Congestion Pricing: A Potential Tool for Reducing Congestion on Maryland's Roadways

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Members of the General Assembly:

Traffic congestion in the Washington, DC and Baltimore metropolitan areas has increased substantially over the past few decades as a result of a significant increase in vehicle miles traveled. One strategy that is being used in several U.S. cities and internationally is "congestion pricing." The Natural Resources, Environment, and Transportation Workgroup of the Office of Policy Analysis has prepared this report to provide more information on congestion pricing and its potential use in Maryland.

We trust this report will be of assistance to members of the General Assembly.

Sincerely,

Karl S. Aro
Executive Director

KSA/LGC/jaw

Executive Summary

The Washington, DC metropolitan area ranked as home to the nation's third worst traffic congestion in 2004; Baltimore ranked 25th. Congestion in these areas has increased substantially over the past few decades as a result of a significant increase in vehicle miles traveled. The costs of congestion are high. Not only does congestion reduce quality of life for those sitting in traffic, but it also increases fuel consumption; reduces road safety; diminishes the competitiveness of businesses; and increases air, water, and noise pollution.

Numerous strategies have been attempted to alleviate congestion, such as building more roads, encouraging a change in land use patterns, and public transport – each has resulted in limited success. One strategy that has shown promise in Europe, and more recently in some U.S. cities, is the concept of congestion pricing. Congestion pricing, which is a market-based approach to transportation management, is defined as any pricing structure in which motorists pay a user fee in exchange for driving on a roadway or into a particular region. Congestion pricing aims to increase the efficient use of roadways by modifying the behavior of drivers.

This report was prepared to provide more information on congestion pricing and its potential use in Maryland. **Chapter 1** provides an overview of congestion pricing. **Chapter 2** briefly describes several examples of congestion pricing in the U.S. and abroad. **Chapter 3** provides detailed case studies of three successful congestion pricing projects that have been implemented in the U.S. **Chapter 4** reviews the past and current congestion pricing proposals in Maryland. Finally, **Chapter 5** provides conclusions regarding the use and implementation of congestion pricing in Maryland.

This report concludes that with careful planning and public input, congestion pricing could serve as a valuable tool to alleviate congestion on Maryland's roadways. Accordingly, the State should continue to pursue the use of congestion pricing.

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Chapter 1. Background

Congestion: A Serious Problem in the State

Traffic congestion in the State's two metropolitan areas, Baltimore and Washington, DC, is having negative impacts on many of the State's citizens. Congestion robs people of time; increases fuel consumption as well as air, water, and noise pollution; and decreases road safety and the competitiveness of businesses. Nationwide, the economic costs in terms of reduced worker productivity, delayed shipment of goods, and wasted fuel were estimated in 1993 to be approximately $40 billion annually. The negative impacts associated with congestion will worsen with the inability of road and public transit capacity to keep pace with the relentless growth in vehicular travel.

In 2004 the Texas Transportation Institute estimated that nationally, Washington, DC had the third highest amount of congestion; Baltimore ranked 25th. In both areas congestion has worsened substantially over time. For example, the amount of annual delay per traveler in 1982 was estimated to be 9 hours in Baltimore and 21 hours in Washington, DC. In 2002 the estimated annual delay increased to 48 hours in Baltimore and 67 hours in Washington, DC. **Exhibit 1** presents data on congestion and its impacts for these two metropolitan areas in 2002.

Exhibit 1
Baltimore and Washington, DC Congestion in 2002

Metropolitan Area	Annual Delay/Traveler (hours)	Total Congestion Cost (Millions)	Percent Peak Travel Congested	Excess Fuel Consumed (Million Gallons)
Baltimore	48	$1,069	86%	100
Washington, DC	67	$2,274	70%	204

Source: Texas Transportation Institute, *Urban Area Report*, 2004

The significant increase in congestion over time has resulted from an increase in total vehicle miles traveled, which is driven by the number of vehicles on the road and the total miles traveled by each vehicle. **Exhibit 2** shows the estimated increase in the number of vehicles traveling many of the State's roadways and how the number has increased over time.

Exhibit 2
Estimated Average Daily Traffic
1989 – 2003

Road	County	Location	1989	1993	1998	2003	Increase 1989-2003
I-95	Baltimore City	Ft. McHenry Tunnel	84,250	94,233	109,778	118,413	41%
I-95	Baltimore City	Harbor Tunnel	29,971	51,457	58,686	70,604	136%
I-495	Montgomery	West of MD-650	160,430	186,429	193,642	216,05	35%
I-70	Frederick	East of MD-17	41,164	44,123	52,868	53,475	30%
U.S.-50	Anne Arundel	Bay Bridge	44,055	51,423	62,896	68,530	56%

Source: State Highway Administration

Road congestion occurs when traffic slows from optimal speeds due to heavy traffic flow or narrow roadways due to construction, traffic incidents, or too few travel lanes for the demand. Congestion is reached at the point where transportation system performance is no longer acceptable.

Congestion Mitigation Measures

A variety of congestion mitigation measures to increase road efficiency and reduce road congestion have been developed. The following is a limited list of accepted practices to address congestion.

- ***Information Technology Systems (ITS):*** As a congestion mitigation strategy, ITS attempts to resolve congestion problems through streamlining toll collection and by providing up-to-date information regarding traffic congestion to allow motorists to plan accordingly and reduce the impact of congestion on their lives. ITS solutions include electronic toll collection, traffic advisory radio, dedicated cellular phone lines for travelers to report traffic information, cable television stations dedicated to traffic updates, Internet sites with traffic information, ramp meters that control the flow of traffic onto a highway, variable message signs, and transportation management centers.

  In Maryland the State Highway Administration maintains regional operations centers and posts alerts on variable message boards along major highways and on a web site that drivers can access before getting on the road. Electronic toll collection has proven to be very useful in congestion mitigation. Drivers do not stop at a toll booth; rather, the toll is collected by an electronic transponder in each car. Cars without transponders are photographed, and the registered owner of the car is sent a bill for the toll.

- ***High Occupancy Vehicle (HOV)/Carpool Lanes:*** HOV lanes seek to reduce congestion by increasing the person-moving capacity of the existing infrastructure by restricting certain lanes to vehicles with a specified minimum occupancy. When implemented on freeways, the following three types of facilities are used – separated roadway, concurrent flow lanes, and contraflow lanes[1]. Additionally, the separated roadway may either be a reversible-flow facility (as in I-95 in northern Virginia) or a two-way facility. Benefits of HOV lanes include travel time savings and increased transit use where bus/rail lines are adjacent to HOV lanes. However, there are limited opportunities in the State for additional HOV lanes. In addition, in general, HOV lanes have been underutilized and have not been effective in reducing traffic congestion. Maryland uses concurrent flow HOV lanes on U.S. 50 near Bowie and on I-270 near Washington, DC to Frederick. Effective enforcement of the minimum vehicle occupancy standard is critical to preventing congestion on HOV lanes.

- ***Construction of Additional Capacity:*** Increasing road capacity either through the construction of new roads or the expansion of existing roads can alleviate congestion on existing routes. However, the substantial expansion of the State's roadway capacity in the last few decades has not solved the State's congestion challenges for several reasons.

  - First, the State's increase in the supply of roadway capacity, which is constrained by budgets, environmental and public approval concerns, and physical limitations, has been outpaced by the increase in demand for road travel. A 2000 study in the *Journal of Transportation and Statistics* estimated that since 1969 the amount of lane-miles on primary roads in the State has increased by 0.4 percent annually while the total amount of vehicle miles traveled on these roads increased by 3.5 percent annually. The Texas Transportation Institute estimates that the Baltimore metropolitan area requires an unobtainable 105 lane-miles of roadway in order to prevent congestion from worsening.

  - Second, evidence suggests that increased roadway capacity causes induced travel demand. Induced travel demand is the increase in total vehicle miles traveled on a roadway network resulting from increased roadway capacity beyond that which occurs from other influences (such as income and population). Research indicates that the elasticity of road miles traveled with respect to road expansion is between 0.3 and 0.6 – this suggests that a 10 percent increase in roadway capacity would lead to a 3 to 6 percent increase in the total amount of vehicle miles traveled.

- ***Road Incident Management:*** Road incident management attempts to reduce congestion through surveillance and management of incidents by reducing the time to detect, respond to, and clear incidents. Incident management includes freeway safety patrols,

[1] A concurrent flow lane is a freeway lane in the peak direction of travel, not separated from general-purpose lanes, designated for the exclusive use by HOVs. A contraflow lane is a freeway lane in the off-peak direction of travel designated for exclusive use by HOVs traveling in the peak direction during high volume periods of the day.

call boxes, dedicated cell phone lines, and other ITS solutions. The use of freeway safety patrols or courtesy patrols to assist motorists by changing a tire, providing gasoline, towing a vehicle to safety, or protecting a disabled vehicle from being struck has increased in recent years across the country. The use of courtesy patrols to manage road incidents in other states has proved to reduce peak hour congestion caused by traffic incidents or to increase the peak hour speed on roads. Maryland currently uses teams to patrol certain highways during peak travel hours, assisting motorists in distress.

- ***Public Transit:*** Public transit tends to be most prevalent in heavily urban areas and among lower income individuals. Traditional modes of transit include light rail or subway lines, commuter trains, and bus service. Commuters, however, continue to exhibit a strong preference for driving to work rather than utilizing public transit. The National Capital Region Transportation Planning Board estimated that 75 percent of commuters in the Washington, DC metropolitan area, the area in Maryland with the most developed public transit system, were not more likely to use public transit even after receiving information on public transit options.

