the operating and maintenance costs that have to be funded out of revenues from moving freight. These savings go right to the individual corporate bottom line (though their national implications may be something else again).

Fifty years ago, U.S. railroad companies had more track capacity than they knew what to do with: double-track (and even four-track) main lines in many places, paralleling bypass lines, alternate routes galore between U.S. cities—to a point where there was never any problem accommodating more trains. But all this track was very expensive to maintain, and too often it wasn't paying its way from the revenues the corresponding track miles could generate.

In response, the railroad companies embarked on a massive track-abandonment campaign. From a purely corporate point of view, it's more profitable to turn away customers because of insufficient track capacity than to be able to accommodate all comers during periods of peak demand.

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Meanwhile, those UPS containers must now move by truck, which adds to traffic congestion on U.S. highways. Domestic freight movement by truck significantly outpaces other modes of freight transportation (see Figure 1), which further inconveniences private automobile drivers.

These motorists were never consulted about this change, nor were they compensated in any way for the new inconveniences imposed on them, not by Union Pacific, which could claim total innocence because no rational person would insist that it accept more freight-

moving business than it could handle, and not by UPS, which could also claim total innocence, as it had been presented with a fait accompli by Union Pacific that left it with no recourse but to shift its package containers to “free highways.”

But suppose these highways weren’t free. Suppose every

driver had to pay a fee each time he wished to travel on them—a fee determined by how many miles he drives, the time of day he chooses to make his trip, the size and weight of his vehicle, the amount of pollution it generates per mile, and the number of other motorists who want to use the highway at the same time. Suppose further that some of the revenue generated by these fees was used to support more railroad track capacity (but not simply higher profits for railroad’s top management) so that highways could be less crowded with trucks. Simple enough in theory, except that railroads, highways, airlines, ocean shipping ports, and transit systems live in totally different transportation funding worlds.

This circumstance directly affects the travel choices confronting, for example, the New York business traveler who must get to a

Monday luncheon meeting in Cleveland with an important client. She can leave her Upper West Side apartment before breakfast and catch a taxi on the corner to LaGuardia Airport (there is still no train service from Manhattan to LaGuardia that bypasses the always-crowded highways in Queens), hoping she has left early enough to provide an adequate time cushion against unpredictable delays, like the one that disrupted her last trip to Cleveland, when a trailer truck lost its brakes on the Brooklyn-Queens Expressway, demolished four automobiles, killed two of their drivers, and stalled the traffic in which our traveler was imprisoned for two hours while she missed her flight and had to postpone her trip to another day.

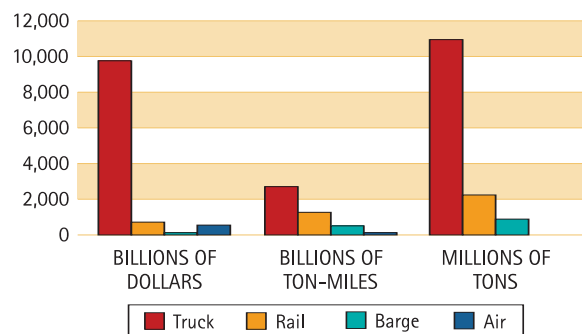
Or, she can fly to Cleveland Sunday evening and check into a hotel. That is, if her company’s bean counters will approve the added cost of the hotel plus dinner and breakfast, not to mention reimbursing her for the extra money she has to pay her day-care provider to stay overnight with her daughter.

Is it any wonder that our traveler is increasingly tempted by the third alternative—to rent a car in the middle of the night and drive the 500 miles to Cleveland (a portion of which she will travel during the morning rush hour, when she will contribute to traffic congestion and air pollution), arriving worn out and bleary-eyed for her all-important meeting?

Equally compelling is the plight of the manager of an apparel chain on Long Island. His main customer base consists of teenage girls, whose mercurial tastes dictate the shortest possible time between his awareness of their lemminglike rush to embrace the next clothing fad and the arrival in his stores of the new jeans that reflect this fad. For this business manager, the just-in-time delivery concept is more than simply a B-school abstraction. It’s a basic reality affecting his bottom line.



Figure 1: U.S. Domestic Freight Movement (2000)

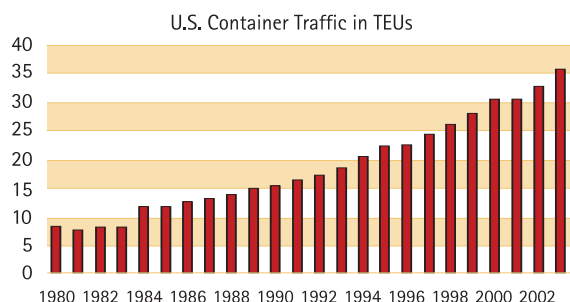


Source: AASHTO,
Freight-Rail Bottom
Line Report

In theory, his Hong Kong suppliers can turn out new jeans to his specifications virtually overnight in their Shenzhen factories and pack them into containers that ship out the following evening from the Port of Hong Kong. In theory, these containers can be transferred from their ships to railroad cars when they arrive at the Port of Los Angeles, then hauled by diesel locomotive up the Alameda Corridor's rail line to Union Pacific's vast classification yard in Colton, Calif., to be sent across country by train. In theory, these trains can quickly transfer the containers full of jeans to trucks once they reach New York, and the trucks can deliver them to the Long Island apparel stores in time to stock the racks for the coming weekend's shopping blitz.

This theory works well enough in Asia, but it breaks down on this side of the Pacific pond. Like other U.S. ports, the Port of Los Angeles sits far back on the technology curve compared with many

Figure 2: Trends in U.S. Container Traffic



Source:
American Association of
Port Authorities
(www.aapa-ports.org)
(vertical axis = millions of
twenty-foot equivalent
units)

foreign ports when it comes to timely unloading of container ships, even though the 14 percent annual increase in freight import volume is outstripping the capacity of its facilities to handle containers efficiently (see Figure 2). Further, the Alameda Corridor rail line has increasingly become a long storage siding where trains sit parked for too many hours because of congestion in the Colton yard. This is caused by inadequate track capacity on Union Pacific's lines out of Southern California, which prevents Colton from dispatching trains in a timely fashion.

When the trains carrying the containers full of jeans finally reach the New York area, they terminate in a rail yard in northern New Jersey. The trucks onto which the containers are loaded face an hourlong trek up the New Jersey Turnpike, across the George Washington

Bridge and the always-congested Cross Bronx Expressway, then down over the Bronx Whitestone Bridge and the traffic-choked Van Wyck Expressway before finally reaching Long Island—often too late in the day to make store deliveries.

It's no wonder the apparel-chain manager has to build at least an extra week into his shipping schedule from Asia. This often forces him to miss significant changes in the fashion preferences of his teenage customers, and he ends up having to "eat" obsolete inventory as a result. This is all because of separate transportation modes that fail to reflect the increasing dependency of today's economy on fast, reliable, fully integrated goods movement from the factory to the customer.



Or consider the anxieties dogging the ambitious young real estate developer who has sunk everything he owns and can borrow into a new residential development around a pristine lake in Rockland County north of New York. He has just spent a Sunday afternoon taking through his houses a young couple from Manhattan expecting their first child. They loved the style of the houses, and the prices were well within what they could afford, but the husband was concerned about the commute to his job in Manhattan. Was there any alternative to a long drive into Midtown? Or a long drive the other way to a commuter rail station where he might (or might not) find parking? Could he seriously think about finding a different job somewhere in northern New Jersey to minimize the time he would have to spend commuting?

