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REDUCING CONGESTION

Congestion Pricing Has Promise for Improving Use of Transportation Infrastructure

Statement for the Record of
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Physical Infrastructure Issues

May 6, 2003

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Highlights

Highlights of GAO-03-735T, a statement for the record to the Joint Economic Committee, U.S. Congress

Why GAO Did This Study

The nation's transportation systems have become increasingly congested, and pressure on them is expected to grow substantially in the future. Most transportation experts think a multifaceted approach is needed to address congestion and improve mobility. One potential tool is congestion pricing, that is, charging users a toll, fee, or surcharge for using transportation infrastructure during certain peak periods of travel. Pilot projects to test this approach are currently under way in the United States and the technique has been used more extensively abroad.

Interest in the usefulness of congestion pricing has been growing, as evidenced by several recent proposals. However, there have also been concerns raised about the fairness of such practices to some users of transportation systems. GAO was asked to identify (1) the potential benefits that can be expected from pricing congested transportation systems, approaches to using congestion pricing in transportation systems, and the implementation challenges that such pricing policies pose, and (2) examples of projects in which pricing of congested transportation systems has been applied to date, and what these examples reveal about potential benefits or challenges to implementation.

This statement is based on prior GAO reports and other publicly available reports.

www.gao.gov/cgi-bin/getrpt?GAO-03-735T.

To view the full statement, including the scope and methodology, click on the link above. For more information, contact JayEtta Hecker at (202) 512-8984.

What GAO Found

Congestion pricing can potentially reduce congestion by providing incentives for drivers to shift trips to off-peak periods, use less congested routes, or use alternative modes, thereby spreading out demand for available transportation infrastructure. Congestion pricing also has the potential to create other benefits, such as generating revenue to help fund transportation investment. Possible challenges to implementing congestion pricing include current statutory restrictions limiting the use of congestion pricing, and concerns about equity and fairness across income groups. In theory, equity and fairness concerns could be mitigated depending on how the revenues that are generated are used.

Evidence from projects both here and abroad shows this approach can reduce congestion. Such projects have also shown they can generate sufficient revenue to fund operations—and sometimes fund other transportation investment as well. However, projects were not necessarily able to demonstrate benefits for the full range of transportation users. For example, those who were able to use the special freeway lane saw a decrease in travel time. But, in some cases, there was little systemwide reduction in travel times, and congestion increased on alternative routes. Nonetheless, there is some evidence that equity and fairness concerns can be mitigated. Some projects have shown substantial usage by low-income groups, and other projects have used revenues generated to subsidize low-cost transportation options. In addition, some recent proposals for refining congestion-pricing techniques have incorporated further strategies for overcoming equity concerns. For example, the Fast and Intertwined Regular (FAIR) lanes proposal in New York suggests crediting users of the non-tolled lanes to partially pay for them to use public transportation, or to use the express lanes on other days.

Source: Orange County Transportation Authority.

On this highway in Orange County, California, a pilot project allows drivers to pay a toll to use newly added express lanes.

Mr. Chairman and Members of the Committee:

We appreciate the opportunity to offer this statement for the record about the role that charging fees for the use of congested transportation infrastructure can play in improving mobility in our nation's transportation systems. There is widespread agreement that mobility is essential for a strong economy. It provides people with access to goods, services, recreation, and jobs; it provides businesses with access to materials and markets. It also promotes the movement of personnel and material to meet national defense needs. However, our transportation systems—for surface, maritime, and air transportation—have become increasingly congested. By some measures, for example, overall roadway congestion has increased more than 50 percent between 1982 and 2000 in some of the largest metropolitan areas. Congestion results in significant costs to the environment through increased pollution, and to individuals and businesses through wasted energy, time, and money.