- ***Employer Transportation Reduction Strategies:*** Many employers, particularly larger companies and governments, are responding to employee concerns about the amount of time spent commuting to the office. These strategies include company-sponsored carpools, compressed workweeks, flextime and staggered hours, and telecommuting either from home or from regional telework centers. In 2001 an estimated 450,000 workers commuted at least part-time in the Washington and Baltimore metro areas. The number of workers teleworking has also been increasing substantially in the last few years; nationally it is estimated that the number of workers teleworking has increased by 40 percent since 2001. Companies may qualify for certain federal and State tax benefits, including Maryland's Commuter Tax Credit, which provides up to $600 annually in tax benefits per employee.

- ***Congestion Pricing:*** Congestion pricing, also called value pricing, is any pricing structure in which motorists pay a user fee in exchange for driving on a roadway or into a particular region. Congestion pricing represents a market-based approach that attempts to match supply to demand. Congestion pricing allocates roadway space, a scarce resource, in a more efficient manner by incorporating more of the costs and benefits of driving than are otherwise incorporated.

Although numerous strategies have already been employed in an effort to reduce congestion on Maryland's roadways, each has achieved limited success. While consideration of a full range of congestion mitigation methods is likely necessary to ease Maryland's congestion problems, the success of congestion pricing in other areas offers hope for the Washington, DC and Baltimore regions.

How Does It Work? The Economic Principles Behind Congestion Pricing

Roadways are typically considered a type of public good – something that is generally not efficiently produced by the private sector because (1) non-paying beneficiaries cannot be easily excluded and (2) the good is non-rivalrous – one person can benefit from it without decreasing another person's benefit. A pure public good exhibits both of these properties. For example, the benefit received by one person from national defense does not prevent the benefit from being enjoyed by another person, and it is not easy to exclude people who do not pay for the benefit. Roadways, however, are a congestible public good – the benefit of a road received by one person is decreased by congestion caused by additional drivers.

Absent congestion pricing, a driver makes trips throughout the day according to where their marginal benefit from each trip equals or exceeds their marginal private cost of making the trip. The cost of the driver's time plus the costs of operating the vehicle constitutes the driver's marginal private cost. Not included in this decision are external costs, or consequences, caused by the person's driving. These include the increase in travel time experienced by other drivers as well as the pollution emitted by the vehicle. These external costs plus the marginal private cost represent the marginal social cost from making a trip.

When decisions are made based on the marginal social cost, the outcome is efficient – people are made as well off as possible. However, decisions made solely based on marginal private cost are inefficient – too many people are driving because decisions are made based on an artificially low cost. Society is not as well off as possible. Governments build roads, and for the most part, give away their use. Lacking an efficient pricing mechanism, drivers pay for road use with their time by waiting in traffic.

The goal of congestion pricing on public roads is to set tolls for travel during congested periods that would make the price that the driver pays for such a trip equal or close to the total cost of that trip (including external costs). Surcharges are intended to 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 times or on less congested routes. The surcharges mean the roadway is full of drivers who, at that moment, have a high willingness to pay for their time. People who do not have a high willingness to pay will take alternative modes of transportation, use alternative routes, or defer travel to non-peak hours.

Environmental Effects of Automobile Travel and Congestion Pricing

Marylanders drive more than 135 million miles each day, contributing up to 40 percent of the pollutants responsible for the State's air pollution problems. Automobile pollutants include hydrocarbons (including volatile organic compounds (VOCs)), nitrogen oxides, carbon monoxide, and carbon dioxide. These pollutants contribute to the formation of ground-level ozone or "smog," acid rain, and global warming. Air pollution in central Maryland is a serious problem; the U.S. Environmental Protection Agency has designated the Baltimore metropolitan area as a "severe" ground-level ozone nonattainment area and the Washington, DC metropolitan area as a "serious" ground-level ozone nonattainment area. In addition to contributing to air pollution, automobile travel contributes to the pollution of the Chesapeake Bay through the atmospheric deposition of air pollutants onto the land and waterways of the State.

Research indicates that congestion increases the amount of pollutants automobiles produce by decreasing the efficiency at which vehicle motors operate. A Pacific Research Institute study concluded that vehicle emissions such as VOCs and carbon monoxide were 250 percent higher under congested conditions than during free-flowing traffic.

Congestion pricing results in environmental benefits by reducing congestion and by decreasing total vehicle miles driven. It should be noted, however, that although pollution would be expected to be less on a State roadway with congestion pricing, the total environmental benefits to the State would be relatively modest due to (1) the relatively small amount of total automobile travel in the State that would be affected if congestion pricing were instituted and (2) the multi-state sources of pollution in Maryland. For example, the airshed of the Chesapeake Bay extends west to Indiana, south to South Carolina, and north to New York. Although the environmental benefits of congestion pricing may be modest, the primary goal of congestion pricing is to reduce congestion. Any environmental benefits that may occur are an additional dividend, and this dividend would be one component of the State's overall efforts to reduce air pollution.

Implementing Congestion Pricing: The Use of High Occupancy Toll (HOT) Lanes

Although other forms of congestion pricing are used around the world, including area schemes (charging a fee to drive into a particular area), the most common type of congestion pricing uses HOT lanes. HOT lanes are limited-access, normally barrier-separated highway lanes that provide free or reduced cost access to HOVs, and also provide access to other paying vehicles not meeting passenger occupancy requirements. HOT lanes attempt to maintain volumes consistent with uncongested levels even during peak travel periods. Most HOT lanes are created within existing general-purpose highway facilities and offer potential users the option of using the general-purpose lanes or paying for premium conditions on the HOT lanes. The HOT lane concept combines congestion pricing and lane management. Congestion pricing is used to moderate demand during peak periods, and lane management is used to restrict access to designated highway lanes based on occupancy, vehicle type, or other objectives.

Benefits of HOT lanes include:

- HOT lanes have the potential to keep HOV lanes at their optimum utilization;

- HOT lanes can help to reduce congestion in the general-purpose lanes by diverting some solo drivers from the adjoining general purpose lanes;

- HOT lanes generate increased revenues for transportation corridor improvements, both highway and transit;

- HOT lanes provide a premium travel option for drivers who have a special need to reach their destination on time and are willing to pay for better service; and

- HOT lanes increase the reliability of a transportation network by increasing the predictability of travel times.

The Federal Highway Administration (FHWA) supports the use of HOT lanes. The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) created a Congestion Pricing Pilot Program, offering grant support to metropolitan planning organizations willing to experiment with pricing mechanisms to improve highway operations. FHWA has provided funding to assist with feasibility studies, implementation projects, and evaluations of operational projects. In 1998 the federal transportation program was reauthorized as the Transportation Equity for the 21st Century (TEA-21). The Congestion Pricing Pilot Program was broadened and renamed the Value Pricing Pilot Program. FHWA has stated that they will give priority to those HOT lane proposals where it is clear that an HOV lane is under-utilized.

Pricing

Toll levels are set to limit the number of users by willingness to pay. The fee structure of HOT lanes might be fixed, vary by time of day, or vary in response to real-time traffic conditions. Regardless of the fee structure, higher charges should be charged during peak demand periods to help maintain good traffic conditions. Information on toll levels is conveyed to motorists through variable message signs located near entry points.

Toll Collection

Electronic tolling is increasingly proving to be a reliable method of toll collection. Electronic tolling requires each driver to have a transponder that is attached to the vehicle and pre-programmed with identifying information such as driver name, address, and license plate number. Overhead antennas pick up the presence of a transponder and automatically charge the toll to the corresponding account. The driver is sent a bill or a credit card is charged for the toll. Electronic tolling allows any HOT lane system to avoid the delays associated with manual toll collection.

Enforcement

For enforcement and lane management to work efficiently, the toll lanes must be separated from the non-tolled lanes. This includes physical barriers or lane markings. Access to the lane might be provided at intermittent points, but in many cases there is only a single entry and exit point. If a solo driver enters the toll lane without a transponder, law enforcement can issue the driver a fine. In addition, toll facilities use cameras to photograph license plates of toll violators. The registered owner of the vehicle is normally mailed a ticket.

One problem with HOT lanes that exclusively use electronic tolling systems is that not everyone will always own the appropriate transponder, particularly out-of-state drivers. Jurisdictions are experimenting with technology that captures license plates and automatically sends a bill for the toll to the registered owner of the car. If the toll is not paid, a fine is added. Research suggests that while this method reduces the possibility of toll booth congestion and eliminates the need for significant personnel costs, the toll operator can expect to forgo some revenue as a result of uncollectible tolls.

Equity Concerns

One of the major criticisms of congestion pricing is that it is unfair to certain groups of people. The argument is that HOT lanes favor the rich because the poor are unable to afford toll charges. This, however, is no different than traditional transportation financing measures, such as gasoline taxes, which are regressive in nature. The equity concerns regarding congestion pricing, however, are mitigated by several factors:

- Although there is a correlation between the use of HOT lanes and income, evidence collected to date from existing U.S. HOT lanes suggests that users of all income levels use the lanes. For example, studies of the SR 91 Express Lanes in Orange County, California indicate that roughly one-quarter of the motorists in the toll lanes at any given time are in a top income bracket, but the majority are low and middle-income motorists. Lower-income motorists may use HOT lanes periodically when circumstances dictate a reliable commute time (i.e., when a critical appointment exists or when day care facilities charge fees for late pick-up of children), while wealthier people take advantage of tolls frequently, thus putting revenue into the system that can be used to maintain and expand travel options for all people.

- Toll revenues can be "recycled" or used for programs that benefit lower-income individuals, such as public transit or toll credits.

- From a public welfare standpoint, under congested conditions, everyone is worse off, whereas under an efficient system, society as a whole is better off (similar to cigarette smoking, congestion is a public bad; the government has the ability to increase the cost of the public bad in order to discourage it).

- Discounts could be provided for certain categories of drivers such as the disabled or people under certain income levels.