The developer's heart sank as he listened to these questions, because he had heard them all too often from prospective home buyers, who ended up shaking their heads and walking away. As he stands alone among his vacant houses, he keeps wondering whatever happened to the long-discussed plan to turn the freight rail-

road that runs through the nearby town into a commuter rail link to Manhattan. Transit ridership on the nation's bus and rail lines may be up by 24 percent during the past six years, but just as with other travel modes, the need for new investment to meet this rising transit demand continues to outstrip available funds by significant margins.

Finally, let's think about the choices confronting the elderly couple living in a classic suburban tract house with a large yard. Their vision losses and diminished reaction times no longer make it feasible for them to drive to the local supermarket, to the dentist they've patronized for nearly 20 years, or to the family doctors they depend on to treat the growing list of ailments that are inevitable with their advancing age.

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Fortunately, they have a married daughter who lives nearby and is able to drive them where they need to go. But the daughter's husband is mulling over the attractive promotion he's been offered by his company, which would require them to relocate to a city across the country. What's left for the elderly couple in that case? There's no local bus service in their community, where everyone has always had his or her own car. Taxi services cost more than the couple can possibly afford.

Doctors and dentists have long since stopped making house calls. And supermarkets have always assumed that their customers would come to them.

Must the elderly couple deal with the reality of their loss of personal mobility by moving to an assisted-care facility for people like them if their son-in-law decides to accept the promotion? Must they sell their house and give up their long-cherished independence in exchange for life in a combination bedroom/sitting room, where everything is presumably done for them?

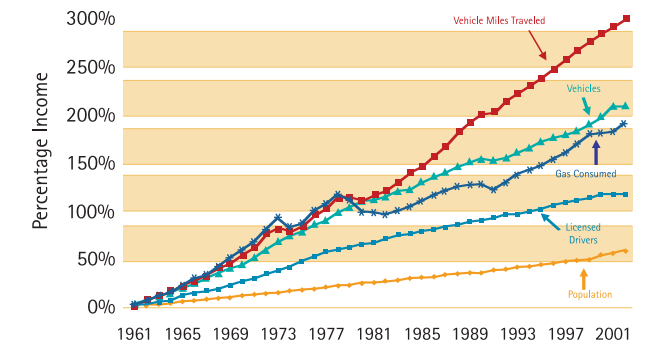
These examples of the frustrations and economic losses arising from inadequate mobility are increasingly reflected in broad quantitative measures of national transportation sufficiency. The American Association of State Highway and Transportation Officials (AASHTO) reports that vehicle miles traveled on the nation's roadways have grown by some 80 percent during the past 20 years (see Figure 3) while lane capacity has increased less than 2 percent. [Figure 3 Source: American Association of State Highway and Transportation Officials and Texas Transportation

Institute] According to the Texas Transportation Institute, the resulting increase in roadway congestion translated into 5.7 billion gallons of wasted fuel and the loss of 3.5 billion hours of productivity during 2003 in the nation's 75 most congested areas, for a total congestion price tag of approximately \$70 billion. This squandering of resources hampers the nation's ability to compete internationally.

Academic libertarians tell us that the answer to this problem lies in allowing individual entrepreneurs maximum freedom to discover profit-making opportunities to serve the nation's complex mobility needs through the free market, with the marketplace itself using its magic to coordinate everything so that enough of the right kind of mobility is provided in the right places.

Meanwhile, stained-glass central-planning types assure us that the answer lies in having government take a properly macro view of mobility needs, working its way down through the hierarchy of details as planners seek to determine what kind of transportation facilities are needed in what quantities and in what places, and

Figure 3: Conditions Underlying Growth in Fuel Consumption at the National Level



Source:
American Association
of State Highway and
Transportation
Officials and Texas
Transportation
Institute

then proceeding to build them in accordance with a detailed master plan. What could be more logical?

To which the libertarians respond that central planners never get it right because they can't out-think the free market. (Except, of course, when it came to winning World War II, for which the federal government chose central planning as its primary economic management tool to produce and allocate the vast quantities of fighting men, guns and ammunition, tanks, planes, and ships that overwhelmed Germany and Japan. But who remembers that even Adam Smith acknowledged that the free market has no role in fighting wars?)

The Last Picture Show

One of the nation's most unusual movie theaters is the Bijou Theater in Santa Rosita in northern California.

Until four years ago, it was no different from any other small-town American movie theater trying to survive on modest ticket sales as the town's last outpost of a vaguely art deco Hollywood social culture that had largely disappeared elsewhere. But things changed when the elderly owner died of lung cancer and his widow announced she was going to sell out to a local real estate developer who planned to convert the Bijou into a private gym and sports-medicine office building (with each use presumably complementing the other).

This announcement created a groundswell of dismay throughout the town at the prospect of losing its only traditional movie theater. This dismay reached such proportions that the town's government found itself pressured into buying the Bijou from the owner's widow to keep it open showing movies. And in a burst of civic enthusiasm that would have done credit to the People's Republic of Santa Monica, the government even proceeded to abolish all admissions charges. Henceforth, the Bijou would be open to all at no cost,

"just like a city park or swimming pool," the mayor proclaimed with great pride. Ever since, the Bijou's operating costs have been funded entirely by Santa Rosita's municipal budget.

Needless to say, this free movie policy has led to a considerable change in the Bijou's attendance patterns. Virtually no one goes to the movies on weekday afternoons anymore. Even on weekday evenings, the Bijou rarely has more than a handful of moviegoers. But on weekends, when local schools and most businesses are closed, the picture changes dramatically. Then, the theater is full of people eager to enjoy its free offerings, with many more waiting patiently in long lines outside for seats to become available. And when the Bijou is playing an especially popular film, these waiting lines begin forming early in the morning well in advance of the noontime opening, reaching such lengths that Santa Rosita's police department has to assign several of its all-too-few police officers to control the crowds outside.

On its face, this sounds like a ridiculous way to operate a movie theater. Everywhere else, movie theaters charge their highest ticket prices on weekend evenings, when moviegoer demand is at its peak, in order to maximize their box office revenues (which not so incidentally spreads out demand by encouraging some moviegoers to attend on weekdays, when ticket prices are lower). But the Bijou has no tickets. Access to its seats is free for everyone. Free, that is, in the sense of not charging any money for seat access, but considerably less than free when one considers the hours that moviegoers have to wait in line for seats to become available on high-demand weekends.

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Access to highway lanes is free to all motorists, regardless of the time of day or day of the week and despite the fact that we must pay for access to every other transportation mode. Free, that is, in not charging motorists a dollar price for each mile they travel, but scarcely free when we consider the time they have to spend traveling that mile during periods of high demand when bumper-to-bumper traffic reduces average speeds to about 10 miles per hour.

Until fairly recently, we had the excuse that the logistical problems of directly charging motorists for highway use made the whole idea impractical. Charging for highway use meant using tollbooths where motorists had to stop and pay from their pockets. And tollbooths meant toll plazas, which consumed so much space that there could never be enough of them on busy highways to avoid long lines of

motorists creeping forward at a snail's pace. So most U.S. highways had to follow the Bijou Theater's practice of being free for everyone.

Fortunately, new technology is abolishing this excuse. In one form or another, every vehicle can be equipped with technology that responds to radio signals from roadside transceivers that identify the vehicle, measure the distance it travels along the highway, and charge the vehicle owner's computerized account for this distance according to whatever rate per mile is in effect. This rate can vary depending on the type of vehicle (more for heavy trucks that wear out pavements faster, less for compact cars), the time of day traveled (more during high-demand periods, less for times when demand is low), the amount of pollution the vehicle generates per mile of travel, and even the actual level of demand at any given

time, pricing access to highways exactly the way we price access to movie seats (except at Santa Rosita's Bijou Theater).