In recent reports covering all three of these transportation systems, we have analyzed ways to make these systems operate more efficiently—including ways to do so without major new capital investment.[1] One such approach involves congestion pricing—that is, charging a higher price to use the system during peak periods or on congested routes. Doing so provides incentive for users to shift to less congested times or make other adjustments. Those who value the service enough will pay the additional price; those who value it to a lesser degree will shift their use accordingly. Currently, there is renewed interest in the role that congestion pricing can play in enhancing mobility, as evidenced by several recent proposals to institute pricing policies from industry, interest groups, and the Department of Transportation.

My statement for the record is meant to provide some overall perspective on what we have learned about congestion pricing. It addresses (1) the potential benefits that can be expected from pricing congested transportation systems, approaches to using congestion pricing in transportation systems, and the implementation challenges that such

[1]U.S. General Accounting Office, *Surface and Maritime Transportation: Developing Strategies for Enhancing Mobility: A National Challenge*, GAO-02-775 (Aug. 30, 2002); *Marine Transportation: Federal Financing and a Framework for Infrastructure Investments*, GAO-02-1033 (Sept. 9, 2002); *National Airspace System: Long-Term Capacity Planning Needed Despite Recent Reduction in Flight Delays*, GAO-02-185 (Dec. 14, 2001).

pricing policies pose, and (2) examples of projects in which pricing of congested transportation systems has been applied to date, and what these examples reveal about potential benefits or challenges to implementation. My statement today is based in large part on our prior work in all three types of transportation systems. We have also gathered additional information by reviewing publicly available reports on a number of projects that are part of the Federal Highway Administration's Value Pricing Pilot Program, a program that funds projects that demonstrate the potential of congestion pricing to address congestion problems, and on selected projects in other countries.

In summary:

- According to several reports from the Transportation Research Board and others, applying congestion-pricing methods to our nation's transportation systems could have potential to help reduce congestion and enhance mobility by providing incentives to shift travel to off-peak periods or less congested routes, thereby more efficiently using transportation infrastructure. Congestion pricing also has the potential to create other benefits, such as generating revenue to help fund investment in transportation systems directly from users. While there are a number of potential benefits, implementing pricing methods for our transportation systems faces numerous challenges. Opportunities to pursue congestion pricing are limited because of current statutory restrictions limiting the use of congestion pricing and concerns about equity and fairness. For example, federal statutes restrict the charging of tolls on interstate highways, except where tolls previously existed or where exceptions have been made for pilot projects. Concerns about equity center around the effect that congestion pricing may have on lower-income groups. The economics literature suggests that these concerns can be mitigated somewhat because all income groups could conceivably benefit from congestion pricing, depending on how the revenues generated are used.

- A number of congestion pricing projects are in place in surface and air transportation systems, both here and abroad. For the most part, they demonstrate that congestion pricing can be successful in generating greater economic efficiency and reducing congestion within transportation systems. Pricing projects have also successfully shown that they can generate revenue sufficient to fund their operation and, in some cases, fund the operation of additional transportation projects as well. For example, in San Diego, where users pay a toll to use a less crowded freeway lane, some of the revenues are used to operate a new express bus service, providing commuters with more travel options. However, in at least one circumstance, congestion pricing was not as effective in reducing

travel during peak periods, either because travelers had little or no choice other than to travel at peak times or on peak routes, or the congestion toll was set too low to influence demand. Projects were also not necessarily able to demonstrate benefits for the full range of transportation users. For example, those who were able to use the special freeway lane saw a decrease in travel time, but in some cases there was little systemwide reduction in travel times, and congestion increased on alternative routes. Nonetheless, there is some evidence that equity and fairness concerns can be mitigated. Some projects have shown substantial usage by low-income groups, and other projects have used revenues generated to subsidize low-cost transportation options. In addition, some recent proposals for refining congestion-pricing techniques have incorporated further strategies for overcoming equity concerns. For example, the Fast and Intertwined Regular (FAIR) lanes proposal in New York suggests crediting users of the non-tolled lanes to partially pay for them to use public transportation, or to use the express lanes on other days.