- Even drivers who choose not to pay for access to HOT lanes can benefit from reduced congestion in the general-purpose lanes.

- Although research indicates that higher-income drivers may benefit more from congestion pricing than lower-income individuals, it also shows that higher-income individuals bear a proportionally higher amount of the costs of congestion. Peak-period traffic is often composed primarily of middle- and upper-income users.

- Resources for the Future, in a 2003 study, analyzed three different pricing schemes for the Washington, DC metropolitan area and concluded that a HOT lanes policy would be more equitable than other road pricing schemes, with all income groups benefiting even before toll revenues are recycled.

Chapter 2. Examples of Congestion Pricing

Programs to charge motorists for the use of roads during peak travel times have been implemented in the U.S. and around the world. Studying these examples may provide insight into how to achieve successful implementation of congestion pricing in Maryland. U.S. examples of active high occupancy toll (HOT) lanes are provided in greater detail in **Chapter 3: Case Studies**.

U.S. Examples of Active HOT Lanes

Orange County, California – SR 91 Express Lanes

The SR 91 Express Lanes are a 10-mile, four lane, HOT facility in the median of a section of SR 91 in Orange County, California. Toll rates are collected electronically and vary according to a predetermined toll schedule. High occupancy vehicle (HOV) -3+ vehicles travel for free during all periods except weekdays 4:00 to 6:00 p.m. in the eastbound direction. The SR 91 Express Lanes are owned and managed by the Orange County Transportation Authority.

San Diego, California – I-15 Express Lanes

The I-15 Express Lanes are an 8-mile, reversible, two lane facility that runs in the median of I-15 in San Diego, California. Toll rates vary depending on current traffic conditions and are adjusted every six minutes in response to real-time traffic volumes. Vehicles with two or more occupants may use the I-15 Express Lanes for free. The I-15 Express Lanes are operated under the FasTrak program of the San Diego Association of Governments, the region's metropolitan planning organization.

Houston, Texas – I-10 and U.S. 290 (Katy and Northwest Freeways)

The Katy and Northwest Freeways in Houston, Texas allow HOV-2 vehicles to gain access to the HOV-3+ lanes during peak hours for a $2 fee. The strategy is an attempt to increase lane usage without allowing them to become overly congested. Buses and HOV-3+ vehicles use the HOT lane free of charge at all times. Single-occupant vehicles are prohibited from using the lanes. The HOT lanes are managed by the Metropolitan Transit Authority of Harris County, Texas through the QuickRide program.

Exhibit 3 provides a chart of active HOT lanes in the U.S. Only Orange County, San Diego, and Houston have active HOT lanes. Construction is underway for new HOT lanes in Denver, Tampa, Minneapolis/St. Paul, and Dallas.

Exhibit 3
Active HOT Lane Projects in the U.S.

Metro Area	In Operation	Underway	Being Studied
California			
Alameda County			I-680
Los Angeles			U.S. 101
Marin County			U.S. 101
Orange County	SR-91		
San Diego	I-15	I-15 expansion	I-5, I-805, SR-52
Santa Clara County			U.S. 101, I-880, SR-87
Sonoma County			U.S. 101
Colorado			
Denver		I-25N	I-70[1], C-470
Florida			
Miami			I-95, SR-821, SR-836
Orlando			I-4
Tampa		SR-618	
Georgia			
Atlanta			GA-316[2]
Maryland			
Baltimore			I-95, I-695
DC suburbs			I-495, I-270, MD 5, InterCounty Connector
Minnesota			
Minneapolis/St. Paul		I-394	
North Carolina			
Piedmont Triad[3]			I-40
Research Triangle[4]			I-40
Oregon			
Portland			Highway 217
Texas			SR-167
Dallas		I-635	network of HOT lanes
Houston	I-10, U.S. 290	I-10	network of HOT lanes
San Antonio			I-35, I-10, TX160
Virginia			
Hampton Roads			Congestion pricing study
DC suburbs			I-495[5], I-95
Washington			
Seattle			SR-167

[1] I-70 is in the proposal stage, but the project is not yet underway
[2] GA-316 is in the proposal stage, but the project is not yet underway
[3] The Piedmont Triad consists of Greensboro, Winston Salem, and High Point
[4] The Research Triangle consists of Raleigh, Durham, and Chapel Hill
[5] I-495 is in the proposal stage, but the project is not yet underway

Source: Reason Foundation

Besides HOT lanes, congestion pricing is also applied to tunnels and bridges. There are two examples of congestion pricing at tunnels and bridges in the U.S.

New York/New Jersey Tunnels

The Port Authority of New York and New Jersey (PANYNJ) manages and maintains the region's bridges, tunnels, bus terminals, rail system, and seaport. PANYNJ is responsible for a system of tolled tunnels and bridges that vary toll rates according to peak and off-peak hours. PANYNJ tolls the following bridges and tunnels: George Washington Bridge, Lincoln Tunnel, Holland Tunnel, Goethals Bridge, Outerbridge Crossing, and Bayonne Bridge. The toll for two-axle vehicles at all locations, effective March 2001, is $6 in cash for all hours, $5 during peak hours and using E-ZPass, and $4 during non-peak hours and using E-ZPass. Larger vehicles are tolled at higher rates. The system also offers a carpool toll rate of $1 for E-ZPass customers who have three or more people in a vehicle.

Lee County, Florida Bridges

Lee County, Florida began tolling two of four bridges connecting Cape Coral and Fort Myers in 1998. The strategy is part of the Variable Pricing Program, a federally funded program to study ways to reduce congestion. The grant consists of a three-party agreement with the Federal Highway Administration, the Florida Department of Transportation, and Lee County. The two bridges using congestion pricing schemes, Cape Coral and Midpoint, offer a 50 percent discount to electronic toll users during off peak hours. The 50 percent discount on the $1 toll is offered Monday through Friday from 6:30 to 7:00 a.m., 9:00 to 11:00 a.m., 2:00 to 4:00 p.m., and 6:30 to 7:00 p.m. In order to participate, drivers must have an account with Leeway, Lee County's system for electronic toll collection.

International Examples of Congestion Pricing

A Deloitte Research study released in 2003 suggested that at least 72 percent of major European cities are either interested in or are already proceeding with a congestion pricing scheme. Unlike the U.S., which has focused on HOT lanes, European cities are pursuing a variety of congestion pricing techniques including area schemes. Asian cities have also pursued congestion pricing as a means to deal with gridlock. The following provides several examples of congestion pricing in Europe and Asia.

London, England

In February 2003, London began to charge vehicles a flat fee of 5 pounds (approximately $9) per day to enter the central city between 7:00 a.m. and 6:30 p.m., Monday through Friday. The charge is enforced using automatic number-plate recognition technology made possible by placing small pole-mounted cameras throughout the charging zone. Drivers with incomes under certain levels or those who live within the zone receive a 90 percent discount for driving in the area. Deloitte Research found that since charges were instituted in February 2003, average traffic speeds have increased by 37 percent, and congestion has decreased by 40 percent.

Enforcement has remained a big challenge with London's area scheme. There have been problems with stolen license plates, criminals replicating the license plates of other motorists, and drivers incorrectly entering registration details. Several measures taken to address these problems include asking drivers to confirm certain details when they set up their accounts and the use of vans to track persistent evaders.

Businesses within the zone have experienced decreases in traffic and sales. In response, local policy makers are considering changes to the charge that would introduce some flexibility to the current flat fee. One proposal considers charging rates based on the amount of time spent inside the zone, much like a parking garage fee.

Deloitte Research drew several conclusions from London's area scheme: (1) strong political commitment by the majority of London ensured that the charge went ahead despite several attempts by opponents to delay it; (2) reinvesting all revenues in transport improvements increases public acceptance; and (3) consulting the public on key aspects of the scheme helped avoid opposition.

Trondheim, Norway

Trondheim, Norway instituted a congestion charging scheme similar to London by instituting a toll ring around the city center. The objective is to generate revenues for public infrastructure for car drivers, pedestrians, bicyclists, and public transportation. The toll is a fully electronic system using transponders with nonstop toll lanes at 12 stations. All motorists entering the city center are charged based on the time of day and type of vehicle; there is no charge on motorists as they exit the city. Heavier vehicles pay twice the charge of passenger vehicles. Trondheim worked with the public and businesses within the city center for six years to gain input and acceptance of the toll plan prior to implementation. National laws were also altered to permit the tolling of existing highways.

The Trondheim toll ring is an example of a public-private partnership. The city of Trondheim created a separate toll road company to own and manage the toll road. Public entities own two-thirds of the project, including the tolling infrastructure, while local commercial organizations own the remainder. **Exhibit 4** illustrates the average charges paid by drivers in Trondheim.

Exhibit 4
Trondheim Toll Ring
Average Charges Per Inbound Crossing (USD)

	Weekdays, 6:00 until 10:00 a.m.	Weekdays, 10:00 a.m. until 6:00 p.m.	Weekdays, 6:00 p.m. to 6:00 a.m. and Weekends
Passenger cars	$1.70	$1.30	No charge
Heavy vehicles	$3.45	$2.65	No charge

Source: Institute of Transportation Studies at the University of California at Berkeley

Seoul, South Korea

Seoul, South Korea introduced several traffic management strategies in the 1990s to combat a reliance on single-occupant vehicles on the main roads into downtown Seoul. Seoul increased vehicle taxes, increased parking fees, and instituted restraints on the use of private cars. Congestion pricing was also applied to the two major arterial roads linking the southern part of Seoul to the central business district. Beginning in 1996, Seoul assessed a charge of 2,000 won (approximately $1.70), on private cars with two or fewer occupants from 7:00 a.m. until 9:00 p.m. during the weekdays and from 7:00 a.m. to 3:00 p.m. on weekends and holidays. The toll is collected with staffed toll booths. Several classes of vehicles, such as taxis, public transportation vehicles, trucks, and cars with three or more people, travel the road free of charge. Seoul has seen increases in traffic speeds and use of public transportation while only experiencing a slight increase in traffic on nontolled alternative routes.