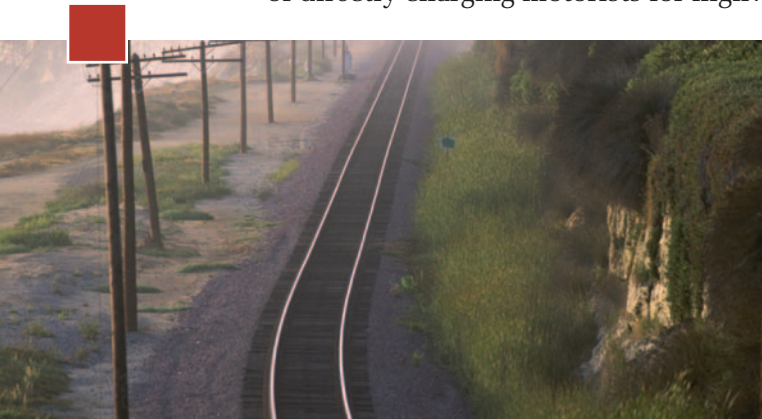
Any discussion of making a publicly owned facility self-supporting with user charges is inevitably going to raise the issue of privatization, which is usually defined as selling off a traditionally governmental operation to the private sector. These days, the advantages of privatization have been clouded by opponents who insist that it has been oversold by too many of the wrong people with their own special axes to grind. One of their favorite examples is the case of British Railways, which became a travesty of privatization because the Tory government of John Major undertook it mainly as a way of looking good for an upcoming election.

But the fact is, many countries (including the United States) have found that the promised benefits of better service at less cost from a private firm seeking profits have become an encouraging reality. Private firms make money in the highway maintenance business because they deliver better service to motorists.

The failures of privatization most often illustrate what happens when a good concept becomes corrupted by the wrong people with the wrong agendas. Yet, privatization happens to be a better-than-good concept when its key features are properly understood and put to work in a prudent fashion. This is true for two simple reasons.

The first is that private firms aren't hamstrung by civil-service salary constraints. They can pay the going private-sector rate to attract and keep the best managers. All else being equal, it is scarcely unreasonable to expect the best managers to achieve better results than managers of lesser caliber who are willing to work for

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the much lower salaries typical of most government agencies. It is simply a matter of getting what you pay for. And these days, the marketplace for good managers is too rich an arena for governments to compete in.

The second reason builds on the same general principle: Private firms have much more flexible procurement regulations. This enables them to acquire the newest tools and technology and put them to work generating more revenue at less cost as soon as they prove themselves. By contrast, government procurement regulations reflect the belief that it's better to spend a hundred dollars on triple-chrome-plated oversight procedures than to risk letting a single dollar slip away to a supplier who doesn't deserve it.



The power of these two reasons to produce better service at lower costs is why the right kind of privatization under the right kind of accountability has to be an important consideration for any enterprise built around the principle of self-supporting user charges. This is the classic “make or buy” concept, and it is too often misunderstood by opponents of privatization. But it is exactly what the managers of highways that become self-supporting must understand in their bones. They must seek every reasonable opportunity to outsource roadway maintenance, the operation of toll-collection systems, and many of the other services they need by relying on private firms competing in the open market. Simply following the traditional route of trying to staff up to do everything from A to Z on their own risks turning the concept of self-supporting highways into little more than a public jobs program.

The most effective model for true accountability in transportation may be found in the semi-autonomous Chinese metropolitan region of Hong Kong. Its subway and commuter rail systems happen to generate attractive profits carrying their daily millions. They are modern, efficient, safe, and very much oriented to the needs of their customers. The two corporations that run them were created and capitalized by Hong Kong's government as distinctly commercial ventures. Their success in strict accounting terms has been so notable that the government is now selling minority ownership shares to private investors through Hong Kong's stock market. But only minority shares, because in Hong Kong, privatization means that individual investors should be allowed to participate in commercial successes that the government has created, when the time is right. This is very different from how the meaning of this term was corrupted in the United Kingdom when the government of John Major sold off British Railways to create a bonanza for hungry city types with little regard for the practical issues that had earlier led Margaret Thatcher to conclude that British Railways was not a proper candidate for privatization.

Why Price Rationing Makes Sense

Given all the above, there are at least three reasons why substituting the price-rationing approach to delivering highway transportation for the Bijou-Theater approach is not simply an option but a necessity:

1. The “free” highway concept increasingly results in insufficient funds to build and maintain the highways we need to support growing economic activity, especially in the metropolitan regions that generate most of the nation's gross domestic product.
2. We may be able to redistribute at least some travel volume from high-demand periods to lower-demand periods if we price highway access sensibly.

- Highway pricing opens up a brand-new funding source that can help the entire national complex of largely uncoordinated transportation modes to function in a more efficient and integrated manner.

Lack of Funds. Today's highway funding depends primarily on motor-vehicle fuel taxes and appropriations from state and local government budgets. But fuel tax revenues can no longer keep pace with needs, because of the self-serving political assumption that it's impossible to "raise taxes" in a nation where taxes have become a dirty word. Meanwhile, government budgets are increasingly burdened with higher funding demands for education, prisons, beefed-up security from terrorist threats, and a host of other deserving public services.

So highway funding inevitably gets short-changed, which is easy to do because it takes a while for the impact to become apparent.

The result is a growing backlog of unmet highway needs that increasingly limits how rapidly the American economy can grow. Almost \$1 trillion will have to be spent on highways and transit systems during the first quarter of the 21st century simply to prevent the already deteriorated condition of the highway system from getting any worse.

Adding in the cost of improving the system to overcome the effects of past under-spending and keep pace with growing demand raises this backlog to \$1.9 trillion (see Figure 4).

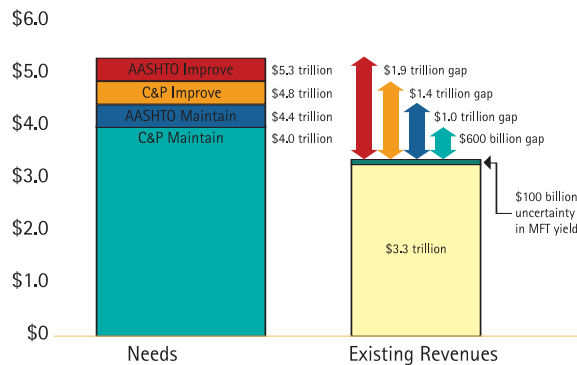
We can quibble about the actual size of these numbers, but their magnitude is so gigantic that it scarcely matters whether the esti-

mates are off by 5 or 10 percent (give or take). What matters are the general proportions of these needs, which are extremely worrisome. And the longer we wait to address them, the worse they become.

The "pay-as-you-travel" concept for funding highways can change all this. Like charging for movie seats, charging motorists for how much they travel, when they travel, how much pollution they generate when they travel, and what kind of vehicles they use for travel has a built-in sense of "fairness" that fuel taxes can never provide. New technology lets us carry the fairness concept even further by providing discounts to certain population groups, such as the elderly, the disabled, and the working poor (who are often highly auto-dependent and least able to change their commuting times). By explicitly dedicating the revenue from highway charges to transportation purposes only, we avoid the negative perception dogging all government budgets that "too many of my tax dollars are used to support services that benefit only other people." Pay-as-you-travel means that motorists support the highways they use according to how much they use them.

