Congestion in Maryland
A Bumper to Bumper Analysis

Department of Legislative Services 2008

Congestion in Maryland
A Bumper to Bumper Analysis

Department of Legislative Services
Office of Policy Analysis
Annapolis, Maryland

July 2008

Contributing Staff

Edward M. Cheston
Lesley G. Cook
Jaclyn Dixon
Evan M. Isaacson
David B. Juppe
Jonathan D. Martin
Patrick T. Tracy

Support Staff

Kimberly J. Landry

For further information concerning this document contact:

Library and Information Services
Office of Policy Analysis
Department of Legislative Services
90 State Circle
Annapolis, Maryland 21401

Baltimore Area: 410-946-5400 ● Washington Area: 301-970-5400
Other Areas: 1-800-492-7122, Extension 5400
TDD: 410-946-5401 ● 301-970-5401
Maryland Relay Service: 1-800-735-2258
Email: libr@mlis.state.md.us
Home Page: http://mlis.state.md.us

July 2008

The Honorable Thomas V. Mike Miller, Jr., President of the Senate
The Honorable Michael E. Busch, Speaker of the House of Delegates
Honorable Members of the General Assembly

Ladies and Gentlemen:

One of the most pressing transportation issues facing the country is traffic congestion. According to the Reason Foundation, nearly 69 percent of Maryland's urban interstates were congested in 2005 – ranking the State the fifth worst in the country. Although congestion is a result of numerous factors, the primary cause is that population growth has outpaced roadway capacity in recent decades.

Congestion results in an increase in commute times, lost work hours, delayed freight, and wasted fuel. It also increases air pollution and accelerates the degradation of transportation infrastructure. Thus, it has far-reaching economic and environmental impacts.

Transportation agencies have identified a number of strategies to reduce congestion, including adding new capacity to the transportation system (*e.g.*, building more roadways and public transit options); increasing the efficiency of the existing system; and managing the demand-related stress on the system. Accordingly, a broad array of strategies is needed. In addition, despite the action taken during the 2007 special session to increase transportation revenues, financial resources to expand the State's transportation system are limited, and the level of future federal aid is uncertain.

Maryland has implemented a number of congestion mitigation measures; however, the State does not have a clear and comprehensive strategy to address the issue. Committee narrative in the 2008 *Joint Chairmen's Report* requires the Maryland Department of Transportation and the State Highway Administration to develop and submit a plan to address congestion. This plan, which is due in November 2008, will be a starting point for examining the issue and identifying more coordinated solutions. However, the General Assembly will need to continue to track this issue over time.

The Department of Legislative Services has prepared this report to assist the General Assembly in understanding congestion, the magnitude of the problem, and potential strategies to reduce congestion in the State. Should you have any questions, please contact Jon Martin of the Office of Policy Analysis at (410) 946-5530.

Sincerely,

Warren G. Deschenaux
Director

WGD/JDM/kjl

Contents

Transmittal Letter iii

Executive Summary vii

Chapter 1. Congestion as a National Issue 1
- Background 1
- The Cost of Congestion 2
  - Economic Impact 3
  - Infrastructure Impact 3
  - Environmental Impact 3

Chapter 2. Congestion in Maryland 5
- Congestion Performance Measurement 8
- Economic Impact 9
- Infrastructure Impact 10
- Environmental Impact 10

Chapter 3. Congestion Mitigation Strategies Nationally and in Maryland 11
- Roads 11
  - New Roadway Construction 11
  - Maximizing Use of Existing Infrastructure 12
    - System Preservation 13
    - Chokepoints 13
  - Intelligent Transportation Systems 14
    - Ramp Metering 14
    - Incident Management 14
    - Message Boards 15
    - Periodic Measurement 15
    - Electronic Toll Collection 15
- Other Strategies 17
  - Public Transit 17
  - Congestion Pricing 18
    - High Occupancy Toll Lanes 18
    - Express Toll Lanes 18
  - Changing Use Patterns 19
    - High Occupancy Vehicle Lanes/Carpooling 19
    - Teleworking 19
    - Flexible Scheduling 20
    - Alternative Commuting Promotion 20

Land Use and Planning 21
Transit Oriented Development 21
Other Smart Growth Programs 21

Chapter 4. Financing Transportation 23

Conclusion and Recommendations 25

Executive Summary

One of the most pressing transportation issues facing the country is congestion. The concern regarding congestion is reflected in the U.S. Department of Transportation's decision to identify congestion as a top priority and to launch its National Strategy to Reduce Congestion. Furthermore, in January 2007, the U.S. Government Accountability Office added transportation finance and capacity as part of its High-Risk series of issues facing the country and in need of Congressional oversight.

While congestion is a national issue, it is also a pressing issue for Maryland. By any national measure of congestion, the State of Maryland, and the Baltimore and Washington Metropolitan areas in particular, consistently rank as two of the most congested areas in the country. While there are a number of factors that contribute to congestion, Maryland's congestion problem can be linked largely to the fact that the State's population growth (and related growth in vehicle miles traveled) has outpaced the growth in the transportation network (specifically, roadway capacity).

With more than 5.6 million residents, Maryland has the nineteenth highest population in the nation, yet is the ninth smallest state. By 2030, Maryland's population is expected to grow by nearly 18 percent, or approximately one million people, some of which can be attributed to an influx of individuals as a result of the Base Realignment and Closure process. As the State's population continues to grow, Maryland's scarce land will be increasingly needed for the infrastructure to support its residents, and congestion will become increasingly difficult to manage.