Singapore

During the 1970s, Singapore experienced rapid industrial growth and faced the problem of urban traffic congestion. To help deal with this problem, the Singapore government increased the cost of buying and owning a car through tariffs, improved public transportation to encourage its use, enhanced traffic management of existing roads, and implemented a congestion pricing scheme in 1975 that still exists today. The area scheme defines a restricted zone in the central business district containing a land area of roughly 2.3 square miles. Singapore collects a charge for the right to enter the restricted zone during morning and afternoon peak travel hours. Vehicles must display a license purchased on a daily or monthly basis and may enter the zone through one of 22 entry points. The license costs approximately 4 Singapore dollars (approximately $2.40) daily or 80 Singapore dollars monthly (approximately $48.19).

Originally, Singapore exempted taxis, buses, military and service vehicles, and carpools of four or more individuals. However, in the nearly 30 years of operation, Singapore has eliminated many of these exemptions in an effort to strengthen the results of the area scheme. The area scheme has been extremely successful in curbing traffic during peak travel hours; the program is said to have decreased traffic flow in the central business district by 50 percent.

Chapter 3. U.S. Case Studies

There are currently three examples of congestion pricing on highways in the U.S.: SR 91 in Orange County, California; I-15 in San Diego, California; and the Katy and Northwest Freeways in Houston, Texas. This chapter provides case studies of these facilities.

Orange County – SR 91 Express Lanes

Background

In 1989, California AB 680 authorized the California Department of Transportation (Caltrans) to enter into agreements with private entities to construct transportation demonstration projects. The Act authorized Caltrans to lease rights-of-way, grant easements, and issue permits to enable private entities to construct transportation facilities. The $134 million 91 Express Lanes facility was one of four public-private partnerships made possible by AB 680. It was built entirely with private funds through the California Private Transportation Company (CPTC).

The SR 91 Express Lanes opened in 1995 and was the first example of high occupancy toll (HOT) lanes in the U.S. The lanes allow HOV-3+ vehicles at reduced rates and single-occupant vehicles at full rates. The 91 Express Lanes provide two lanes in each direction between the SR 91/55 junction in Anaheim and the Orange/Riverside County line (four general-purpose lanes run in each direction and are free). The lanes run east/west for approximately 10 miles in the median of SR 91. Access points to the express lanes are provided only at each end of the facility. There are no other competing freeways in the immediate area. At the entrance of the 91 Express Lanes, drivers have a choice to either pay a toll to use the express lanes or use the general-purpose lanes for free.

In January 2003 the Orange County Transportation Authority (OCTA) purchased the 91 Express Lanes from CPTC for $207.5 million. OCTA assumed $135 million of taxable debt and advanced $72.5 million in internal bus and rail operating funds. The original franchise agreement between Caltrans and CPTC was also transferred to OCTA. OCTA is a public entity, while CPTC is a private firm.

Toll Policies and Method of Pricing

Toll rates are set as a function of traffic demand in the Riverside Freeway/SR-91 corridor. Since tolls are collected electronically, toll prices can vary based on a predetermined toll schedule. Hourly traffic volumes are tracked over a 12-week period. When hourly volumes consistently reach or exceed 3,200 vehicles per hour per direction, tolls are adjusted to maintain a predictable level of service. The existing toll schedule, implemented on August 1, 2003, as well as a map of the system, is shown in **Appendix 1**. Tolls fluctuate from $1.05 to $6.25 according to a toll schedule driven by demand.

Until May 2003, high occupancy vehicle (HOV)-3+ vehicles were charged 50 percent of the scheduled toll rates throughout the day. HOV-3+ vehicles now travel for free during all periods except weekdays from 4:00 to 6:00 p.m. in the eastbound direction. Public buses do not pay tolls on the 91 Express Lanes. Discounted tolls are offered to zero emission vehicles, motorcycles, and vehicles with disability or veteran license plates. All other vehicles pay regular tolls.

Method of Toll Collection

The 91 Express Lanes use the FasTrak electronic tolling system; there are no tollbooths. All vehicles using the lanes must have an electronic transponder mounted inside the vehicle. When traveling through the toll zone, the transponder is read by an overhead antenna, and the posted toll amount is automatically deducted from the customer's account. The toll collection zone widens from two to three lanes in each direction, and HOV-3+ vehicles pass a visual inspection in the leftmost lane to ensure that there are three or more persons in the vehicle.

Enforcement

The 91 Express Lanes are barrier-separated from the free general-purpose lanes. Access points are provided only at the end of the 10-mile facility on the east and west. Vehicles attempting to use the lanes without FasTrak are sent violations. Violations are identified by cameras that take pictures of a vehicle license plate. As part of an agreement with the state of California, OCTA contracts with the California Highway Patrol (CHP) for enforcement services. The 91 Express Lanes are officially designated as part of the California State Highway system; therefore, traffic laws that apply to all other California state highways also apply to the 91 Express Lanes, including speed, carpool, and toll evasion violations. CHP enforces carpool and toll violations with fines up to $500.

Public Outreach and Political Issues

The passage of AB 680 paved the way for the 91 Express Lanes; however, it was the emphasis throughout the planning process on public involvement that allowed the project to succeed. From the initial stages through the operation phase of the project, CPTC communicated with and sought input from the public. Comprehensive surveys of travelers and businesses were conducted, and a number of focus groups were convened. Project planners polled for public acceptance of the project, as well as the projected usage of a HOT lane facility and the willingness to pay to use it. The stakeholders involved in the planning process included the County Board of Supervisors; Environmental Defense; the Reason Foundation; the Orange County and Riverside County Transportation Commissions; Caltrans; state legislators, local mayors, and council representatives; and the International Bridge, Tunnel, and Turnpike Association. Additionally, several local and state officials championed the project giving it a distinct advantage.

Public Transportation

Public buses are allowed to use the 91 Express Lanes at no charge. Several current bus routes utilize the 91 Express Lanes. However, OCTA does not provide excess revenue to support public transportation.

Uses of Toll Revenue

When CPTC owned and operated the 91 Express Lanes, a non-compete clause in the Franchise Agreement with Caltrans prohibited any general-purpose capacity improvements to be made to the SR-91 corridor. OCTA eliminated the non-compete clause as a requirement in its acquisition of the 91 Express Lanes. A list of major improvements in the SR-91 corridor are planned including adding lane capacity in certain areas, improving interchanges and ramps, and constructing barriers. All excess toll revenue, beyond those for operating, maintenance, and debt reserves, must go to the SR-91 corridor. For fiscal 2005, the OCTA Board of Directors recently approved $2.5 million in toll revenues to help improve the eastbound side of the 91 corridor.

Socioeconomic Issues

According to the Federal Highway Administration (FHWA), evaluations of the 91 Express Lanes have shown that certain travelers are more willing to use the tolled facility. Females, particularly women ages 30 to 50, are more likely than any other group to choose a toll road. Additionally, travelers with high incomes, higher education, middle aged, and commuters are more likely to acquire a FasTrak transponder. According to OCTA, 80 percent of users are long-term users (2+ years), most users fall between 35 and 44 years of age, most are married with 1.2 children, the annual average household income of users is $71,000, users average $22 per month in tolls and average 2 trips per week, and users are more likely to use the lanes in the evening.

Impact of Priced Lanes

OCTA has stated that the 91 Express Lanes have allowed them to move more vehicles and people through the 91 corridor. From fiscal 2003 to 2004, overall trips in the corridor are up by 12 percent from 10.0 million to 11.2 million. Carpool trips (those traveling with three or more passengers) are up 43.4 percent from 1.5 million to 2.2 million. Additionally, average vehicle occupancy counts are up. Morning average vehicle occupancy is up from 1.36 million to 1.49 million and evening peak is up from 1.38 million to 1.42 million.

San Diego – I-15 Express Lanes

Background

The I-15 Express Lanes in San Diego, California began as a high occupancy vehicle (HOV) facility that first opened in 1988. The two reversible HOV lanes were constructed with $31.8 million in Federal Transit Administration (FTA) funds in the median of an 8-mile stretch of I-15, extending from the juncture of I-15 and SR 56 to the north and I-15 and SR 163 to the south. There are no freeway exits along the 8-mile stretch of highway.

The lanes were originally intended to attract carpooling commuters heading south to downtown San Diego; however, the lanes were underutilized. To increase usage of the lanes and to provide funding for the I-15 corridor, the San Diego Association of Governments (SANDAG), the region's metropolitan planning organization, proposed converting the lanes to a HOT facility. SANDAG won federal approval and a $7.96 million grant in January 1995, after FHWA revised the eligibility criteria to include HOT lane projects. The San Diego region also contributed a $1.8 million match to the federal grant and $230,000 was contributed by FTA. After the California legislature passed legislation enabling the HOV lane conversion, the newly converted HOT lanes were opened to paying solo drivers in December 1996.

The I-15 Express Lanes are operated under the FasTrak Program of SANDAG. The project is currently self-supporting, generating approximately $2 million in toll revenue per year. SANDAG has discussed extending the I-15 Express Lanes north as far as SR 78 Escondido. This expansion would create a 20-mile, two-directional managed lane facility.

Toll Policies and Method of Pricing

Under the program's first phase, called ExpressPass, users were issued a vehicle permit which allowed unlimited use of the HOT lanes. Initially, 500 monthly permits were sold at $50.00 per month. SANDAG issued 200 more permits in February 1997 and one month later raised the permit price to $70 per month. The second phase of the project began in March 1998; under the second phase, variably priced per-trip tolls replaced the flat monthly fee, and the facility was opened up to unlimited membership. The lanes continue to operate in this fashion today.