Under the right circumstances, this can even turn entire metropolitan roadway networks into fully self-supporting enterprises in the best free-market sense. They could be owned by partnerships of government and the private sector, as in Hong Kong, and be liberated from the arbitrary limitations of fuel taxes and government budgets but subject to the kind of marketplace discipline that encourages them to buy pavement maintenance services, and many of the other services they need, from properly qualified private firms to maximize efficiency. They could recognize the true significance of life-cycle costs when they make trade-offs between capital spending for reconstruction and operational spending for

Figure 4: Cumulative Needs and Revenues, 2000 to 2025 (projected)



Sources: Cambridge Systematics, based on AASHTO data and FHWA's "2002 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance" report to Congress (C&P report). MFT = motor fuels tax.





annual maintenance, with their overall spending levels directly linked to the actual needs of users, as defined by what users are willing to pay for different levels of service.

Managing Travel Demand. In a world where goods and services aren't available in unlimited quantities, some kind of quantity rationing is inevitable. In the former Leninist nations of Eastern Europe, time rationing was the standard method. The prices of consumer goods were kept low enough for everyone to afford, but consumers had to spend inordinate amounts of time standing in line to make purchases. This obviously favored those consumers who placed the lowest value on their time.

The alternative is price rationing. In effect, consumers bid up the price for immediate purchase of a particular good or service until the limited quantity available balances the quantity demanded. This is how the United States rations the supply of most goods and services, with two notable exceptions. One is access to movie seats in Santa Rosita's Bijou Theater, and the other is access to virtually all of the nation's roadway lanes. These exceptions rely on time rationing. This favors those who value their time the least and penalizes those who value their time the most (which is not quite the same as saying that the rich and the poor are equally allowed to sleep under expressway overpasses).

There is some evidence that motorists respond positively to roadway-lane price rationing in the few locations where it has been

tried. They seem willing to make conscious trade-offs between the dollars they spend and the time they save when it comes to making various kinds of trips. The more effective this turns out to be when it is implemented on a sufficiently large scale, the more we can use pricing differences to redistribute travel demand among various roadways and various times of day. The end result will be to bring the actual daily traffic capacity of existing roadway networks much closer to their theoretical capacity. This means more efficient use of already-available lane miles, thereby reducing the number of additional lane miles we need to create. This follows the principle already used by managers of big-city multiplex movie theaters, who charge higher ticket prices on Saturday nights at the theaters playing the most popular movies and lower prices at other times and other theaters. The effect is to redistribute seat demand to maximize the number of "occupied-seat hours per week," which is a measure of how efficiently a movie theater's most important resource (defined as available-seat hours per week) is being used.

Finally, we can also implement something called performance pricing on such highways. This means that we effectively guarantee the motorist a certain average speed on the road, which is posted on variable message signs at each entry point along with the price per mile. If real-time monitoring shows that the average traffic speed is falling below this level, the rate per mile the motorist is charged is automatically reduced (even to zero, in the event of accidents that bring traffic to a halt).

This money-back guarantee provides the motorist with the confidence that she will enjoy the shorter trip time she is paying for, thereby removing a source of doubt about whether roadway pricing can really deliver what it promises and making the highway that much more attractive. At the same time, the potential for the higher rate gives the roadway operator an additional incentive to make sure the highway is providing truly superior service (including rapid clearing of accidents and excellent pavement conditions).

This is the same principle used by private firms that distribute goods and services throughout the marketplace.

Integrated Transportation Funding. Remember what happened when Union Pacific decided it no longer had the track capacity to accommodate special UPS trains of high-priority package containers? UPS now has to move these containers across country by trailer trucks. But doing so only adds to traffic congestion on the “free”

highways they must use, increases pavement wear and tear, and riles other motorists who wonder why their trips have to be slowed by so many trucks.

Wouldn't it make more sense to provide Union Pacific and other freight railroads with enough extra track capacity (“redundant track,” in the strict cost-accounting sense) so that more rather than fewer freight containers can move by rail instead of by truck? Of course it would.

But who is to pay for this extra track capacity? Not the private railroad companies, for they can maximize shareholder value (or at least the profits that top management controls) only by having no more track capacity than they can fully utilize as much

of the time as possible. Perhaps the American taxpayer pays for the extra track capacity, on the assumption that having this extra capacity is “somehow in the national interest.” But we’ve been down that road so many times that it’s worn out its welcome.

Which leaves the national roadway network. By every objective measure, this is the nation’s largest and most important transportation mode. It has the most route miles, moves the most people, and carries the most tons of freight. It reigns supreme at the top of the transportation hierarchy because it is the mode that makes the business plans of all other modes economically viable.

Why does it have this capability? First and most obviously, because it connects all the other modes to each other and to the front doors of the people and business firms that generate travel demand.

Second and equally important, because it functions as the “mode of last resort,” handling the travel demand that other modes, for whatever reason, can’t or won’t accommodate. That, again, is because access to it is perceived as being “free.” Therefore, it allows the other modes to be distinctly choosy about which travel demand they will serve, when and under what conditions, and in what volume. If the roadway system didn’t exist, there is no way the other modes could function as free enterprises (certainly not in the cost-accounting sense, and probably not in the economic sense, either). They would all have to become like branches of the military, maintained at taxpayer expense to serve “the national purpose” (however defined).

This is because economic activity inevitably and unavoidably generates travel demand, which must be accommodated at whatever level it requires if economic activity is to flourish. The American tradition has generally been to encourage individual entrepreneurs to stake out niche markets along this demand curve on which to focus their various transportation services. When the spectrum of services provided by private entrepreneurs leaves gaps where certain travel demands aren’t being accommodated, government steps in to establish public enterprises to fill them. This tradition has worked more or less well, but only because it is backstopped by an extensive roadway system that charges nothing to those not served by other travel modes.

If in the name of economic sanity we try to place the roadway system on something like a paying basis by charging motorists for its use and reserving all the revenues generated for roadway-only purposes, we can certainly enhance the system’s financial status. But we also risk diminishing its backstopping capability with respect to the other modes. Some travel demand may become too costly to be

accommodated as a result. So it would end up not being served and the economic activity it supports could no longer take place.

A more sensible approach (certainly from a broader social and environmental perspective) is to implement roadway pricing in a manner that effectively converts the roadway system into a basic funding source for all transportation modes, while removing the overt price bias that creates the illusion that roadways are cheaper to use

than other modes. This would mean that the backstopping function of roadways would be increasingly carried out through the financial support the roadways could provide for other modes rather than simply acting as the “price-free” mode of last resort.

By generating revenue that enables the other modes to have increased capacity, the roadway system lets these modes accommodate some of the travel demand that would otherwise have to move on roadways. This can benefit everyone. It certainly benefits those motorists who enjoy less crowded roads if more freight is moved by rail than by truck, more intercity travel takes place by air, and more local commuting is done on rail transit lines. And it also produces social benefits by accommodating travel demand in a more economically efficient and environmentally friendly manner. Finally, it expands the arena of choices for

consumers and producers alike. This enhances the overall productivity of a market-based economy, where more choices are always better than fewer choices.

The Cross-Subsidization Fallacy

Some academic economists have a dirty word for generating revenues in one mode that can also be used in other modes. It’s called

“cross-subsidization” and is presumed to compromise the inherent vitality of a free-market society, where every enterprise is supposed to “pay its own way” in the best traditions of a child’s sidewalk lemonade stand. Therefore, the concept of having roadways subsidize other travel modes is a heresy.

It’s true there are institutional, administrative, and public acceptance hurdles to overcome before cross-subsidies can be implemented effectively. But these subsidies can take a wide variety of forms. Sharing road revenue with transit services in the same corridor where the revenues are collected is quite different from using nationwide road revenues to make selected investments in the freight system. Admittedly, there is much work to be done in making these choices work, but there are two reasons why the negative academic view is both unrealistic and wrongheaded.