Congestion has far-reaching economic, environmental, and infrastructure impacts. For example, the Greater Baltimore Committee released a report in the fall of 2007 noting that roadway congestion costs Maryland $3.1 billion per year in lost work hours and fuel.

State transportation agencies across the country have identified a number of strategies that can be implemented to reduce congestion. Strategies can include actions ranging from constructing new roadways and public transportation to using technology and pricing as a way to promote behavioral changes. Based upon what other states are doing and what the literature indicates, a congestion mitigation effort needs to include a broad array of strategies and cannot be limited to simply constructing new roadways or expanding public transportation.

Further complicating the problem is that the cost to address congestion is high. While State funding for transportation was recently enhanced during the 2007 special session, those additional funds will only begin to address the $40 billion in unfunded projects that has been identified by the Maryland Department of Transportation (MDOT). Furthermore, there is also a good deal of uncertainty regarding the amount of federal transportation funding the State will receive in the future. Given these funding constraints, low cost and innovative

strategies to address congestion will need to be considered.

While Maryland has implemented a number of congestion mitigation measures, and while MDOT has a number of projects in the Consolidated Transportation Program that on their own will help to reduce the rate of growth in congestion, the State does not have a clear and comprehensive strategy for how best to address the problem. Although committee narrative in the 2008 *Joint Chairmen's Report* requires MDOT and the State Highway Administration to develop a State plan to address congestion by November 2008, the General Assembly should continue to track this issue over time.

Chapter 1. Congestion as a National Issue

Background

Since the 1950s, the rate of automobile ownership nationally has steadily increased. In combination with suburban residential development, the population surrounding urban centers has become more dense and traffic congestion has increased. According to the U.S. Census Bureau, Americans today spend more than 100 hours commuting to work each year; and only New Yorkers have a longer commute time than Maryland residents.

According to the Reason Foundation, a nonpartisan public policy research group, nearly 69 percent of Maryland's urban interstates were congested in 2005 – ranking the State the fifth worst in the nation for urban congestion. Four states – Montana, Wyoming, North Dakota, and South Dakota – report no urban congestion, while 17 states report that more than half of their urban interstates are congested. **Exhibit 1** presents the five states with the most congested urban interstates, as well as the data for the three states surrounding Maryland.

Exhibit 1
Percent of Interstate Urban Congestion

Rank	State	% Congested
1	California	83.33
2	Minnesota	77.78
3	New Jersey	73.35
4	North Carolina	72.47
5	**Maryland**	**68.58**
12	*Delaware*	*58.54*
28	*Pennsylvania*	*43.17*
30	*Virginia*	*42.54*

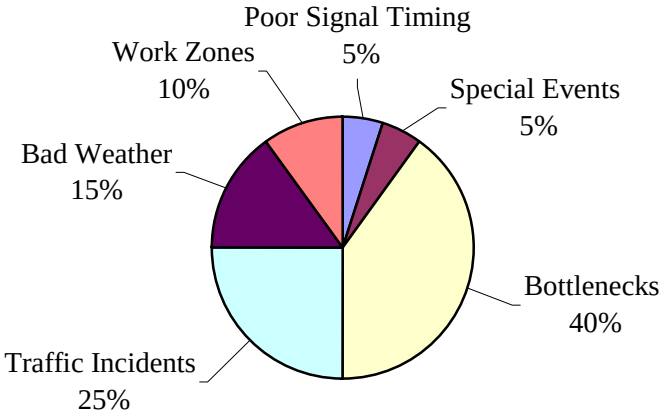
Source: The Reason Foundation, 16th Annual Report on the Performance of State Highway Systems (1984-2005)

Various types of roadways contribute to the difficulty of uniformly defining and measuring traffic congestion. However, narrowing the scope to solely urban areas, where most congestion occurs, does allow for a more exact and measurable analysis of traffic congestion. The Texas Transportation Institute (TTI), a transportation research group that collects congestion-related data from 437 urban areas throughout the country, develops performance measures used by the Federal Highway Administration (FHWA).

One measure relied upon by TTI is the travel time index, which compares the peak period travel time to free-flow travel time. Specifically, the travel time index is calculated by dividing the peak travel time by the free-flow travel time. In addition, the travel time index measure includes both recurring and nonrecurring congestion, thus offering a reliable estimate for the typical conditions faced by urban travelers. According to TTI, the national average travel time index for the largest 85 urban areas is 1.30; the average travel time index for all 437 urban areas is 1.26. For purposes of comparison, the Washington, DC metropolitan area has a travel time index of 1.37, ranking it seventh in the country, which translates into a 20 minute free-flow travel trip taking 27.4 minutes during peak travel time. Furthermore, the Baltimore metropolitan area ranks fifteenth nationally for the highest travel time index at 1.30, or a 20 minute free-flow travel trip taking 26 minutes during peak travel time. When comparing the change in these two metropolitan regions since 1982, the travel time index for each has increased faster than the change in the national average.

Congestion results from a variety of sources, including accidents, insufficient roadway capacity, and badly timed traffic lights. FHWA has identified the most prevalent sources of congestion nationwide, as shown in **Exhibit 2**.

Exhibit 2
Sources of Traffic Congestion Nationwide



Source: Federal Highway Administration

The Cost of Congestion

Longer commutes and traffic congestion stress the economy; cause harmful environmental and health effects; jeopardize federal transportation aid; and accelerate transportation infrastructure degradation.

Economic Impact

TTI's *Urban Mobility Report* provides a summary of national measures and the impact of congestion. In 2005 dollars, on average, congestion was estimated to cost each individual $710 in 2005 compared to $260 in 1982. This translates into a national cost of $78.2 billion in 2005 compared to $14.9 billion in 1982.