Toll rates currently range between $0.50 and $4.00 depending on current traffic conditions. Tolls may be raised up to $8.00 in the event of severe traffic congestion. To maintain free-flow on the lanes, toll rates are adjusted every six minutes in response to real-time traffic volumes. The actual toll at any given time is posted on the roadside signs to inform drivers of the current price for using the lanes. The lanes operate only during peak hours in the direction of the commute. During all other times, the reversible lanes are closed to traffic. From 5:45 to 11:00 a.m., all vehicles in the express lanes travel southbound; from 12:00 to 7:00 p.m., all vehicles travel northbound. On the weekend, all vehicles in the HOT lanes travel northbound.

To preserve carpooling incentives that existed with the original HOV lanes, vehicles with two or more occupants may use the I-15 Express Lanes for free. Motorcycles may also use the lanes for free. The toll rates, along with a map of the system, are presented in **Appendix 2**.

Method of Toll Collection

When the I-15 Express Lanes first opened in December 1996, electronic tolling capability did not exist. Visual inspection was required to determine whether a vehicle had the required decal permit. In June 1997, transponders were introduced, allowing for electronic enforcement of permit requirements. The transponders also enabled the collection of data about usage of HOT lanes. Under the current system, electronic signs at the entrance of the HOT lanes (at both the north and south ends) notify motorists of the toll as they approach the toll lanes. Motorists enter the Express Lanes at normal highway speeds. Toll collection occurs when the motorist travels through the tolling zone where overhead antennas scan the windshield-mounted transponder and automatically deduct the posted toll from the motorist's pre-paid account.

Carpools use the I-15 Express Lanes for free. When traveling in a carpool, motorists who own a transponder put it in a silver static bag that prevents a toll from being charged to the owner's account. If vehicles only carpool on the I-15 Express Lanes, a FasTrak transponder is not necessary.

Enforcement

The I-15 Express Lanes are barrier separated. CHP visually inspects carpool vehicles and FasTrak customers. An electronic monitor will tell officers if a solo motorist is a qualified FasTrak customer who has paid a toll. It is a violation of the California Vehicle Code to use the I-15 Express Lanes without two or more people in the vehicle or without a FasTrak transponder visibly displayed and a current FasTrak customer account. Carpool violations carry a minimum fine of $341 for the first offense. FasTrak customers who are traveling alone and have their transponder in the silver static bag are also violators. Toll evasion fines start at $20 per violation and increase based on prior citations. The toll evasion fines are handled through account service fees and processing fees in addition to the toll that should have been charged at the time of travel.

Public Outreach and Political Issues

The I-15 HOT lane initiative included early efforts to assess public opinion and potential usage of the lanes before the facility was launched. During the early 1990s, when SANDAG was working toward converting the existing HOV lanes to HOT lanes, SANDAG contracted with a consultant to collect baseline market survey data. Commuters in the I-15 corridor were queried in focus groups, telephone surveys, and intercept surveys on their attitudes toward variable tolling and traveling in the corridor. The findings from these pre-project studies formed the basis of strategies for pricing and for customer communications. The project also benefited significantly from having a strong political champion.

Uses of Toll Revenue

FasTrak revenue from the I-15 Express Lanes generates approximately $2 million per year. Approximately $750,000 per year is used for operating costs and $60,000 per year is used for enforcement provided by CHP. State law requires the remaining revenue to be spent on improving transit service along the I-15 corridor. Revenue fully funds the Inland Breeze (Route 980/990) express bus service providing service from the Rancho Bernardo area to downtown San Diego.

Public Transportation

All revenue not used on operating costs and law enforcement is used to support public transit along the I-15 corridor, including the Inland Breeze (Route 980/990) express bus service. The Inland Breeze route received nearly $1 million in fiscal 2004; the level of funding is adjusted annually based on the consumer price index. Route 980 utilizes the I-15 Express Lanes and Route 990 does not. The service operates during peak weekday commute times, from approximately 5:00 to 10:00 a.m. and 2:00 to 7:00 p.m.

Socioeconomic Issues

SANDAG has commissioned research and analysis groups such as the San Diego State University Foundation and Godbe Research and Analysis to conduct studies in areas such as market research, operations, and overall evaluations of the FasTrak program. A San Diego State University Foundation report released in 2001 found that FasTrak users were different from other I-15 users in several ways: (1) they were from higher income households; (2) more highly educated; (3) predominantly 35 to 54 years old; (4) more likely to be homeowners; (5) more likely to be middle-aged females; and (6) more likely to come from two vehicle families. Although FasTrak users were often found to share certain characteristics such as higher household income, the study concluded that the I-15 Express Lanes were not viewed as elitist. The study noted that this perception did exist during the first year of the I-15 Express Lanes but was not an issue by the second year.

A public outreach report released by SANDAG in 2002 discussed several key equity concerns. The public outreach report used stakeholder interviews, focus groups, transit rider surveys, and telephone surveys to gain information on how the public views the I-15 Express Lanes. Very few individuals had major concerns with equity issues. Many individuals stated that the introduction of bus rapid transit on the I-15 Express Lanes helps all socioeconomic groups to benefit from the managed lanes. In a focus group, when a full explanation of all I-15 Express Lane features were explained, nearly 85 percent felt the system was fair. Most people in the group based their approval on the fact that the system provides options that work for people in a variety of different situations and that solo drivers help support transit and carpool alternatives. Since this study in 2002, SANDAG has continued to follow the equity issue. General surveying by SANDAG indicates that no significant equity issues exist and that the project receives high approval and acceptance rates (above 60 percent for most groups).

Environmental Impacts

A report by the San Diego State University Foundation in 2001 indicated that the I-15 Express Lanes may have moderated emission levels along the I-15 corridor during a period when emission levels increased substantially along a nearby interstate corridor. This study took place from 1997 to 1999. This study did note the difficulty of isolating emission levels in a particular corridor because other factors, such as job growth, home construction, and population growth, have the ability to influence data.

Impact of Priced Lanes

A 2001 report by the San Diego State University Foundation that studied traffic patterns from 1997 to 1999 indicated that I-15 Express Lanes may have helped alleviate congestion on the I-15 main lanes by redirecting an increasing share of volume onto the I-15 Express Lanes. Although it is difficult to measure success, the I-15 Express Lanes seem to have had a positive impact on the I-15 corridor.

Houston – Katy and Northwest Freeways

Background

The Katy Freeway (I-10) HOV lane opened in 1984 as a 13-mile, reversible lane on the west side of downtown Houston, flowing inbound in the morning and reversing in the afternoon. Only transit and vanpools were initially permitted; service was eventually expanded to include HOV-2+ vehicles. Due to high demand and poor traffic conditions, in 1988, the HOV status was upgraded to HOV-3+ during peak periods. This change, however, caused the lane to be underutilized. In 1998, the Texas Department of Transportation (TxDOT), Houston METRO, and FHWA funded a feasibility study of a HOT lane on the Katy Freeway, which resulted in a value pricing demonstration called QuickRide. QuickRide was viewed as a way to increase use of the lane without allowing it to become overly congested. QuickRide allows HOV-2 vehicles to gain access to the HOV-3+ lane for a $2 fee.

The QuickRide program was so successful that in 2000, it was expanded to a second HOV facility in Houston, the Northwest Freeway (U.S. 290). The Northwest Freeway’s HOV lane runs for 15.5 miles and has operated as a one-lane barrier-separated reversible HOV lane since its inception. The QuickRide program is in operation on the Northwest Freeway only during the morning peak, when the HOV-3+ restriction is in effect.

A map of the system is presented in **Appendix 3.**

Feasibility Study and Public Outreach

A number of elements were examined during the HOT lane feasibility study, including assessing the available capacity and the potential demand at different pricing levels, legal issues, and public sentiment. One critical analysis involved determining how many HOV-2 carpools would use the facility at different pricing levels. Legal and institutional issues also were examined; for example, the ability to charge for use of the HOV lane, the ability to enforce fines and penalties, and other policy changes.

Before implementing the QuickRide system, Houston METRO and TxDOT conducted focus groups to assess public sentiment toward the proposed fee system. Marketing and public information materials were created to provide public outreach. Public advertisements for the program appeared in print and radio media in late December 1997, one month prior to the program's implementation. The system also has a web site that contains basic information about the program[1].

Toll Policies and Method of Pricing

Buses and HOV-3+ vehicles use the HOT lane free of charge at all times. Single-occupant vehicles are prohibited at all times, mainly due to the corridor's high demand and its limited capacity. On the Katy Freeway, HOV-2+ carpools may use the lane without charge except during the morning and evening rush hour peaks – from 6:45 to 8:00 a.m. and from 5:00 to 6:00 p.m. Monday through Friday. During those times, HOV-2+ carpools may use the lane for a $2 toll. On the Northwest Freeway, QuickRide is in effect only during the morning peak, when the HOV-3+ restriction is in effect. HOV-2+ carpools may use the HOT lane at all other times, and may pay the $2 toll to use the lane during the morning peak.

Method of Toll Collection

Since its inception, the QuickRide system has used fully-automated toll collection. Windshield-mounted electronic transponders are issued by Houston METRO. Participants pay a $2.50 monthly service fee for each transponder. Large digital displays at approaches to the HOT lane inform drivers when QuickRide rules are in effect. Overhead readers deduct the toll from the user's prepaid account. An initial balance of $40 is required on each transponder. When the account balance falls below $10, the user's credit card is charged to bring the balance back to $40. Monthly statements reflect all trip costs and credit card charges.