The first reason concerns the obvious fact that a true marketplace is an open exchange where no enterprise can survive for long without providing benefits to other enterprises in the course of trying to maximize its own profits. This is the whole basis of the barter system, which is a natural outgrowth of the human instinct to trade and therefore the genetic grandfather of market economics. While it can be argued that today’s price-free roadway system is providing benefits to other modes through its backstopping capability, it is doing so in an economically irrational manner that ultimately robs the entire transportation system of the resources it needs to accommodate travel demand in an efficient and socially productive way.

The second reason the academic viewpoint on cross-subsidization is flawed is more down-to-earth. It turns out that most transactions

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in the U.S. economy don't take place in what academic theorists would regard as a true marketplace. Rather, they take place within large, vertically integrated corporations where they are subject to top-down central planning in a rigorous command-and-control environment that would presumably do credit to the Leninist ideal. In corporations that are seriously market-driven, only the sales function actually generates outside revenues through the marketplace. All other functions (making goods, buying supplies, providing the necessary mix of supporting services, and so on) operate within an integrated framework where cross-subsidies are the norm.

That's what defines a modern market economy. Apart from mom-and-pop retail stores that simply buy finished goods for resale, most successful enterprises must create the goods and services they sell on the open market. But the process of creation is so complex as to require numerous specialized internal functions that are effectively cross-subsidized through the external revenues directly generated by the sales function.

The same is true of multiproduct corporations like pharmaceutical companies that regard themselves as collections of quasi-independent business portfolios. Each product line functions as a separate business, recording its own revenues and profits and keeping track of what kind of annual return these profits generate on its invested capital. But not all products are equally profitable in terms of the investment return they generate, and some even run losses in a strict accounting sense. In such cases, does sound portfolio management dictate abandoning these products?

The answer turns out to be no. No, because some of the company's most profitable new products may depend for their sales volume on customers who regularly purchase older products that are steady sellers but whose profits are modest or even negative. Therefore, these nominally "unsuccessful" products are providing internal subsidies to successful products by delivering customers to them.

Since these cross-subsidies are so important to the company's overall financial health and status as a full-service firm, the more sophisticated forms of portfolio management recognize their value and make appropriate allowances. U.S. auto manufacturers, for example, deliberately produce and sell low-margin vehicles that have high fuel mileage to create a window in their federally mandated average mileage standards for the sale of SUVs and other high-margin vehicles whose fuel mileage is much lower.

Converting the national roadway system into a revenue-generating enterprise that can help fund other travel modes is consistent with this reality. It paves the way for organizing the various travel modes that have too long acted like separate enterprises into a single, integrated transportation entity that can properly position itself to serve the national economy in an increasingly competitive world, just like a well-managed corporation.

Sins of Our Old Age

On July 17, 2003, an 86-year-old man driving alone along a downtown street in Santa Monica, Calif., lost control of his car and plunged into a crowd of pedestrians, killing 10 of them.

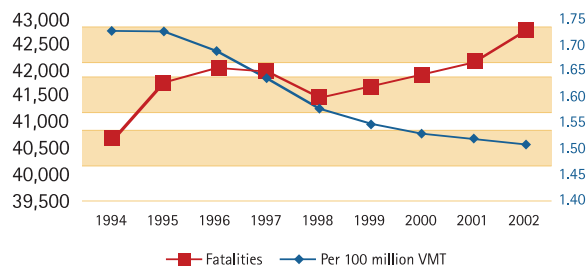
This was one of the largest mass killings in Southern California history. If the man had been behind the barrel of a gun, the incident would have been a major news story all over the country for at least several days, just like the Columbine shootings. But because the man was behind the wheel of an automobile (which, as Figure 5 shows, routinely kill some 43,000 Americans each year), the whole



thing was treated as an “unfortunate accident” and quickly faded away. Even so, the incident is significant because of what it tells us about a growing social and economic problem that has major implications for the future of transportation in the United States.

Throughout most of its first century of infatuation with the automobile, the United States was a young nation, with the age distribution of its population heavily skewed toward the 20s and 30s. During this period, the age issue wasn’t related to being too old to drive but of being too young and having to be carted around after school by the equivalent of today’s soccer mom.

Figure 5: Fatalities per 100 Million Vehicle Miles Traveled (VMT)



Source:
U.S. DOT Fatal Accident
Reporting Systems

Apart from everything else, there were solid economic reasons for this. For not only did the automobile become the most popular transportation mode, it also became the cheapest, because it isn’t burdened by the high labor costs that periodically contribute to forcing other transportation modes, like the airlines, into Chapter 11. People drive themselves around. They volunteer their transportation-operating labor freely and without question, asking nothing in return except cheap gasoline and reasonably uncongested roads, which American society was able to provide for a great many years.

In large part, this cost-free provision of transportation-operating labor was practical because of the human brain’s remarkable capac-

During the decades after World War II, when the United States increasingly structured vast areas of its developed landscape around a growing dependence on the automobile, the unspoken assumption was that driving was a natural and desirable means of mobility.

ity for multitasking. It turned out that a person could drive a car in traffic with surprisingly few accidents while still holding conversations with passengers, thinking about work at the office, scolding children, eating breakfast or lunch, and obsessing about personal problems. Driving a car didn’t require one’s full-time attention to the exclusion of all else. It could be treated as an incidental activity while the driver concerned himself with other things because of the brain’s ability to partition off just enough of its attention to keep the driver out of trouble. Therefore, providing free labor to operate cars in traffic wasn’t perceived as something that came at the expense of other activities.

But one of the penalties of growing old is the gradual loss of multitasking capacity—along with slower reaction times, diminished depth perception, narrowing peripheral vision, and increased difficulty switching our conscious attention from one thing to another. The fact that people over 65 now constitute the fastest-growing segment of the population and will eventually total one-fifth of all Americans calls into question the basic viability of the auto-dependent society we have developed since World War II.

- Do we vastly expand the fledgling paratransit systems that provide on-demand chauffeured van service in some communities so that the elderly can be driven where they need to go? If so, who pays for this? The public purse is already struggling to meet the escalating medical costs of the elderly.
- Do we replace the thousands of spread-out, auto-dependent suburbs with more-compact town-house communities that can

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be served by frequent minibus systems and light rail lines? Groups such as the New Urbanism movement appear to have had some success building a few such communities in U.S. metropolitan regions and integrating local stores with residences so that walking-based shopping trips are practical, but this flies in the face of conventional land-use planning and may require some dramatic shifts in public attitudes.

- Do we restructure our whole approach to delivering common consumer goods and services, so that the provider routinely comes to the consumer's home instead of the consumer having to drive to the provider's store?
- Do we move the elderly into assisted-care facilities where they no longer have to worry about driving themselves here and there? They would have to give up their independence in the process, so they wouldn't have to be a burden on their children or anyone else but a vague and faceless entity called "society."

No one knows what the practical solutions are when a major portion of an auto-dependent society becomes too old to drive. No one even seems to be thinking about it. We have taken for granted something that has been the norm for at least half a century: virtually everyone drives.



At some point the marketplace may intervene to provide answers for at least some of the elderly. What happens before that point is reached remains within the purview of a public that is addicted to the automobile and dependent on highways for its personal and business transactions. At what price can Americans remain on the go and romantically

obsessed with their cars? That is an issue we as a nation will be obliged to address.

Technology to the Rescue?

Anyone who watches the weekend NASCAR stock car races on network television is regularly treated to automobile wrecks of the most spectacular kind. A group of 5 or 10 or 15 cars barreling along at about 150 miles per hour in the kind of close formations we normally associate with urban expressways abruptly dissolves into chaos. Some cars ram the track's retaining walls with unbelievable force. Others spin out and are rammed broadside by cars following close behind. Still others are flung into the air like children's toys and go rolling end over end down the track, often bursting into flames when they finally come to rest. But when it's all over, virtually every driver walks away without a scratch.