Infrastructure Impact

In addition to direct costs to drivers, congestion also increases the wear and tear on roadways. While there is no national measure for the impact of congestion on transportation infrastructure, it is clear that a significant investment is needed to maintain and expand the transportation network. The U.S. Department of Transportation recently estimated that traffic on most of the interstate network would exceed capacity in 2020 and that $78.8 billion annually would be needed to maintain the current highway network, with an additional $15.8 billion to maintain the transit network. For contextual purposes, the federal fiscal 2009 proposed budget for highways is $39.4 billion.

Environmental Impact

Another major impact of congestion is its effect on the environment. One measure of the environmental impact of congestion is to look at the amount of motor fuel wasted. Based on TTI measures, each individual wasted 26 gallons of fuel in 2005 due to congestion, compared to 9 gallons in 1982. Nationally, this translates into 2.9 billion gallons of wasted fuel in 2005.

According to the U. S. Environmental Protection Agency (EPA), motor vehicle emissions contribute up to 95 percent of urban air pollution, including lead, carbon monoxide, ozone, and suspended particulate matter. High amounts of carbon monoxide at ground level can lead to carbon monoxide poisoning and can impair visual perception, manual dexterity, and exercise capacity. Carbon monoxide can also cause harmful respiratory, cardiovascular, and central nervous system effects by reducing the delivery of oxygen to the body's organs and tissues. The World Health Organization estimates that urban air pollution causes 800,000 premature deaths each year. Statistics similar to these emphasize the direct link between traffic congestion and societal health.

In 1990, Congress amended the federal Clean Air Act (CAA) to tie transportation funding for new projects directly to efforts by the states to reach attainment of air quality standards. Under the conformity requirement, transportation projects cannot create new National Ambient Air Quality Standards (NAAQS) violations, increase the frequency or severity of existing NAAQS violations, or delay attainment of NAAQS. EPA has the authority to withhold federal transportation funding if state transportation programs fail to comply with CAA air quality standards. On August 10, 2005, President George W. Busch reauthorized the Safe, Accountable Flexible, and Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU), the

six-year surface transportation act. SAFETEA-LU altered the conformity testing process by reducing the frequency for making conformity determinations on updated transportation programs from every three years to every four years. Maryland revises its six-year capital transportation plan every year.

Under the conformity requirement, a regional emissions analysis must be conducted in order to assess the regional impacts that transportation investments will have on emissions within nonattainment or maintenance areas. The latest EPA-approved emissions models must be used to estimate regional emissions. However, in nonattainment and maintenance areas, highway and transit projects must be found to conform before they are adopted, accepted, approved, or funded.

Chapter 2. Congestion in Maryland

In response to an issue presented to the budget committees in the Department of Legislative Services' fiscal 2008 budget analysis, the State Highway Administration (SHA) categorized congestion as recurrent or nonrecurrent, with the amount of congestion evenly divided between the two. SHA defines congestion in Maryland as either:

- **recurrent congestion**: congestion that occurs on a regular basis at the same location; this type of congestion is usually caused by traffic demand regularly exceeding available capacity; or

- **nonrecurrent congestion**: congestion that occurs when incidents such as accidents, disabled vehicles, special events, or weather-related occurrences result in temporary traffic demand that exceeds roadway capacity.

In each case, SHA indicated that the underlying factors that cause demand to exceed capacity, for the most part, are not under the control of the Maryland Department of Transportation (MDOT).

Instead of defining what conditions constitute congestion, SHA has developed general principles for measuring congestion on a particular roadway. According to SHA, there are three overarching goals for measuring traffic congestion:

- first, the measures must be repeatable; that is, the application of measures to a given roadway operating under the same set of conditions must yield the same results from year-to-year and location-to-location;

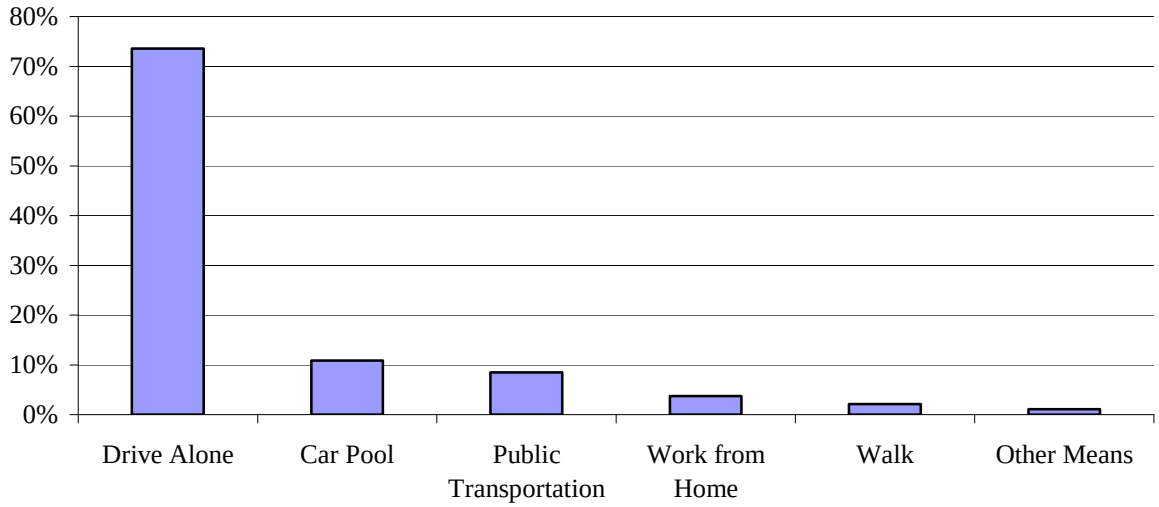
- second, the measures must be valuable in that the value of the performance measure is meaningful to its recipients; and

- third, traffic congestion measures must be sustainable.