[1] http://www.hou.metro.harris.tx.us/services/quickride.asp

Financing/Uses of Toll Revenue

The original HOV lane on the Katy Freeway was constructed with FTA funds, as it was originally intended for transit and carpools. The QuickRide program was initially funded as an FHWA Priority Corridor Program. The program started at a relatively low cost, in large part because existing resources could be used. For example, METRO police were already present at HOV exit locations so enforcement was economical. Telephone inquiries are handled by existing staff at METRO's regional carpool matching office. No new toll collection equipment was needed in the field because transponder readers were already in place.

Revenue generated through the program covers the nominal operating costs associated with maintaining and servicing participant accounts (approximately $100,000 annually).

Enforcement

Enforcement is a major challenge. On both the Katy and Northwest Freeways, concrete barriers separate the QuickRide lane from the outer general-purpose lanes. METRO police are stationed at specified locations. Mobile units can tell the police if a car has a valid transponder; if it does not, the police count the number of people in the car. If there are only two people, the police stop the vehicle. Because the program does not allow single-occupant vehicles in the HOT lanes, and because no technology exists that can accurately count the number of people in a given car, enforcement must be visual, manual, and real-time.

Political Issues

Because tolls were instituted on existing HOV lanes to provide access to those who were ineligible to use the lanes, political opposition was not a problem.

Public Transportation

All of Houston's HOV lanes, including the Katy and Northwest Freeways, have adjacent park-and-ride lots and significant transit usage. The park-and-ride lots have transit stations with covered passenger waiting areas and other amenities. Direct access ramps connect the major park-and-ride lots and transit stations to the HOV lanes. Transit centers without park-and-ride lots or with only small lots are located at strategic transfer points. METRO provides a high level of bus service in each corridor. Buses and over-the-road coaches are operated on many routes. METRO also operates a rideshare program.

Socioeconomic Issues

Burris and Hannay (2002) analyzed the equity issue of the Houston QuickRide project. The analysis was based upon survey data on QuickRide enrollees and 1998 QuickRide usage data. Although QuickRide enrollees were found to have significantly higher incomes and to be significantly younger than drivers on the Katy Freeway main lanes, QuickRide usage (once enrolled) did not vary significantly by respondent income, occupation, age, or household size. The study also found that no drivers were made worse off due to the program, and that, once enrolled, the QuickRide program is a benefit to most travelers, as long as the occupants of the vehicle value their travel time at a rate exceeding $3 per hour each.

Burris and Appiah (2004) found that household size, occupation, and hourly wage rate were not good indicators of the frequency of QuickRide usage. Socioeconomic characteristics such as age, household type, and education, however, have significant effects on QuickRide trip frequency. The study found that participation in QuickRide increases with increasing trip length, perceived time savings, and frequency of trips in the travel corridor. Participation decreases with increasing carpool formation times but is generally irresponsive to minor changes in the $2 toll. The study also found that QuickRide is more likely to be used for commute trips than other trips.

Burris and Stockton (2004) found that QuickRide users are mostly married with children, educated, professional, aged 35 to 54, with annual household incomes greater than $75,000.

Impact of Priced Lanes

Daily use of the program has increased over time. According to FHWA, in 1998, QuickRide averaged 103 daily users on the Katy HOT lane. By 1999, some 121 participants were using the program daily. About 22 people used the Northwest Freeway HOT lane in 2000, with use growing to 56 by 2002. As of April 2003, there were 1,476 active QuickRide accounts. Burris and Stockton (2004) cite an average of 208 trips per day in 2003. The majority of users do not use the QuickRide program every day, but are occasional users, with 1 in 4 transponders being used in a given week, and about 1 in 20 transponders being used five or more times a week. Most participants were persons who formerly traveled in single-occupant vehicles on the freeway main lanes.

The traffic effects of the QuickRide program have been less pronounced than other pricing projects; this is likely due to the smaller scale of the project and the limitation of the availability of "entry for a fee" access to HOV-2+ vehicles. HOV usage, however, has shown modest improvement during the peak traffic period. Burris and Stockton (2004) estimated travel time savings at 17.33 minutes during the morning peak on the Katy Freeway, 15.04 minutes during the afternoon peak on the Katy Freeway, and 10.51 minutes during the morning peak on the Northwest Freeway.

According to TTI, QuickRide's primary goals of increasing person movement and average vehicle occupancy have been met. Clark and Barnes (2001) found that among QuickRide participants, the reported number of trips made alone was halved, and the number of carpool trips doubled. In addition, participants are satisfied with the program, reporting that they enjoy the flexibility the program provides.

Before and after studies of the Katy Freeway showed that its HOT lane application resulted in the following positive effects:

- an increase in the number of HOV-3+ carpools during peak hours;
- a redistribution of HOV-2+ carpools to before and after the peak hour;
- an increase in average traffic speeds;
- an improvement in the Katy HOV's level of service; and
- the transportation of the same number of passengers more efficiently.

The Future of QuickRide

Due to the success of the program and increasing congestion in the area, activities are underway to explore options to modify and expand the QuickRide project. The study will address modifying user fees, changing fee collection technology, enhancing enforcement capabilities, and expanding marketing and outreach efforts. Several options are currently under consideration, including:

- expanding the HOV-3+ restriction and the QuickRide program to the evening rush on the Northwest Freeway;
- expanding the HOV-3+ restriction and the QuickRide program to the shoulders of each peak period in conjunction with time-of-day variable pricing where the shoulder toll is less than the peak period toll; and
- allowing single-occupant vehicles to pay to use the HOT lanes during off-peak periods, when excess capacity exists.

In addition, managed lanes are under construction on the Katy Freeway, which will result in four middle toll lanes rather than one; this new capacity is scheduled to be opened by 2010.

Chapter 4. Congestion Pricing in Maryland

In recent years, congestion pricing has emerged as a possible method to improve mobility in the Washington, DC region. With the announcement from the Virginia Department of Transportation of plans to build high occupancy toll (HOT) lanes on a 14-mile stretch of I-495, this issue is likely to only increase in visibility. The issue of congestion pricing is not new to Maryland. The Maryland Department of Transportation (MDOT) undertook a statewide study of HOT lane opportunities in response to the 1999 *Joint Chairmen's Report*. MDOT conducted a one-year value pricing study that considered a full range of value pricing strategies, including HOT lanes. The study was partially funded by the Federal Highway Administration (FHWA) through its Value Pricing Pilot Program. A year later, MDOT provided preliminary recommendations that a public outreach and education program should begin and that the variable pricing concept should be further considered for implementation on a pilot basis. Candidate locations for consideration of implementation included U.S. 50, I-270, and/or the Chesapeake Bay Bridge. MDOT stated that, prior to the pilot project, a major public outreach effort would be carried out to educate the public on variable pricing and the proposed pilot program. However, in 2001, MDOT was directed to end the HOT lane studies in response to perceived concerns regarding equity.

On October 21, 2003, the State Highway Administration (SHA) briefed the Maryland Transportation Task Force on potential toll financing including managed lanes. SHA recommended that Maryland continue to explore toll financing options for those projects that show good potential either as traditional toll or managed lane projects. SHA also recommended that toll financing should become an explicit component of SHA's project development process. Regarding managed lanes, SHA presented several issues: (1) access would need to be limited to electronic tolling (transponders like E-ZPass or video tolling concepts); (2) in some cases, a new lane and one existing lane would need to be tolled to make the project economically viable; and (3) HOT lanes would be very difficult to enforce, so all vehicles in the managed lanes would have to be tolled except buses and vanpools.

In addition to congestion pricing schemes on highways, Maryland has also studied the possibility of congestion pricing on tolled bridges. During the 2003 legislative session, the Maryland Transportation Authority (MdTA) was directed to prepare a report on congestion mitigation measures at the Chesapeake Bay Bridge. In its November 2003 report, MdTA stated that it will not move forward with a congestion pricing scheme on the Chesapeake Bay Bridge in the immediate future. MdTA provided several reasons for this conclusion: (1) a consultant study concluded that the Chesapeake Bay Bridge is not a good candidate for congestion mitigation measures due to lack of alternative routes, physical limitations, and extent of peak period travel demand; (2) current construction at the Chesapeake Bay Bridge to renovate the deck of the westbound span, widen the eastbound toll plaza approach, and create a dedicated E-ZPass lane; and (3) the current trust agreement does not provide flexibility for congestion pricing at the Chesapeake Bay Bridge exclusively. Although MdTA does not recommend moving forward with congestion pricing at this time, it continues to look at short-term options such as providing real time traffic information, capital project initiatives for roadway improvements, and

E-ZPass enhancements and advertising. After completion of the current Chesapeake Bay Bridge construction projects, MdTA advises that it will continue to study and implement ideas for mitigating congestion, including possible congestion pricing alternatives.

SHA and MdTA are currently studying several congestion pricing options for Maryland. The agencies are attempting to identify alternatives that address capacity, congestion, and safety needs of the highways. According to SHA, Maryland is studying several potential locations for congestion pricing on existing roads:

- ***I-270 Eisenhower Highway (Address Congestion and Safety Issues on I-270 between I-495 and I-70):*** The I-270 Corridor is a major north-south route that connects Western Maryland to the rest of the State and the Washington, DC region. Transit options are available in the region, but the expected increase in population and employment in Montgomery and Frederick counties will likely require additional measures. SHA and the Maryland Transit Administration (MTA) are studying several combinations of highway and transit strategies including the "No-Build Alternate" which will provide a means to compare all other alternatives; using Transportation System Management/Transportation Demand Management techniques; and installing Express Toll Lanes, new interchanges, and transit options such as light rail and/or bus rapid transit. Transportation System Management/Transportation Demand Management involves improving the operation of existing transportation facilities such as bus service, constructing additional park and ride lots, or providing interactive transit information at major employment centers. SHA and MTA are studying alternatives that would provide light rail or rapid bus transit, additional general-purpose lanes, or Express Toll Lanes. Project planning activities are currently underway with location/design approval of a selected alternative expected during summer 2006.