NASCAR's experience illustrates that there is, in fact, a technology solution to the issue of reducing deaths and injuries from auto accidents in the United States. The necessary technology to help prevent cars from running into each other at speed and protect their occupants when they do could be built into the next generation of standard passenger cars.

But there's a catch, as there always is when we depend on technology to ride to our rescue: The cost of building this protective technology into new cars would further inflate their sticker prices, which are already higher than most American motorists can manage comfortably. That is why increasing numbers of motorists are turning to the secondhand market (not to mention the third-hand and fourth-hand markets) when they need to replace their cars. This is leading to a steady rise in the average age of cars on American roadways as an increasing (and now majority) proportion of the nation's private auto fleet consists of cars that are in their second decade of operation.

This is the same kind of problem that afflicts other technology designed to make cars smarter, safer, and better able to respond to



road conditions (including the need to monitor the miles they travel so their owners can be charged fair prices under certain roadway pricing schemes). Even if the government were to mandate the inclusion of this technology in all new cars beginning with next year's models (and auto manufacturers were in a position to comply), we would still have to wait nearly a generation before a large enough proportion of the nation's automobile fleet was equipped with this technology to make a meaningful difference.

Can we wait that long? Or does it mean that relying on such technology isn't practical, and that we had better start looking for solutions that aren't burdened by such lengthy lead times?

An obvious example of technology phase-in issues involves roadway pricing. Some of its advocates insist that the technology question is too basic to deserve much attention. The government can simply pass out free signal transponders to all motorists so that the unique ID of each motor vehicle can be read by roadside monitors at each highway on-ramp and off-ramp. That makes it a simple matter for the monitoring system's computers to charge each motorist's account based on the number of miles he traveled, the time of day he made his trip, and the type of vehicle he used. Along with it would be the attractive promise of abolishing all federal motor-vehicle fuel taxes at the end of the year or so it would take to get such a system up and running. Nice enough in theory, but it ignores some practical realities that must be addressed.

Not the least of these is how we deal with vehicles that don't have working transponders. They may belong to visitors from other parts of the country where roadway pricing has not yet been adopted. Or they may be owned by people whose incomes are too low for them to have the credit cards on which most computerized roadway pricing systems are based. Do we simply prohibit such vehicles from using highways that have pricing systems? Do we provide special cash payment facilities for these vehicles (which could be logistically complicated and costly)? Or do we build the transponder into

each vehicle on the assembly line as part of its original equipment, provide it with a payment account system as part of its registration, and somehow work through the complexities of ensuring that only vehicles whose payment accounts are current can be driven legally?

The last approach offers the advantage of linking on-board pricing technology with other on-board technology that enhances vehicle safety and convenience. But we would probably face a phase-in period of at least several decades before enough suitably equipped vehicles would be in operation for roadway pricing to be able to assume the entire burden of funding the maintenance and expansion of the nation's highway system. That's why the most practical approach may be to piggyback onto the "smart card" national ID system that the federal Department of Homeland Security is talking about. If a single electronically encoded card can provide secure identification for every adult in the United States, there's no reason why it can't also serve as a charge card for paying to use various surface transportation modes, including roadways. For sure, this proposal further exacerbates debate about privacy rights.

Meanwhile, we can't put off dealing with the growing backlog of roadway repair and upgrading, whose costs have long since outstripped the dollar-generating capacity of the existing roadway funding system. As AASHTO estimates, the existing transportation revenue system provides less than two-thirds of the funds needed each year to prevent this backlog from becoming unmanageably worse. So we are clearly on the road to ruin in terms of ensuring ourselves of the highway system we need if the nation is to fully realize its economic growth potential.

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But there may be a two-pronged strategy to address this problem. At its heart is a long-term transition to a use-based roadway pricing system that is robust enough to fully meet the nation's roadway funding needs on a regular basis. The logic of charging drivers for the transportation system they use based on how much they use it and when they use it is beyond dispute. As discussed earlier, it extends to the roadway system the well-established marketplace principles that have worked so well in delivering other goods and services to the American people. And unlike the free-movies policy that has left the Bijou Theater in Santa Rosita woefully short of the funds it needs to replace its antiquated sound system and overhaul its air-conditioning facilities, this approach links how much can be invested in the nation's roadway system with the collective judgment of American motorists about how much transportation they want to consume.

But all this will take time to realize fully. For the near-term interim, the obvious choice is an immediate increase in the federal fuel tax—but closely coupled with accelerated use of mileage-based fees wherever and whenever available technology makes this feasible. The gasoline tax has the virtues of being familiar and accepted, having low transaction costs, and being fairly well-related to overall road usage. To make it more effective as a revenue tool, the gasoline tax should be indexed to keep pace with rising costs driven by growing roadway use and general inflation, and its revenues should be formally lockboxed for transportation purposes only to avoid any question of whether these revenues are being “borrowed” to fund nontransportation activities.

This approach piggybacks onto the implicit policy changes that are finally surfacing in the White House and Congress. Both of these branches are seeking ways to encourage the growth of roadway pricing as an eventual replacement for the “temporary” fuel tax increases, which they are beginning to realize are needed to prevent the roadway funding backlog from becoming so unmanageable as to wreck any chance of addressing projected federal budget deficits.

But despite the official speeches in favor of roadway pricing, there is still no evidence that the feds have yet recognized that pricing is simply one element in a larger mix embracing new technology, more savvy management, and a sharper focus on motorists as customers rather than as taxpayers. Nor is there any awareness that the various surface transportation modes must be seen as components of a single, integrated system instead of continuing to be separate political constituencies.

It is important to note that the fuel tax increase proposal would truly be temporary, because it foresees abolishing the entire fuel tax once enough suitably equipped vehicles are operating to make serious roadway pricing sufficiently widespread to take over full funding responsibility for the nation's roadways.

In this context, the avowedly temporary nature of the fuel tax serves as an incentive to impel comprehensive roadway pricing to happen sooner rather than later, with multimodal smart cards helping to accelerate the phase-in by giving drivers a fuel tax credit when they use toll roads or public transit.

But for roadway pricing technology to be accepted by American motorists, it must be perceived as delivering superior travel service on an ever-increasing basis and with appropriate regard for equity and environmental considerations. Implementation of the money-back-guarantee concept should go hand in hand with the implementation of roadway pricing from the beginning so that motorists can see for themselves that guaranteed travel-time savings are the flip side of having to pay for access to highways that were once price-free. Making high-polluting vehicles pay more per mile than lower-polluting vehicles is consistent with the principle of using the price system

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to encourage environmentally positive results. Both concepts come under the heading of managing technology properly, and the management of technology (including expanding the use of smart ID cards to pay for travel in a variety of surface transportation modes) is at least as important as its development.

Tomorrow's Children

In simple terms, the United States should undertake four measures to address the transportation crisis that threatens to undermine the nation's ability to meet the challenges of the 21st century:

1. Provide the country with a truly integrated surface transportation system that emphasizes the travel customer rather than the individual travel mode.
2. Begin this process of integration with freight transportation, in which the immediate need may be the greatest, because so many essential business operations end up being driven by transportation complications instead of the other way around.
3. Fund surface transportation in a contemporary, integrated, and sufficiently robust manner that recognizes the importance of having individual modes complement and support each other financially, just as various business functions and product lines do in a well-managed corporation.
4. Resolve the too-long-neglected safety issues—especially involving automobiles—that threaten to deter and disrupt the use of transportation as a generator of economic activity.