Background

Major capital investment in highways, public transportation systems, waterways, and airports are currently funded, in part, through various taxes and fees on users, such as fuel taxes or sales taxes; landing fees and docking fees; and tolls on certain roads, tunnels, and bridges. However, these revenue-raising instruments do not always provide strong incentives for efficient use of transportation infrastructure. For example, the tax rates on gasoline, which are the same regardless of whether vehicles are traveling during congested or uncongested periods, provide no incentive for travelers to use the infrastructure more efficiently. Similarly, landing fees at airports that are based on aircraft weight help create incentives for airlines to shift to smaller, lighter aircraft providing more frequent service, which results in increased demand for runways at peak times and therefore increased congestion.

Due in part to increasing volumes of traffic, as well as these built-in disincentives to the efficient use of the transportation infrastructure, congestion on our nation's highways, airways, and waterways remains a national problem. On already crowded roadways, passenger vehicle travel is expected to grow by almost 25 percent this decade, and freight movement by trucks may grow by a similar amount. In the nation's air transportation system, before the terrorist attacks on September 11, 2001, an unprecedented number of delays in commercial airline flights occurred—a substantial part of which were due to airport and airspace congestion, particularly during peak morning and evening hours. At 31 of the nation's busiest airports, 28 percent of the domestic flights arrived late

in 2000. While flight congestion declined significantly with reduced traffic after the attacks, a more robust economy and less public apprehension about flying will likely lead to renewed demands on the air transport system. At locks on our inland waterways and at major seaports, congestion has also been growing. For example, the U.S. Army Corps of Engineers estimated that 15 key locks would exceed 80 percent of their capacity by 2020 as a result of the expected growth in freight travel, as compared to 4 locks that reached that level in 1999, resulting in significantly increased delay.

Numerous methods can be used to address congestion, including building new infrastructure, improving maintenance and operation of infrastructure, and using the existing infrastructure more efficiently through demand management strategies, including pricing mechanisms. Experts with whom we talked said that consideration of a full range of these methods is likely necessary to ease our nation's transportation congestion.[2] In theory, congestion pricing, as one of these methods, is useful for mitigating the delay costs of congestion. If highway, aviation, and waterway users were charged extra for peak-hour use, some would shift to less busy times, or make other adjustments, thereby alleviating delay at the peak periods.

Many other areas of the economy frequently use peak-period pricing mechanisms when demand varies considerably by time of day or season. Electricity providers, for example, often charge higher prices at peak periods and lower prices when demand is reduced. Other industries with common peak-pricing practices include telecommunications, airlines, and hotels and resorts. In addition, Amtrak and some transit systems use peak-period pricing.

[2]GAO-02-775.

Research Suggests Significant Benefits, but Some Challenges, to Implementing Congestion Pricing

In theory, using congestion pricing has the potential to enhance economic efficiency, as well as provide other benefits, such as providing market signals that can guide capital investment decisions, and generating revenue to help fund such investment directly from users of the system.[3] There are several approaches to implementing congestion pricing on roads and at airports. However, incorporating pricing into our transportation systems involves overcoming several implementation challenges, such as current restrictions on using congestion pricing on our highways and on runways, and equity and fairness concerns.

Congestion Pricing May Encourage Greater Economic Efficiency, and Provide Other Benefits

Economists generally believe that charging automobile, truck, vessel, and aircraft operators surcharges or tolls during congested periods can enhance economic efficiency by making them take into account the external costs they impose on others in deciding when, where, and how to travel. In congested situations, external costs are substantial and include increased travel time, pollution, and noise. The goal of efficient pricing on public roads, for example, would be to set tolls for travel during congested periods that would make the price (including the toll) that a driver pays for such a trip equal or close to the total cost of that trip, including external costs. In theory, these surcharges could help reduce congestion and the demand for road space at peak periods by providing incentives for travelers to share rides, use transit, and travel at less congested (generally off-peak) times or on less congested routes.