- ***I-495 Capital Beltway (Address Congestion from the American Legion Bridge to the Woodrow Wilson Bridge):*** Regarding I-495, SHA has narrowed its focus of study to three main alternatives: "No-Build Alternate"; use Transportation System Management/Transportation Demand Management techniques; or build one additional lane in each direction and provide six general-purpose lanes and four express toll lanes. The study will consider the use of electronic tolling and enforcement. SHA expects to complete environmental impact studies by winter 2006. Because Virginia is moving forward with plans to institute congestion pricing on a portion of I-495 in that state, studying the use of congestion pricing on this roadway in Maryland is logical.

- ***I-95 John F. Kennedy Memorial Highway (Address Capacity and Safety Issues between Baltimore City and Delaware in Four Phases Beginning with the Section between I-895 North and MD 43).*** MdTA intends to improve road conditions along the entire I-95 corridor from Baltimore City to the Delaware state line. The first phase of the project will study and develop alternatives for the section from I-895 North to MD 43. MdTA is studying three alternatives: "No-Build Alternate"; build additional general-purpose lanes; or build managed lanes. MdTA expects to complete project planning by early 2005 and begin construction in 2006.

- ***I-695 Baltimore Beltway (Address Congestion and Improve Safety and Operations by Providing Additional Capacity from I-95 SW to I-95 NE)*:** The original concept for I-695, the Baltimore Beltway, was to widen from I-95 SW to I-95 NE to four lanes in each direction with pavement to provide a fifth lane for High Occupancy Vehicle (HOV) use. SHA is now investigating a typical section to include three general use lanes and two Express Toll Lanes. This would require taking away a general use lane on the segments already completed from MD 140 to I-83. A study to determine the feasibility of Express Toll Lanes on I-695 is underway and is expected to be completed in fall 2005.

- ***MD 5 Branch Avenue (Address Congestion and Safety by Providing Additional Capacity and Eliminating At-grade Intersections from the U.S. 301 Interchange at TB Junction to North of I-95/I-495):*** As part of the U.S. 301 South Corridor Transportation Study, consideration was given to the addition of HOV lanes along MD 5 from TB Junction to north of I-95/I-495. SHA also completed a separate project planning study for MD 5, which proposed to widen MD 5 to a six-lane freeway. The upgrade and widening of MD 5 has been completed north of Surratts Road. SHA is revisiting the work done as part of the U.S. 301 study to analyze incorporating express toll lanes along MD 5. Consideration will be given to providing two express toll lanes and two general purpose lanes in each direction.

In addition to the studies underway regarding the use of congestion pricing on existing roadways, SHA and MdTA are also studying congestion pricing strategies on one proposed road:

- ***InterCounty Connector (Address Mobility and Safety, Support Development and Local Land Use Plans, and Improve Access between Economic Growth Centers by Constructing a New East-west Multi-modal Highway in Montgomery and Prince George's Counties between I-270 and I-95/U.S. 1)*:** The InterCounty Connector (ICC) is proposed to connect I-270 in Montgomery County to I-95/U.S. 1 in Prince George's County. SHA and MdTA are studying the ICC as a tolled roadway using congestion pricing to manage demand for the roadway in order to maintain relatively congestion-free travel on the proposed facility. SHA and MdTA expect to complete project planning by summer 2005 and begin construction in fall 2006.

Chapter 5. Conclusions

Congestion pricing projects implemented in the U.S. and around the world have proven to be a successful measure to combat gridlock. Although congestion pricing could serve as a valuable tool to mitigate congestion in Maryland, there are many important issues to consider as transportation officials, legislators, interest groups, and the public examine the topic.

- ***Equity*****:** Some critics of high occupancy toll (HOT) lanes have asserted that HOT facilities favor higher income individuals. Despite this criticism, usage data shows that drivers in all income brackets use and support the facilities. In addition, even though only those who choose to pay the toll benefit from the use of the tolled lanes, drivers in the general-purpose lanes also benefit as congestion is reduced and a more efficient system is created. To address equity concerns more directly, HOT lane proposals might consider using toll revenues for public transit, road infrastructure, or tax rebates tilted toward lower-income households.

- ***Education/Outreach*****:** The concept of HOT lanes is still relatively new; public outreach will require a larger educational component than traditional transportation projects. Education is needed to distinguish a HOT facility from normal tolls, communicate how and by whom tolls will be collected, and explain how toll revenues will be spent.

- ***Political Champions*****:** Early involvement by a political champion can be extremely advantageous to the success of the HOT lane project. All projects in the U.S. that have resulted in actual implementation can point to one or more elected individuals that support the use of road pricing. Alternatively, many projects that have not been successful can point to elected officials that actively blocked project implementation.

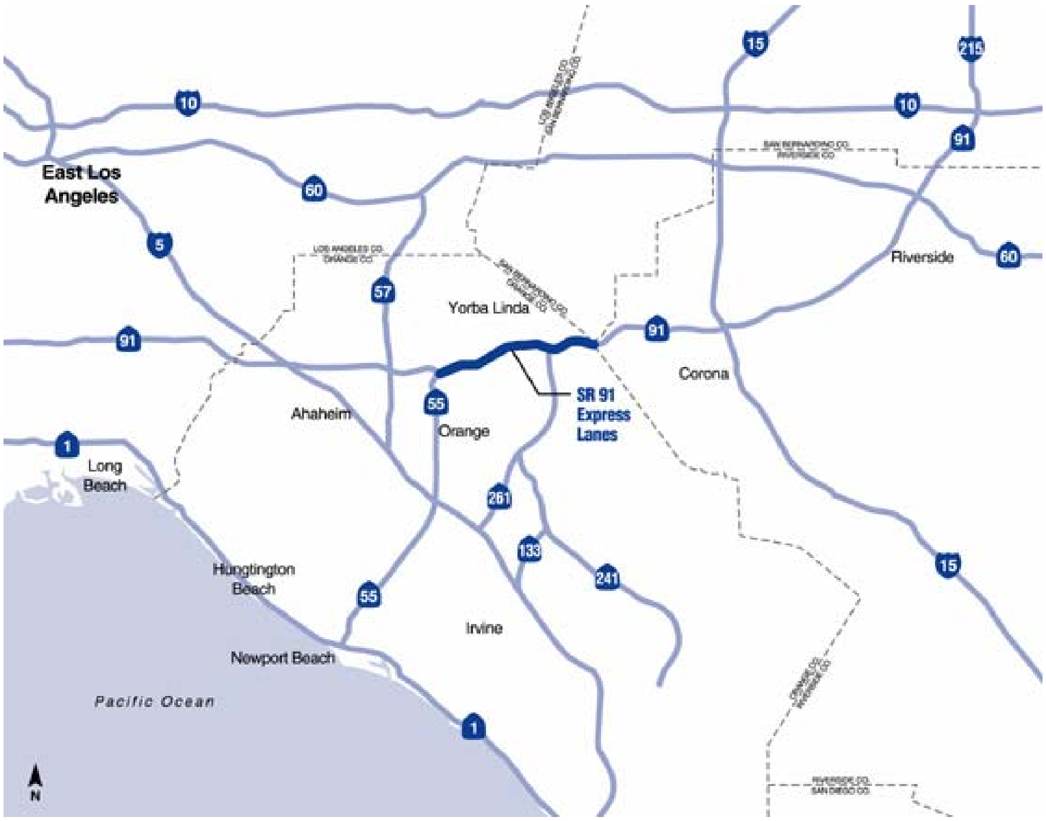
- ***Project Cost:*** Once implemented, HOT lanes have the unique opportunity to create a self-supporting transportation corridor without relying on state funds. State funds for road projects around the nation primarily involve gasoline taxes, motor vehicle registration and titling fees, and special sales taxes. Identifying start-up funds for congestion pricing projects, such as the use of private investment, will be critical.

- ***Technology:*** Electronic toll collection is vital to the success of a HOT lane network. MdTA has continued to market E-ZPass as a convenient and efficient way to pay tolls on Maryland roads. For any congestion pricing scheme to succeed in Maryland, increased promotion of electronic transponders must occur.

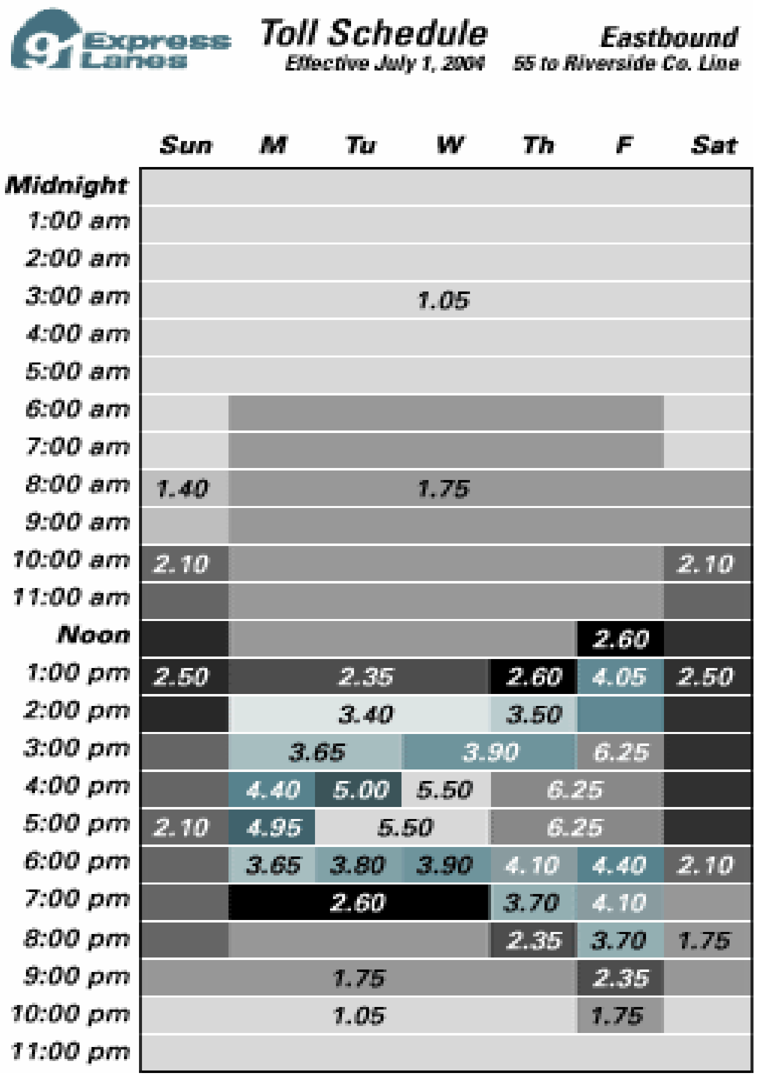
- ***Environmental Benefits:*** Although it is often difficult to collect reliable data on the topic, studies have shown that HOT lanes are likely to provide environmental benefits by reducing greenhouse gases and other emissions caused by stop-and-go traffic and by encouraging commuters to use mass transit and carpools.