Integrated Surface Transportation. People travel from door to door, and so do goods. In a truly functional sense, they don't travel from passenger station to passenger station, from railroad yard to railroad yard, or even from street corner to street corner. The private automobile is the only travel mode that recognizes this and tries to

accommodate it. All other modes hunker down around their separate pieces of the transportation pie, concentrating on what they think they do best to the exclusion of all else, leaving it to the customer to establish her own door-to-door linkages however she chooses.

The great untruth among transportation providers is, "I run trains [buses/trucks/ships/highways/and so on]." But what they should all be saying is, "I move people and goods." It's the difference between an inanimate process and a customer. And we must never forget (or perhaps start learning for the first time) what Peter Drucker said about "creating customers" being the most important goal of every enterprise. Without customers, in a society like America's, we're just going through the motions, like one of those bored trust fund babies who thinks he'd "like to take up sailing."

Hence, our first task among transportation providers is to establish an awareness of the customer as the number-one focus of all activities. This requires a new mind-set, a new appreciation of technology and how to manage it, and a new understanding of the many different ways to provide transportation and who fills what niche. (It goes without saying that we must make this awareness financially possible, which we'll get to in a minute.)

Freight Transportation. Once again, the experience of the Long Island apparel-chain manager illustrates the problem we're facing.

At the end of the weekend, he sifts through the chain's two-day sales records on his laptop computer, whose software quickly shows him with diagrams and tables the customer buying patterns that have been developing for various apparel items. If he sees that

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there has been a sudden rush to buy jeans with large brass rivets, he can immediately get on the phone with the manager of his main supplier in Hong Kong to talk about this. Since it's already Monday morning in Hong Kong, his supplier can have one of his designers quickly sketch some samples of large-rivet jeans online while they talk so they can all see and agree on the exact appearance of the next jean order to exploit the customer preferences that surfaced on Long Island that weekend. As soon as the phone call is over, the

Hong Kong supplier calls one of his factories in Shenzhen to order production that day of the new jeans for immediate shipment to the United States.

The telephone, computer, and software technology that these participants are using is actually quite sophisticated compared with what was available only a few years ago. In fact, it's so sophisticated that the participants aren't even aware of it as they concentrate on doing time-

sensitive business together just as if they were meeting face-to-face on the street. This is true even though they're on opposite sides of the world from each other, and only a few hours pass between the time when teenage girls on Long Island indicate their preference for large-rivet jeans and the time when factories in Shenzhen are sewing a fresh order of said jeans. In effect, the participants have learned to manage technology in a transparent fashion that eliminates the traditional barriers between different parts of the world, different business firms with different ownerships and managements, and even different positions of the sun in the sky.

Management is really about synthesizing all the functional specialties in an enterprise, its organizational structures, its financing, its technology, and, ultimately, its service to the customer. Management isn't a rigid, by-the-numbers process. It's messy and complicated and needs to be able to roll with the punches.

But when the containers with those large-rivet jeans reach the Port of Los Angeles, we're back in the slow-moving 1960s, where none

of these things happens. A craft union crane operator working for a traditional stevedoring company has to move the containers from the ship to railroad flat cars. A craft union locomotive engineer who works for Union Pacific has to haul the flat cars to Colton (or as near as he can get before his scheduled work hours expire). When the flat cars finally reach northern New Jersey, another craft union crane operator working for another company moves the containers onto trucks driven by craft union drivers who work for a trucking company. They struggle through heavy traffic across two states before the jeans finally reach the Long Island stores whose shopping patterns first gave birth to them. All very slow and state-ly, with each company in the transportation chain doing its own thing with only the barest reference to what the others are doing. They are imprisoned by obsolete technology that they still haven't learned to manage with any aplomb.

We can't afford this any longer. The cost of moving freight the old-fashioned way in terms of higher retail prices, lower business profits, less return on invested assets, all the way back up the line to constrained government tax revenues is becoming a burden that drags down American competitiveness in world markets. It's one of the reasons why so many American firms are moving jobs overseas, and it reflects the too-often forgotten truth that the American transportation system exists to support the economy, not vice versa.

Today's U.S. economy is dominated by services and light manufacturing, not the heavy manufacturing that held sway when the Interstate Highway System was planned and that it was intended to serve. This will be even more so tomorrow, escalating even further the already-high value of moving people and goods. What matters increasingly are no longer antiquated, commodity-oriented performance measures like ton-miles and vehicle miles. These are like

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the “number of units produced” measures that were typically used for state-owned enterprises under the old Leninist system in Eastern Europe and China and that bore no relationship to how well the enterprises were actually serving the economy. Such old-fashioned measures have little relevance for the new economy. They must be replaced by those involving time and reliability, which come closer to the kind of objective assessments that “after-tax income” provides for business firms.

Funding Transportation. It goes without saying that nothing in business works without financing. Ever since early merchants in Middle Ages Europe persuaded local countinghouses to lend them cash so they could buy spices and silks the next day from the caravans arriving from China and resell them to local consumers during the following few months, money today has been turned into more money tomorrow (certainly enough of the time for the process to have become institutionalized).

But as the economic process becomes more complicated, barriers inevitably develop. Often, these barriers arise as business firms become more complicated, specialized, rigid, and distinct. Even so, it's still possible to speculate (if only in the abstract) about standing in the marketplace, holding up our purses, and announcing, “I'm seeking transportation from here to there. Who offers to serve me, how quickly, and for how much?”

In effect, that's the condition we are seeking to restore. But the American surface transportation system has become so ossified that nothing like this can be re-created in simple terms. So we have to improvise.

In the mid-1950s, President Eisenhower appointed his old Army buddy General Lucius Clay to head a commission that would recommend how best to finance construction of the federal Interstate Highway System. General Clay duly reported that federal bonds should be issued to fund these highways, and that the highways

should be tolled to generate a revenue stream to retire the bonds and provide for long-term maintenance. This followed the simple and straightforward principle previously adopted by individual states for such highly successful toll roadways as the Pennsylvania Turnpike.

But irrational forces in Congress twisted this around so that the end result was no federal bonds or tolls for the interstate system, pay-as-you-build financing for the highways with modest state participation, and a federal motor-vehicle fuel tax that was claimed to be adequate for long-term maintenance (assuming that inflation remained near zero and the U.S. population didn't really grow).

The bottom line is that the interstate system got built without tolls and with too little regard for the real impact of life-cycle costs (which is why much of its pavement was underbuilt to save on construction costs and therefore became a maintenance nightmare later as heavy truck traffic increased). And it has been deteriorating ever since, since fuel taxes don't begin to provide enough revenue to cover the increasingly costly maintenance—in an increasingly inflationary environment—of its cheaply built pavement, with members of Congress seeming to believe that any kind of tax increase is a recipe for losing the next election. So General Clay was right and Congress was wrong. And we are all paying the price in impaired and congested highways that are increasingly expensive to maintain, while trucks are subsidized, railroad track mileage shrinks, and public transit becomes less competitive.

The best option now is to focus immediate tolling of existing interstate highways on the most highly congested sections. Together with a reasonable (if temporary) increase in the federal fuel tax to offset past inflation and keep its revenues indexed to future inflation, this can begin to provide the revenue stream needed to prevent highways from deteriorating further, restore some of the capacity we've lost from inadequate maintenance in the past, and reconstruct pavements to more rugged standards so they will require less



maintenance in the future. Because today's electronic toll-collection technology makes it possible to retrofit many existing highways so that we can charge for their use on the basis of miles traveled and size of vehicle used, we can institute fairly quickly a revenue stream that will finally carry us forward rather than backward.