Peak-period pricing may have applicability to other modes as well. For example, congestion pricing for using locks on our nation's inland waterways might be a way to reduce delays experienced by barge operators. Similarly, congestion pricing at commercial airports—that is, charging higher landing fees during congested periods—would cause aircraft operators, both airlines and general aviation operators, to consider external costs in making their decisions. As a result, there would be incentives to shift some operations to off-peak hours or secondary airports or to provide the same carrying capacity by operating fewer but larger aircraft.

In addition to increasing the efficiency with which current transportation infrastructure is used, congestion charges may be helpful in guiding capital

[3]For further discussion of the research on congestion pricing, see National Research Council, Transportation Research Board, *Curbing Gridlock: Peak-Period Fees to Relieve Traffic Congestion* (Washington, D.C.: 1994).

investment decisions for new facilities. As congestion increases, the delay cost that an additional user of the system causes for other users also increases. If congestion charges are set such that they reflect external costs, then as congestion increases, congestion surcharges will increase. Rising surcharges provide signals of increased demand for specific increases in physical capacity, indicating where capital investment decisions to increase capacity would be most valuable. At the same time, congestion charges will provide a ready source of revenue for local, state, and federal governments and transportation facility operators to fund these investments in new capacity that, in turn, can reduce delays. In some cases and over a longer period, in places where external costs are substantial, and congestion surcharges are relatively high, this form of pricing might influence land-use plans and the prevalence of telecommuting and flexible workplaces.

Various Possible Approaches to Setting and Collecting Surcharges Exist

Congestion pricing could be applied to transportation systems in a variety of ways, and there are several possible approaches related to which facilities are priced, how the price is set, and how the toll is collected.

Approaches for Roads

In one possible form of congestion pricing for public roads, tolls would be set on an entire roadway or road segment during periods of peak use. In another form, sometimes known as value pricing, peak-period tolls would be set on only some lanes of a roadway, allowing drivers to choose between faster tolled lanes and slower non-tolled lanes. High-occupancy toll (HOT) lanes, under which drivers of single-occupancy vehicles are given the option of paying a toll to use lanes that are otherwise restricted to high-occupancy vehicles,[4] are an example of value pricing. Fast and Intertwined Regular (FAIR) lanes is a recent proposal that is another variation of value pricing. Under the FAIR lanes approach, revenues generated from travelers using electronically tolled lanes would be transferred to travelers using adjacent non-tolled lanes on the same roadway. These transfers would be done through electronic transponders in the vehicles using the toll lanes, as well as the non-tolled lanes. Those in the non-tolled lanes would receive a credit equal to 25 to 50 percent of the current effective toll, which could then be used toward public

[4]Sometimes cars with two riders (including the driver) qualify as high-occupancy vehicles, while in other cases more than two riders are needed.

transportation fares or toward the use of the toll lanes on another day. In this way, drivers in the non-tolled lanes would receive compensation for the additional congestion that may result from increased use of those lanes once tolls are placed on other lanes. In a third form of congestion pricing for public roads, known as cordon-based pricing, drivers would be charged a fee for entering a specific area of a city, such as a central business district, at peak hours.

Approaches for Airports

Two commonly mentioned methods of applying the concept of congestion pricing at airports are differential pricing and auctions. Under differential pricing, airports would set landing fees higher at times when demand for takeoff and landing slots exceeded their availability, and lower at other times, in effect applying a surcharge for using the system at peak-demand periods. An auction approach would allow airports to periodically auction a fixed number of takeoff and landing slots—equal to the airport's capacity—to the highest bidders. For example, an airport, in conjunction with the Federal Aviation Administration, could determine its per-quarter-hour takeoff and landing capacity, and a competitive bidding process among carriers could determine fees during each period, which would also result in surcharges for using the system at peak-demand periods.