With careful planning and public involvement, congestion pricing could serve as a valuable tool to alleviate congestion on many of Maryland's roadways. Accordingly, the State should continue to pursue the implementation of congestion pricing in Maryland.

SR 91 Express Lanes



Source: Federal Highway Administration



Source: Orange County Transportation Authority

91 Express Lanes **Toll Schedule** *Effective July 1, 2004* **Westbound** *Riverside Co. Line to 55*

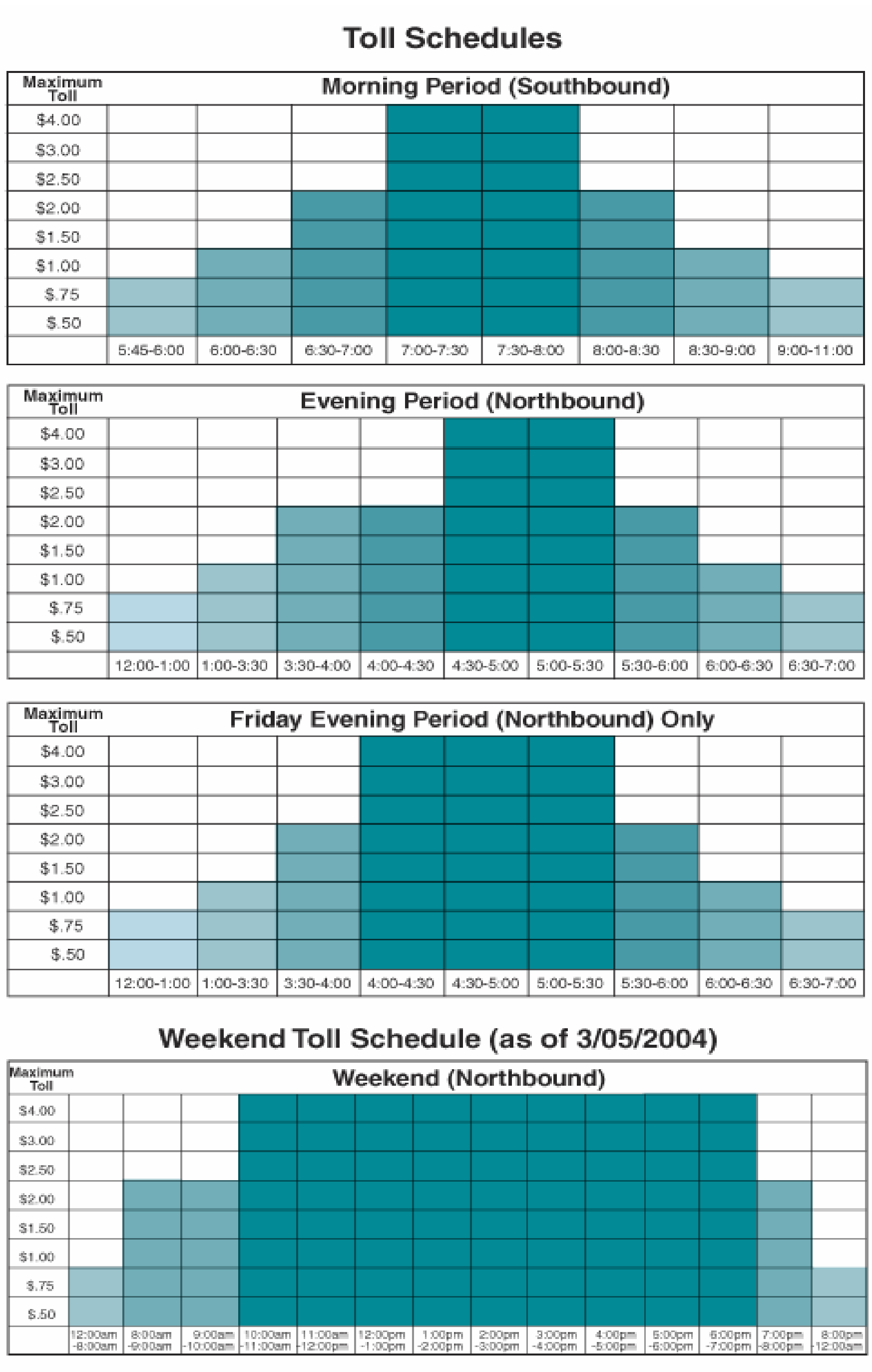
	Sun	M	Tu	W	Th	F	Sat
Midnight							
1:00 am							
2:00 am				1.05			
3:00 am							
4:00 am				2.00			
5:00 am				3.30		3.20	
6:00 am				3.40		3.30	
7:00 am				3.75		3.65	1.50
8:00 am	1.50			3.40		3.30	1.75
9:00 am				2.75			2.10
10:00 am							
11:00 am	2.10						
Noon							
1:00 pm				1.75			2.40
2:00 pm	2.40						
3:00 pm							
4:00 pm						2.10	2.55
5:00 pm	2.55						
6:00 pm						2.50	2.10
7:00 pm						1.75	
8:00 pm	2.10						
9:00 pm				1.05			
10:00 pm							
11:00 pm							

Source: Orange County Transportation Authority

I-15 Express Lanes

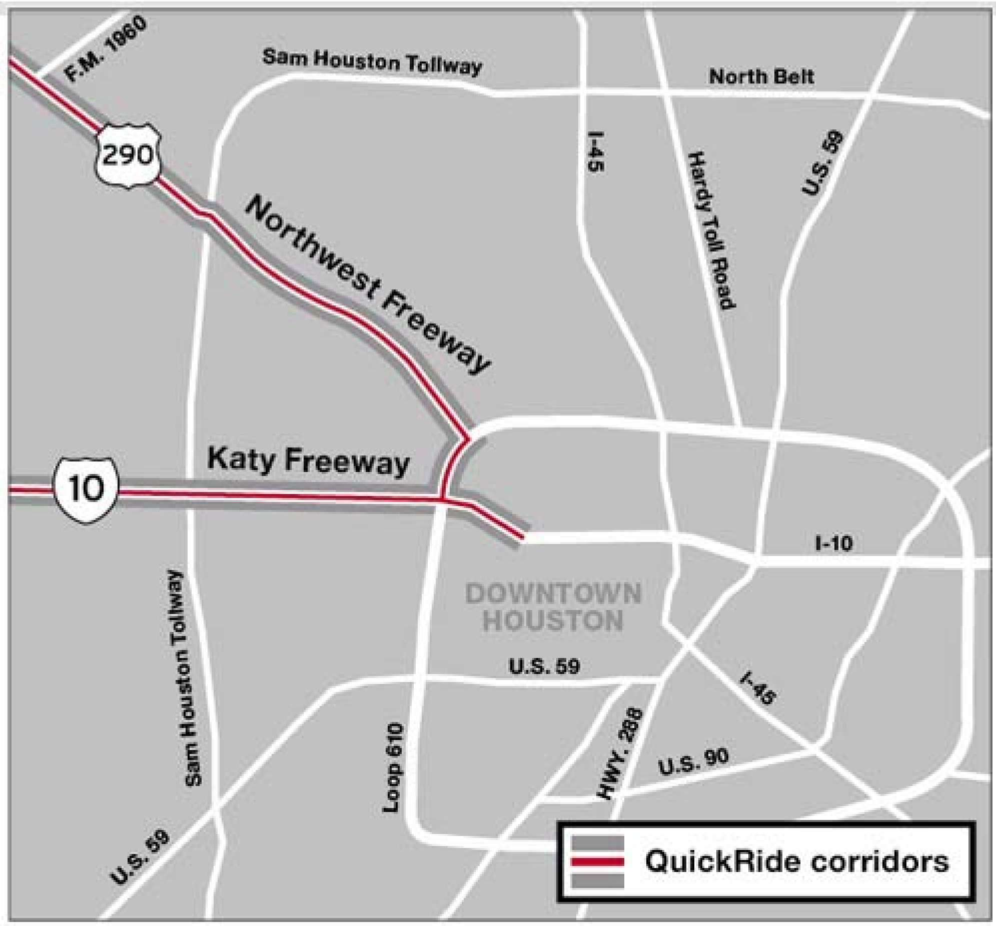
Source: Federal Highway Administration

I-15 Express Lanes



Source: San Diego Association of Governments

Katy and Northwest Freeways



Source: Texas Transportation Institute