But our ultimate goal must still be the kind of highway pricing system that can provide us with a 21st-century funding source for all forms of surface transportation. No travel volume should be forced onto highways simply because the most logical mode of the transportation system lacks the capacity or the operating dollars to accommodate it. In addition, highway users should pay their fair share in a transparent, immediate way that may help create further opportunities for unsubsidized public transit.

Safety Issues. The most critical surface transportation safety issue involves the fact that automobiles are killing more than 40,000 people a year in the United States, and this number is rising. This clearly qualifies as a major health epidemic, whose resulting medical

care and property damage impose increasing cost burdens on the American public. If such a death toll were attached to an obvious viral disease, the public outcry would be sufficient to force the federal government to fund large R&D programs to find a cure. But as matters now stand, the powers that be are too willing to look the other way, even as the rising epidemic of U.S. auto deaths threatens to cause behavioral changes that could hurt the American economy.

The most obvious behavioral changes would show up among the growing segment of the population that is over 65. People become more cautious as they grow older, more aware of dangers to their personal security, more willing to change their behavior to avoid perceived threats they may have

shrugged off cavalierly in their younger days. So the threat of death or serious injury from auto accidents becomes an increasing worry to a steadily aging American population. This worry becomes more sharply focused among even broader segments of the population as local TV news shows devote growing amounts of airtime to dramatic footage of serious traffic accidents and their resulting deaths and injuries (in an effort to offset the significant diminishment of street crime across the country and the fact that the incidence of fires is at a quarter-century low).

It is therefore inevitable that rising numbers of Americans, more and more conscious of the threats to their safety that auto accidents pose, find more reasons to drive less, to shop less, to go to movies and restaurants less often, to spend more of their time in the apparent safety of their homes. And since virtually all driving trips generate at least some economic activity, the rising fear of auto accidents among large segments of the population poses the specter of less economic activity per capita in the future. Therefore, even if we were willing to take a rather chilling bean counter's view of the value of an American life, we still couldn't ignore the economic consequences of having an increasing number of these people participating less and less in the nation's marketplaces out of a fear of driving.

We saw earlier that the right kind of on-board technology can reduce the incidence of motor-vehicle accidents while virtually eliminating deaths and serious injuries in accidents that are unavoidable, and this has significant cost-saving implications as well as life-saving implications. So the real issue is one of national will more than feasibility or cost, which provides some basis for optimism.

After all, Canada has a lower auto fatality rate per hundred million passenger miles than the United States. So do the United Kingdom and the rest of Europe. So do Japan and Australia and many other nations that are farther down the economic development curve

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than the United States. We need to learn from these other nations in order to hasten the day when better on-board motor-vehicle technology can make zero traffic fatalities a realistic goal for the United States.

Strategic Directions

We have referred several times to the importance of managing transportation technology. But let's be clear about the kind of management style we're talking about.

It isn't like that of the typical football coach, who calls every offensive play and defensive formation himself and whose players on the field simply follow orders as best they can (even when the other team does something unexpected). Instead, we're talking about a management style that's closer to that of a basketball coach. Players on the court have to respond instantaneously to the challenges and opportunities presented by the other team, which can rarely be anticipated with much certainty. Therefore, the coach has created in his players an instinctive awareness of the game environment (which is always changing) and the importance of being alert to unexpected opportunities.

To be a savvy transportation manager, this means knowing in advance what you are trying to accomplish, determining how existing technology can help you accomplish this, and looking for opportunities to use technology in ways that its developers may never have contemplated. A real-world example illustrates what this means.

When electronic toll-collection technology first appeared in the early 1990s, some older, tradition-directed toll authorities saw it as a way to help them keep their unionized labor costs under control because it could replace the manual tasks involved in collecting tolls the old-fashioned way. To them, therefore, managing this tech-

nology had a narrow, cost-accounting focus that they measured by "revenue per employee."

Other toll authorities recognized that this technology could collect tolls anywhere on the roadway without interfering with vehicle speeds. Therefore, it eliminated the need for tollbooths, land-hogging toll plazas, and long lines of motorists queuing up to pay tolls. If the authorities were expanding their scope by building new toll roads, they could use this technology to make their operations smoother and more efficient. So their management of this technology had a strong operations focus that they measured by "vehicle throughput per lane mile."

Still other toll-road operators saw things in a very different light. They realized that the ability to collect tolls anywhere on the road while they monitored where each vehicle entered and left meant they could offer motorists more travel choices than had previously been the case. Such choices could involve how much of a particular trip to make using the toll road (because operators could charge motorists so much per mile traveled rather than simply a flat rate), when to make a trip (because they could charge motorists higher rates during peak commuting periods and lower rates at other times), and what kind of vehicle to use for a trip (because they could charge heavy trucks a higher rate than compact sedans).

All of these changes turn toll-paying motorists into customers making choices. So this kind of technology management had an obvious customer-choice focus, which could be measured by "average customer miles per hour and the standard deviation of customer miles per hour."

The next step (hopefully) is an expanding group of transportation professionals who understand how smart cards, more-sophisticated transponders, built-in location-detection systems, and the other grandchildren of the original electronic toll-collection technology can be used to establish a new source of funding for all surface

transportation modes by exploiting the principles of customer choice to generate new dollars. To these visionaries, technology management becomes nothing less than a basic tool for managing entire “integrated portfolios” of surface transportation modes, just as is done in the most sophisticated multiproduct corporations. This might begin at the level of metropolitan regions, eventually moving up the hierarchy to entire states, then to clusters of closely linked states, then finally to broad regions of the nation, to provide virtually seamless and reliable transportation that could make the time dimension of surface travel increasingly irrelevant.

The availability of new technology may be a necessary condition for integrating various surface transportation modes into the kind of smoothly functioning and highly reliable intermodal travel continuum that the 21st century demands. But it is scarcely a sufficient condition. Equally important is the new understanding needed among transportation providers and transportation consumers alike of the many different levels of integration that new technology makes possible, to bring together in meaningful ways public and private infrastructure and its managers with vehicles and their operators.

This must reflect the critical links between the drivers of vehicles and the companies that make these vehicles, between the shippers and receivers of freight and those who move freight, and between private enterprises seeking higher profits and public enterprises seeking the most effective use of government dollars in supporting the national economy. It must integrate paying for the use of transportation infrastructure, managing this infrastructure and marketing its use, developing the new technology it needs to improve service to customers, and designing financing systems that expedite the smooth and logical flow of funds between all these components.

This is the kind of bold new vision for surface transportation that the United States needs if it is to truly prosper in the 21st century rather than simply limp along trying to play catch-up ball. It is the

long-overdue replacement for the past century’s vision, embodied in the Interstate Highway System, which used imagination and concrete to remake an America that still thought of itself too much in horse-and-buggy terms.

The new vision we need must use imagination and information to connect people and organizations, expand mobility, improve safety, raise productivity for moving both people and goods, and generally upgrade the management and output of the physical transportation system. This means learning how to use technology to manage the evolution of diverse surface transportation modes in the direction of becoming a truly unified system.

From one perspective, the history of technology is on our side because it suggests that the basic physical tools are coming, since technology has always had an inevitable upward curve. What matters is how we manage its use. It may be too early to say whether integrating technology into the management of the surface transportation system can materially reduce the need to build more capacity. But it’s obviously going to make more of a difference on this score than continuing to do things the old-fashioned way would.

In the end, the most critical measures of how well our transportation systems are serving us may be those for which no numbers are currently being collected on anything like a comprehensive basis. But one of these measures is likely to be average trip time per mile of travel. The smaller this measure (and its standard deviation) becomes, the better it will be for the American economy.

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