To measure traffic congestion in the State, SHA relies on several different methods that relate to recurrent and nonrecurrent congestion.

Exhibit 3 illustrates the commuter patterns of Maryland residents. As shown, over 70 percent of the population drives to work in his/her car alone.

Exhibit 3
How Marylanders Get to Work

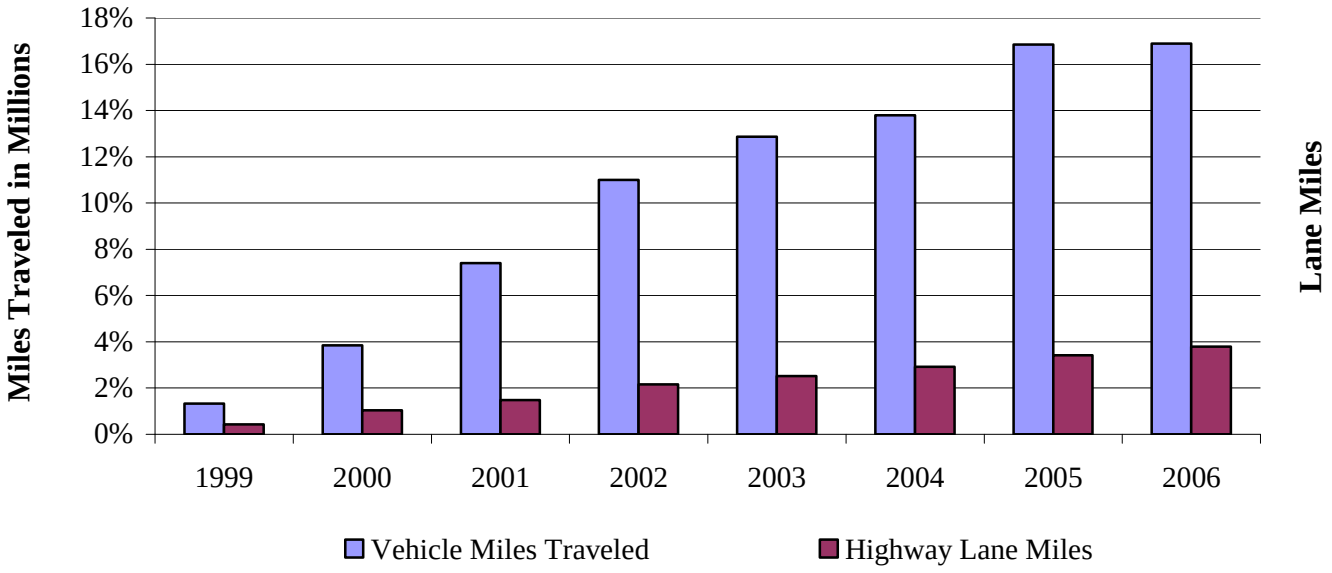


Source: Maryland Department of Transportation, 2007 Annual Attainment Report on Transportation System Performance

As more and more people travel in their cars, more and more demand is created for the existing infrastructure. To date, there have not been any specific State studies regarding the sources of congestion in Maryland and how they compare to the sources of congestion nationwide. However, one of the primary causes of traffic congestion in Maryland is thought to be that the State's population growth has outpaced improvements to the State's transportation system. According to the Texas Transportation Institute (TTI), since 1982, both the Baltimore and Washington, DC metropolitan areas have experienced traffic growth 45.0 percent greater than the growth in roadway capacity.

This is further reflected in **Exhibit 4** which shows, according to SHA, that from 1998 to 2006, vehicle miles traveled increased 17.0 percent (approximately 8.2 billion miles traveled), while total lane miles in the State increased only 4.0 percent (2,500 lane miles). Although the general trend over time has been an increase in vehicle miles traveled, the Federal Highway Administration announced in May 2008 that vehicle miles traveled in March 2008 actually decreased 4.3 percent since March 2007, representing the first decline since 1978. This is thought to be the result of higher gas prices. Long term, the impact that gas prices may have on commuting choices is unclear and will need to be monitored.

Exhibit 4
Percent Change in Vehicle Miles Traveled and Highway Lane Miles Since 1998



Source: State Highway Administration

While commuting has increased at a rate greater than the growth in the transportation network, population growth is expected to continue. In addition, the length of an individual's commute has increased over time. Maryland's population is estimated to grow by one million people by 2030. Part of this growth can be attributed to the Base Realignment and Closure (BRAC) process. The BRAC Subcabinet indicated in its *BRAC Action Plan* that the State may experience an influx of up to 60,000 direct and indirect jobs over the next decade. This infusion of jobs will also translate into new development and added stress on the transportation network as individuals commute to these new jobs.