Structuring and Setting the Tolls

Congestion pricing tolls could be levied using either a predetermined or variable approach. Under the predetermined approach, drivers would pay tolls that are preset and fixed according to the time of day they travel. In contrast, under the variable approach, drivers would pay tolls that vary according to the level of congestion on an affected roadway. For either approach, the amount of the toll to be levied would likely be set by state or local officials, or other toll facility operators, based on information from roadway usage and traveler surveys. The toll structure may also be influenced by the judgment of the toll facility operators. These tolls could then be adjusted upward or downward based on the use of the toll facility in relation to the optimal flow of traffic on the facility.

Collecting Tolls

Electronic methods of collection from users of public roads offer vast increases in efficiency compared to traditional tollbooths, which are labor intensive and relatively expensive to operate, and create congestion as drivers line up to pay their tolls. And, over the past decade, electronic road pricing technology has become more reliable and, as a result, more widely

adopted on many toll facilities.[5] According to a report issued by the Transportation Research Board, technologies that are currently used at some toll facilities to automatically charge users could also be used to electronically collect congestion surcharges without establishing additional tollbooths that would cause delays.[6] In application of cordon-based pricing, drivers would typically purchase and display permits that allow them access to the cordoned section of the city before entering. Daily or monthly permits could be differentiated by color and shape for easy enforcement.

Challenges to Implementing Congestion Pricing Include Legal Restrictions and Concerns about Fairness and Equity

One challenge in implementing congestion pricing for transportation systems is that, at present, greater use of pricing is limited by statutory restrictions. For example, tolls are prohibited on the Interstate Highway System, except for roads that already had tolls in place before they were incorporated into the system (e.g., the New Jersey and Pennsylvania Turnpikes) or where exceptions have been made for the implementation of pilot projects.[7] Also, there are a variety of statutory restrictions on landing fees at airports that can limit use of congestion pricing. Landing fees are typically based on aircraft weight and are required to be set at levels designed to recover the historical costs of providing landing services. Costs imposed by congestion and other externalities cannot be considered in the calculation of the cost base and, hence, cannot be recovered in landing fees. Congestion fees, as well as most other types of fees, are also prohibited on the inland waterways because of the Interstate Commerce clause, according to the Army Corps of Engineers. Therefore, addressing some of these restrictions would be necessary to make greater use of congestion pricing.

Another challenge involves effectively addressing concerns raised about equity and fairness. Because of this issue, political opposition to using this

[5]Under electronic road pricing approaches, users of a toll facility can open accounts of fixed amounts. The account information is stored in electronic transponders that drivers mount on their windshields to "communicate" with an antenna at a signpost (or mounted on an overhead gantry) when their vehicles pass by. User accounts are then automatically debited. In case users have insufficient balances in their accounts or their transponders malfunction, a video enforcement system automatically takes a picture of the offending vehicle. See also David J. Forkenbrock and Jon G. Kuhl, *A New Approach to Assessing Road User Charges*, Public Policy Center (Iowa City: University of Iowa, 2002).

[6]*Curbing Gridlock: Peak-Period Fees to Relieve Traffic Congestion.*

[7] 23 U.S.C. § 301.

approach to address mobility challenges has been substantial. One equity concern that has frequently been raised about congestion pricing of public roads has been the potential effects of surcharges or tolls on lower-income drivers. Because a surcharge would represent a higher portion of the earnings of lower-income households, it imposes a greater financial burden on them and, therefore, is considered unfair.[8] The economics literature suggests that these concerns can be mitigated to some degree. For example, proponents of congestion pricing have noted that all income groups could potentially benefit if there is an appropriate distribution of the revenues obtained through congestion pricing. These revenues could be used to build new road capacity, given back as tax rebates tilted toward lower-income households, or used in some other way so that, in theory, the net benefits for each income group would exceed its costs.

Although equity considerations could potentially be addressed by constructing a congestion pricing system for roads so that all income groups received net benefits, there could still be individuals who would be negatively affected. In theory, the cost of a surcharge or toll would be less for those who could more readily make adjustments to their driving behavior that would allow them to avoid paying the toll. Conversely, drivers who had little flexibility to alter their work schedules to avoid a toll by traveling at off-peak hours could potentially be more affected than workers with such flexibility. Similarly, those whose commuting patterns make it harder for them to form carpools or use transit could also be more affected.