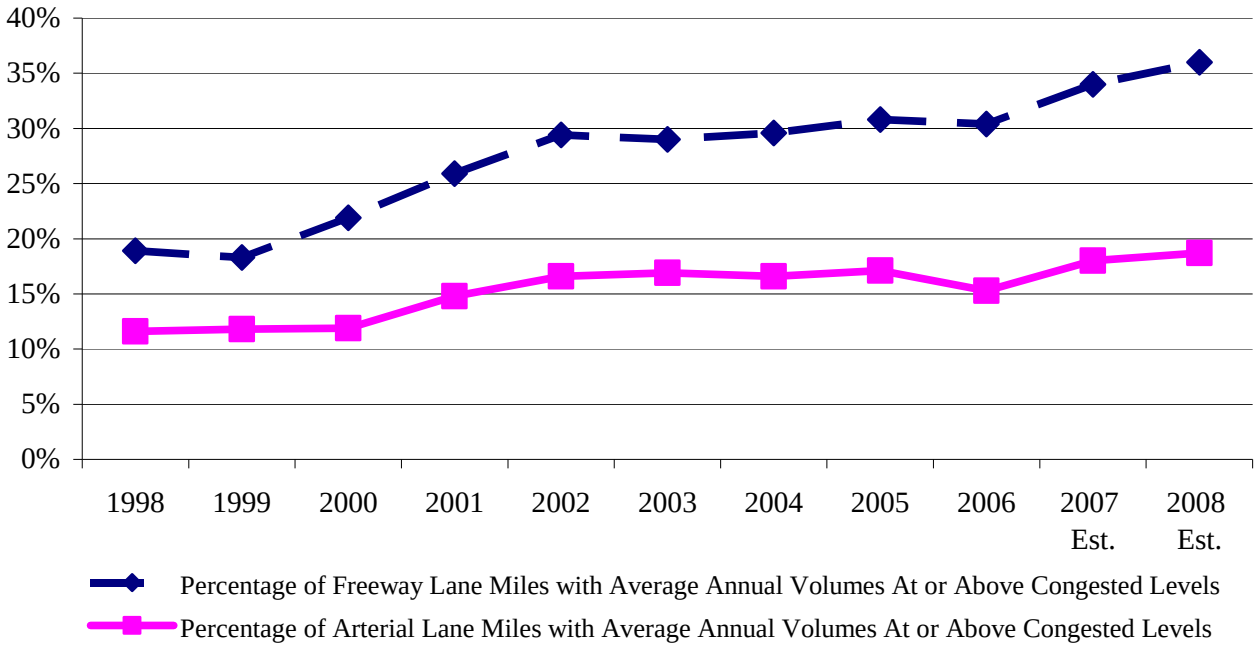
Congestion is most often discussed in terms of its impact on urban areas; however, more rural or less densely populated areas can also experience congestion. Recurring rural congestion is an increasing occurrence due to growing bedroom community populations, tourism, seasonal residences, and travel. For example, during the mid-1980s, the "Reach the Beach" initiative focused on improving travel to and from Maryland's Eastern Shore and increased levels of traffic. Increased traffic translates into more accidents, which also contribute to increased congestion. Moreover, without the level of transportation funding enjoyed by larger jurisdictions, rural communities are often behind the curve in upgrading arterial and secondary roadways to effectively manage the increased demand in traffic. The problem of congestion in rural areas is often exacerbated by the fact that as State roads in rural areas become increasingly

congested, drivers often detour from State roads to nearby rural roads. These rural roads often have only one lane in each direction and are not designed for the growing volume of traffic that uses them.

Congestion Performance Measurement

MDOT's Annual Attainment Report includes a measure of the number of miles of freeway and arterial roads with traffic volumes exceeding certain volume thresholds that are then considered congested. The measure looks at the percentage of roadways with vehicle volumes less than 10,000 per day on arterial roads and 20,000 on highways. **Exhibit 5** provides a summary of this information. As shown, based upon this measure, the rate of growth in congestion on major freeways had leveled off between 2002 and 2006; however, an increase in growth is projected in 2007 and 2008.

Exhibit 5
Percentage of Freeway and Arterial Lanes At or Above Congested Levels
Calendar 1998-2008



Source: Maryland Department of Transportation

SHA notes that due to the variability of traffic, none of the congestion measures currently used yield a statistically valid statewide or urban areawide congestion measure. To address this,

SHA is currently working with the University of Maryland Center for Advanced Transportation Technology to combine the various congestion data sources into a coherent approach that will allow for a statistically valid systemwide congestion measurement.

Economic Impact

In 2007, the Greater Baltimore Committee, the Greater Washington Board of Trade, and the Maryland Chamber of Commerce commissioned a study by TTI, entitled *Maryland's Transportation Infrastructure: The Costs and Benefits to Workforce and Family*. The report estimated that total roadway congestion costs the citizens of Maryland over $3.1 billion per year in lost working hours and fuel. On an individual basis, the study estimated that traffic congestion costs each peak period traveler in the Baltimore region over $800 annually. **Exhibit 6** presents data on congestion and its impacts for the State's two metropolitan areas.

Exhibit 6
Baltimore and Washington, DC Congestion in 2005

	Baltimore	Ranking*	Washington, DC**	Ranking*
Annual Delay Per Traveler (in hours)	44	22	60	2
Excess Fuel Consumed (in million of gallons)	41	18	91	9
Total Congestion Cost (dollars in millions)	**$1,126**	**17**	**$2,331**	**8**

* Rankings are out of 437 urban areas.
** Data is for Washington, DC and both the Virginia and Maryland suburbs of the city.

Source: Texas Transportation Institute, *The 2007 Urban Mobility Report*

According to the TTI study, increasing transportation revenues by $400 million annually should generate approximately $629 million in economic development for the State. The study based its findings on the economy-wide effects of spending $400 million on transportation improvements – namely construction. The study also examined other intangible benefits, such as improved business efficiencies from enhanced mobility. For instance, enhanced delivery times (particularly for perishable goods) should translate into fuel and operating savings, which in turn could reduce production costs and lower prices for consumers. However, knowing what

transportation facilities to construct and where to construct them is vital to determining how to maximize the economic gain from investing in the transportation network.