The arbitrary nature of these distinctions, as well as opposition from those who find the concept of restricting lanes or roads to people who pay to use them to be elitist, raises fairness concerns and accounts for some of the political opposition to congestion pricing. More generally, there is often opposition to paying a charge to use something that was formerly provided "free."

[8]Economists note that even if the burden of congestion charges is greater on low-income households, the same is true of fuel taxes, which are currently paid by users, and sales taxes, which are paid by users and non-users of transportation systems, both of which are relied on for transportation investments. For a discussion of equity concerns associated with increased use of voter-approved local sales taxes to pay for transportation infrastructure, see Martin Wachs, *Improving Efficiency and Equity in Transportation Financing* (Washington, D.C.: Brookings Institution, April 2003).

Existing Projects Show That Benefits Can Result, and Some Evidence Suggests That Implementation Challenges Can Be Mitigated

A number of existing congestion-pricing transportation projects, both here and abroad, show that pricing can influence travelers' behavior to the point of reducing congestion and thus increasing economic efficiency. For example, value pricing pilot projects in the United States show considerable usage and have provided users with a less congested alternative, thus improving traffic flows and reducing delays. In addition, congestion-pricing mechanisms, in general, have demonstrated that they can generate revenue sufficient to fund their operation and, in some cases, fund investment in transportation alternatives. The available evidence also suggests that implementation challenges can be mitigated, although to what extent is not yet clear.

Projects Provide Evidence of Increased Economic Efficiency

A number of the congestion-pricing projects we identified enhanced transportation mobility through improved traffic flows, increased speeds and reduced delays for some users. One way in which some projects have done so is by channeling some drivers into infrastructure that is not being fully utilized even at peak periods. In several locations in the United States, for example, HOT lane projects have been implemented in which vehicles with fewer passengers than would normally be needed to use high occupancy vehicle lanes have been allowed to use such lanes by paying a toll.[9] High occupancy vehicle lanes are generally less congested than other highway lanes, and drivers who use them are thus able to shorten their trip times. The toll for such use varies, increasing during periods of peak congestion. In such HOT lane or value pricing projects in Orange County (as shown in figure 1) and San Diego, California, and Houston, Texas, drivers willing to pay to use the HOT lane saved an average of 12-20 minutes per trip in the peak period. In addition, some projects were able to shift demand on congested infrastructure to less congested time periods. In San Diego, officials were also able to spread out peak period traffic on the toll lanes over a longer period of time by charging a lower toll just before and just after the peak period.

[9]Under the Federal Highway Administration's Value Pricing Pilot Program, the restriction on using tolls on the interstate is lifted for approved projects.

Figure 1: Tolled Lanes on State Route 91 in Orange County, California

Source: Orange County Transportation Authority.

In many instances, however, a congested transportation system may have no equivalent to a high occupancy vehicle lane with additional capacity. In these cases, some other congestion pricing models have been used to encourage travelers to shift their behavior, either by traveling at another time or by using alternative transportation modes, such as buses, trains, or carpools. For example, in Singapore, London, and Norway, congestion pricing has taken the form of cordon-based pricing, where drivers pay to enter entire regions. These projects have demonstrated significant decreases in the level of congestion on roads in the cordoned area and some significant shifts to other alternative modes, as follows:

- In Singapore, the city government instituted a $1 charge in 1975 for private vehicles to enter the central business district in the morning rush hours. Carpools, buses, motorcycles, and freight vehicles were exempted from the charge. The result was an immediate 73 percent decline in the use of private cars, a 30 percent increase in carpools, and a doubling of buses' share of work traffic.

- In London, recent implementation of cordon tolls resulted in traffic decreases of roughly 20 percent, and about a 14 percent increase in the use of buses during the morning commute.

- In Trondheim, Norway, cordon tolls produced a 10 percent reduction in traffic at peak times and an 8 percent increase in traffic in off-peak times in the central business district.