Infrastructure Impact

MDOT does not track the costs associated with infrastructure degradation resulting from congestion. However, MDOT estimates that there are at least $40 billion of unmet transportation needs throughout the State. A sizable portion of this price tag is attributable to maintaining the aging transportation system existing today. During the 2007 special session, the General Assembly provided approximately $400 million annually in additional transportation revenues to meet the State's transportation needs; due to budgetary pressures, this was then reduced to $350 million annually for five years during the 2008 regular session. According to MDOT, the first $250 million of this increase is needed for system preservation costs, such as repaving Maryland's portion of the Capital Beltway and associated bridges, which is expected to cost $2 billion over the next 20 years.

To relieve roadway congestion, proponents of transit services advocate for increased funding to build new projects and expand existing transit systems. However, similar to the costs of maintaining existing roads, the State transit system also requires substantial investment for the operation and maintenance of existing services. For instance, the current budget for the Maryland Transit Administration's Mobility Service that provides transit services to the elderly and disabled is $30 million, which is equal to the cost of operating Baltimore's subway system.

Environmental Impact

As discussed previously, in 1990 Congress amended the federal Clean Air Act (CAA) to tie transportation funding for new projects directly to efforts by the states to reach attainment of federal air quality standards. In Maryland, 11 counties throughout the Washington and Baltimore regions are classified as severe nonattainment areas for ozone and nitrogen oxides.

According to MDOT, all current major projects included in the State's Consolidated Transportation Program have received the required federal conformity determinations. Nevertheless, conformity testing will change as the requirements set by the U.S. Environmental Protection Agency under CAA change. For instance, the daily standard for particulate matter (PM) – a regulated pollutant from motor vehicle emissions – was changed from 65 micrograms per cubic meter to 35 micrograms per cubic meter in 2006. The Maryland Department of the Environment advises that the new PM standard will likely not affect new transportation projects until the 2015-2018 time frame. However, as the number of motor vehicles increases throughout Maryland while the air quality rules become more stringent, managing congestion by building more roads will become increasingly challenging.

Chapter 3. Congestion Mitigation Strategies Nationally and in Maryland

Congestion mitigation strategies typically fall into three broad categories: adding new capacity to the transportation system; increasing the efficiency of the existing system; and managing the demand-related stress on the system. These various strategies may involve a substantial budgetary investment for projects involving new highways or transit lines. However, there are also less expensive solutions, such as deployment of intelligent transportation system (ITS) technologies or demand-reduction strategies to discourage excessive commuting.

While the ultimate goal is an absolute reduction in congestion, a practical first step is to slow the rate of growth of congestion on the transportation system. Following is a summary of some of the congestion mitigation strategies currently being implemented throughout the United States as documented by the U.S. Department of Transportation, the American Association of State Highway and Transportation Officials, the Texas Transportation Institute (TTI), and in the transportation literature. Actions Maryland is taking to address congestion are also addressed where relevant.

Roads

New Roadway Construction

As the population continues to grow, if new highway capacity is not built at the same rate, then congestion will almost certainly increase. New highway capacity includes the construction of new highways, maintaining and enhancing existing highways, and enhancing connections between highways and ports, rail yards, inter-modal transit services, and other residential and commercial activity centers.

In its *2007 Urban Mobility Report*, however, TTI found that expanding the highway network in urban areas will not reduce the level of congestion; rather, it will reduce the *rate of growth* of congestion. In its report, TTI found that the growth in additional roadways must be slightly greater than the growth in travel to simply maintain existing travel times. This suggests that the problem of congestion cannot be completely resolved by implementing a strategy that focuses only on increasing roadway capacity. Instead, any prudent policy approach should couple roadway construction with other strategies. In addition, building new roadways carries with it tremendous economic, environmental, and political costs.

In Maryland, the State Highway Administration (SHA) is engaged in the development and construction of new interstate, primary, and secondary highways. As indicated earlier, this continuing effort has helped to slow the rate of congestion growth from 33 percent between 1999 and 2002, to only 9 percent between 2002 and 2005.

SHA conducts before and after studies in order to gauge the effect a particular road project has on traffic congestion. Additionally, project planning analyses of congestion relief performance are conducted by SHA to determine whether certain efforts to relieve congestion, such as innovative intersection design, are successful, and if so, to what extent.

SHA has also identified the nine most critical projects to respond to specific local and regional congestion concerns. The highest-priority project is the InterCounty Connector (ICC). The ICC is an 18-mile east-west highway running between I-270 and I-95/US 1. This $2.4 billion project is being undertaken by the Maryland Transportation Authority (MDTA) to improve access between economic growth centers in Montgomery and Prince George's counties. It is currently under construction and is scheduled to open in 2012.

Another major new capacity project being undertaken by MDTA is the construction of two new express toll lanes in each direction of I-95 from I-895 to just north of MD 43. Additionally, MDTA has been studying I-95 from north of MD 43 to the Delaware line to determine if other infrastructure improvements or additional capacity is needed.

In addition to these capacity additions, SHA has also identified several future corridors of interest. The first such corridor is the I-270 Eisenhower Highway. Due to already poor service, high rates of congestion, and a rapidly growing population, SHA is studying a 28-mile multi-modal corridor improvement project. The project plan includes both new lane-miles of highway as well as transit options such as a dedicated bus lane. The second critical corridor identified for future planning is the Capital Beltway. With the Capital Beltway study, the Maryland Department of Transportation (MDOT) is currently assessing the feasibility of widening and improving the 42.2 miles of beltway located in Maryland. Improvements to the Capital Beltway may become increasingly urgent as Virginia begins to address capacity issues on its part of the beltway through construction of high occupancy toll (HOT) lanes.

Although the Baltimore/Washington area contains some of the nation's most congested roadways and is the target of multi-modal corridor improvement projects, MDOT's statewide congestion monitoring has led it to undertake several major capacity enhancement projects in other counties. In 2008, SHA is responding to local congestion concerns with projects in Caroline, Carroll, Charles, Frederick, Garrett, and Worcester counties ranging from $27 million to $171 million. There are also dozens of other smaller construction projects ongoing throughout the State.

Maximizing Use of Existing Infrastructure

Because increasing roadway capacity is not a panacea for reducing congestion, additional operational improvements are necessary to produce short term results.

System Preservation

While adding new roads is important, a major priority should be to preserve and modernize the existing system of highways. Routine maintenance will extend the lifetime of existing roads. For much older roads, highways and bridges will need to be rebuilt from the foundation up, or completely replaced and relocated. Though costly, newly built roads give highway agencies the opportunity to modernize structures to accommodate heavier freight loads, faster vehicle speeds, and increased traffic.

SHA is constantly resurfacing and rehabilitating roads in order to maintain the current highway system assets in good operating condition. SHA reports that in 2005, it stemmed the tide of deteriorating pavement conditions for the first time in a decade. SHA reports that in 2006, 83 percent of monitored roads were deemed acceptable ride quality with the target set at 83 percent. Currently, there are 10 major resurfacing projects underway or upcoming for 2008.

In addition, SHA strives to address nonrecurring congestion by seeking to resolve the conditions that cause accidents. To accomplish this, SHA monitors its safety data, seeks out hazardous road conditions, and attempts to respond with prompt spot or safety improvements. Currently, there are 12 major spot safety improvements underway or scheduled for 2008.

Chokepoints

Chokepoints occur where lanes narrow, merge, or run into a bridge, tunnel, or other structures that cannot serve all vehicle types; this then constricts traffic flow. As discussed in Chapter 1, bottlenecks are one of the single greatest causes of congestion nationally. Chokepoints, unlike corridors of congestion, may be caused by very small and localized conditions, and as such, are just as common in rural areas. For example, an old bridge may provide an impasse to vehicles over a certain size or a small tunnel may only allow for vehicle, freight rail, or commuter rail passage of one lane at a time which then has ripple effects down the line. Another common cause of highway chokepoints is on-ramps and lane merges that provide a localized, but severe, imbalance in the supply and demand of highway capacity. The cost associated with resolving these conditions varies greatly depending on whether new infrastructure is built (*e.g.*, new bridge or overpass) as opposed to mere operational changes (*e.g.*, ramp metering, or other technological solutions).

SHA develops and implements access management plans to identify locations where access to highways are constricted and to ensure free flowing access points for all newly created roads or lane capacity. In addition, SHA continues to undertake a number of projects that relieve chokepoints in the roadway system. For example, SHA has constructed several bridges, overpasses, and bypasses to relieve specific highway chokepoints. Bridges that are damaged, under rehabilitation, or otherwise out of service for some or all vehicles, are responsible for many chokepoints in Maryland. Because of this, SHA prides itself on its bridge maintenance capability. This is reflected in part by the fact that for the past six years, Maryland has not had a single bridge with congestion-causing weight restrictions. In addition, SHA constantly monitors

its data to detect particularly congested intersections and responds by adding capacity or seeking alternative performance enhancements.

Intelligent Transportation Systems

Another way in which states have generally been able to maximize their existing capacity of highway infrastructure is through the continuing development and implementation of ITS technologies. ITS technologies rely primarily upon information technology communication devices. For example, traffic cameras, ramp meters, and traveler assistance phones are all wired to centralized or dispersed transportation offices to allow transportation agencies to monitor, make adjustments, or take responsive measures to ongoing traffic conditions. Following are some examples of ways in which ITS mechanisms can improve the operational efficiency of transportation systems.

Ramp Metering

Ramp metering is the use of traffic signals at freeway on-ramps to regulate the rate of vehicles entering the freeway. The signals allow vehicles to enter highways from stopping points on on-ramps at a specified time interval that creates the least disruption to highway traffic flows. Ramp metering represents a technology with the potential to significantly reduce bottlenecks, a leading source of congestion. TTI estimates that nationwide, current ramp metering projects could result in approximately a 38.6 million hour reduction in congestion time and $733 million saved annually.

Incident Management

Delays associated with poor incident response and vehicle recovery times are another major cause of traffic congestion, particularly at times of greater traffic volume. The Federal Highway Administration notes that about 25 percent of congestion can be attributed to traffic incidents. Improving interagency coordination and communication is important to expediting the whole process from detection, to response, to recovery. Both unpredictable (*e.g.*, vehicle accidents, flat tires, etc.) and predictable incidents (*e.g.*, planned lane closures due to construction, special events, etc.) need to be considered in incident management planning. The main participants in incident management are emergency response teams, law enforcement agencies, the private towing and recovery industry, and state highway agencies. Incident management projects appear to have the greatest cost saving operational potential, with a savings of $2.5 billion dollars and a reduction of 130 million hours in congestion annually.

In Maryland, the Coordinated Highways Action Response Team (CHART) program was developed as a joint effort between MDOT, MDTA, and the Maryland State Police, in cooperation with other federal, State, and local agencies. CHART's mission is to improve operations of Maryland's highway system by using real-time mapping technology to improve response time and to mitigate nonrecurring congestion, which accounts for approximately half of

the State's highway traffic congestion. In 2006, CHART personnel responded to 16,000 incidents and assisted 23,000 stranded motorists on Maryland roads. Besides the obvious and direct impact that CHART has on the motorists involved, each time its personnel render assistance, it also prevents further congestion from forming, saving Maryland motorists time and money. SHA has estimated that by June 2008, the CHART program will be preventing an additional 30 million vehicle-hours of motorists' time and saving them $570 million annually.