Such projects have similarly been used to relieve congestion at crowded airports. In one case, the Port Authority of New York and New Jersey imposed surcharges beginning in 1968 for peak-hour use by small aircraft at Newark, Kennedy, and La Guardia airports. These small aircraft, known as "general aviation" aircraft, were not part of scheduled airline operations. The need to accommodate takeoffs and landings for these aircraft during peak periods was adding to passsengers' delays on scheduled airline flights. The port authority raised the peak-period minimum take-off and landing fees for aircraft with fewer than 25 seats from $5 to $25, while keeping the off-peak fee at $5. As a result of the surcharges, general aviation activity during peak periods decreased by 30 percent. The percentage of aircraft operations delayed more than 30 minutes declined markedly over the same period. Similarly, in 1988 at Boston's Logan Airport, the Massachusetts Port Authority adopted a much higher landing fee for smaller aircraft. Like the three New York and New Jersey airports, Logan experienced a large drop-off in use by smaller aircraft. Much of the general aviation abandoned Logan for secondary airports, and delays at Logan dropped.[10]

Projects Can Also Provide Support for Other Transportation Alternatives

Proponents of congestion pricing have noted that others besides those who can afford to pay congestion pricing costs can share in the benefits through an appropriate distribution of any revenues generated. A part of these revenues will be needed to administer the system—for example, to collect tolls. However, existing projects also contain a few examples of situations in which the revenues generated from congestion pricing have been used to benefit other transportation alternatives. For example, the revenue from the HOT lane project in San Diego has been sufficient not only to pay for toll takers and other administrative expenses, but also to

[10]These practices in New York, New Jersey, and Boston have since been discontinued because of a successful lawsuit brought by small commuter airlines and the Department of Transportation.

fund the operation of a new express bus service. This has increased travel choices for all area commuters, including lower-income populations.[11]

International experiences with congestion pricing have been somewhat more extensive and revenues generated from congestion tolls have been substantial. In Singapore, only about 12 percent of the revenue generated from their cordon-based tolls have been needed to cover the costs of operation. In Trondheim, Norway, revenues have exceeded capital and operating expenses of the toll facility by 5 times. Trondheim's toll facility currently generates about $25 million in profit per year. These profits have been used to enhance the capacity of the entire transportation system, including financing additional road infrastructure as well as subsidizing public transportation facilities and services, and pedestrian and bicycle facilities.

Extent to Which Equity and Fairness Issues Can Be Mitigated Is Not Yet Clear

There is some encouraging evidence with regard to mitigating equity and fairness issues in implementing congestion pricing, although the extent to which these concerns can be mitigated is unclear. At least one project we reviewed indicates that implementation of congestion pricing needs to be carefully evaluated as an alternative in some circumstances, because it provides no automatic guarantee of benefits. In Lee County, Florida, the county instituted variable tolls on two bridges based on peak travel periods. The county reduced the toll for using the bridges in off-peak periods. On one bridge, traffic increased during the off-peak period but decreased very little during the peak period. A study from the University of South Florida[12] found that peak-period demand for the bridge was not as flexible as compared to demand during off-peak periods. That is, drivers at peak periods may not have readily available alternatives to commute at different times, use a different mode of transportation, or take another route, and therefore have little choice but to use the bridge during the peak period, or the price of the congestion toll was set too low to influence the demand of those users. The example illustrates the fact that a pricing mechanism may not be very effective at reducing peak-period

[11]A recent proposal for "HOT networks" promotes the use of HOT lanes in conjunction with operating bus rapid transit services, utilizing the revenues from the toll lanes. For more information, see Robert W. Poole, Jr. and C. Kenneth Orski, "Policy Summary No. 305" (Los Angeles, CA: Reason Foundation, 2003).

[12]Chris Swenson, Alasdair Cain, and Mark W. Burris, "Toll Price-Traffic Demand Elasticity Analysis on Variable Priced Toll Bridges" (Tampa: Center for Urban Transportation Research – College of Engineering, University of South Florida, July 1999).

travel if the price is not set properly, or without additional measures that provide travelers with other choices.

Although the congestion pricing projects we reviewed produced little evidence of congestion reductions in adjoining lanes or in other alternative routes, they also produced little evidence that congestion increased in the non-tolled lanes or on alternative routes. For example, while the value pricing projects in California and Texas resulted in less congested alternatives for individuals willing to pay the toll, only one of the projects was able to demonstrate any decreases in congestion on the remaining "free" lanes of the highway. In Orange County, California, a study found that opening two new lanes, which were designated as congestion toll lanes, decreased delays on the other "free" lanes from 30-40 minutes to about 12-13 minutes, while traffic remained stable on alternative nearby freeways. However, there is also some evidence that pricing can increase congestion on alternative routes. In Singapore, where the city used cordon pricing, there was deterioration in traffic conditions just outside the cordoned area caused by travelers attempting to bypass it. Such congestion would adversely impact individuals who do not pay the toll or individuals not using the congested facility. However, at least one study said that the costs of increased traffic on alternative routes did not outweigh the benefits of reduced congestion in the cordoned area.

There are other encouraging signs in relation to distributional impacts from existing projects, although there is no conclusive evidence on the distributional impacts of congestion-pricing techniques. A report on the value-pricing project in Orange County found that there was significant usage of the toll facility by individuals at all income levels. This demonstrates that low-income individuals also value the time they save, and that some value their time enough to be willing to pay a toll that amounts to a higher percentage of their income than that paid by individuals with greater income. However, in value-pricing pilot projects in Orange County, San Diego, and Houston, those using the toll lanes tended to have higher incomes than those using the adjoining lanes.

Experts have noted that tolls might become more acceptable to the public if they were applied to new roads or lanes as demonstration projects, so that tolls' effectiveness in increasing commuter choices could be evaluated. For example, in the Orange County pilot project, where two new toll lanes were added to the highway, opinion surveys have shown a high rate of public acceptance. Other pilot projects in Houston and San Diego have also demonstrated public satisfaction. In addition, recent proposals, such as FAIR lanes and HOT networks, show promise to further

mitigate equity and fairness concerns. FAIR lanes, as previously discussed, and which have been proposed in New York, would credit users of the adjoining lanes, using revenues generated by the toll lanes, allowing those users to use the toll lanes on another day for a reduced or no charge. The HOT network proposal couples HOT lanes with bus rapid transit initiatives, similar to the experience of the pilot project in San Diego, thereby using the revenues from the tolls to broaden the transportation alternatives available for all commuters, including lower-income populations.

Concluding Observations

Traffic on already congested surface, maritime, and air transportation systems is expected to grow substantially over the next decade. This congestion can be considered a shortage; it occurs when more services—from lanes of highway, airport runways, locks on rivers—are demanded than can be supplied at a given time and place. A range of approaches and tools must be applied to solve the pervasive transportation congestion problems that our nation faces in the next decade and beyond. Congestion pricing—although only one of several approaches that can be used to reduce congestion on our nation's roads, airways, and waterways—shows promise in reducing congestion and better ensuring that our existing transportation systems are used efficiently.

Pilot projects and experiences with congestion pricing abroad demonstrate the promise of this approach for reducing congestion and promoting more efficient use of transportation systems by users. Despite this promise, there continue to be concerns over fairness and equity in the application and implementation of congestion pricing, which current projects have not fully alleviated. Some proposed projects, such as FAIR lanes, which use revenues generated to compensate other users of the transportation system, could help alleviate some of the fairness and equity concerns that have been raised. Experts suggest and some projects demonstrate that public opposition to congestion pricing will lessen as these projects show that equity and fairness concerns can be mitigated. However, if congestion pricing is to be more widely applied to transportation systems, the Congress will need to ease statutory restrictions on the use of congestion-pricing applications on transportation systems.

Contact and Acknowledgments

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