Message Boards

A few key technologies have become central in efforts to combat congestion nationwide and in Maryland. Variable or dynamic messaging signs are becoming increasingly commonplace on Maryland roadways. These signs relay critical congestion-reducing information where motorists have a choice among routes and available detours. Installation of signal control systems is also important in maximizing operational efficiency at roadway intersections. These systems reduce the time that motorists spend needlessly stalled at certain intersections. And traffic monitoring centers form the foundation of any effort to resolve the State's congestion problems. The University of Maryland's Center for Advanced Transportation Technology operates a state-of-the-art research laboratory where students and experts monitor traffic patterns and develop innovative technological solutions.

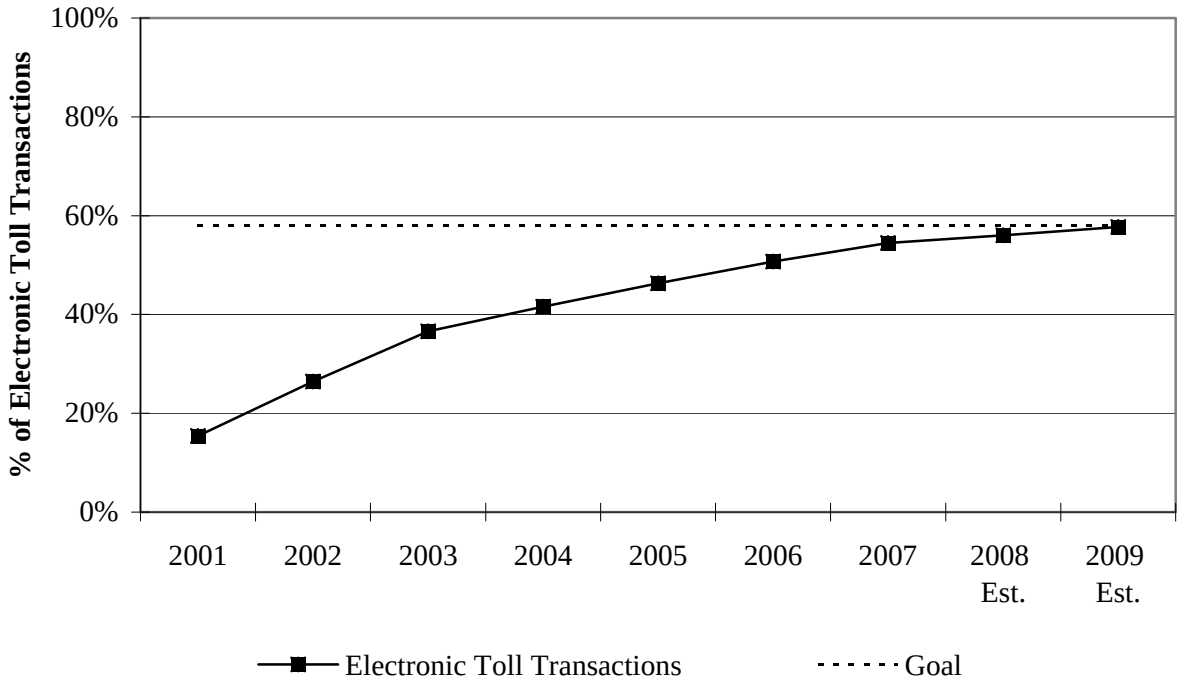
Periodic Measurement

Within MDOT, the Highway Information Services Division's Traffic Monitoring System Team administers SHA's Traffic Monitoring Program. This program is responsible for the collection, processing, analysis, summarization, and dissemination of Maryland's highway traffic data. The data collected through traffic monitoring data is essential to the planning, design, and operation of the statewide road system and the development and implementation of State highway improvement and safety programs. Traffic volume data is collected from over 3,000 program count stations and 79 automated traffic recorders (ATRs) located throughout the State. ATRs are the most reliable in terms of quantifying traffic volume; however, because they are distributed throughout the State as permanent stations to develop system level data on traffic volumes, they are not directly useful for measuring traffic congestion. The 3,000 count stations are not permanent and are used for supplemental traffic counts for a limited period (usually a week) at specific locations to develop traffic volume trends and vehicle miles traveled in conjunction with ATRs.

Electronic Toll Collection

Perhaps the most visible ITS technology on Maryland highways is electronic toll collection. Currently, Maryland and many other states use this technology to relieve congestion caused by toll collection booths. In 2006, Maryland experienced an increase in usage of its radio frequency identification (RFID) E-ZPass technology of 8.6 percent, and for the first time, over 50.0 percent of all tolls paid were through electronic toll collection as shown in **Exhibit 7**.

Exhibit 7
Percentage of Tolls Collected via E-ZPass
Actual Fiscal 2001-2007, Estimated Fiscal 2008-2009



Note: Maryland Transportation Authority's goal is to reach 58 percent by 2009.

Source: Maryland Transportation Authority

Another innovation in electronic toll collection is open road tolling (ORT). ORT uses an overhead gantry system rather than traditional toll booths for toll collection. Utilizing RFID technology, motorists may drive through these overhead gantry systems at highway speeds, thus eliminating congestion near toll booths. Maryland's first projects utilizing ORT technology are currently being constructed: the ICC and the express toll lane on I-95 north of Baltimore. Promoting increased usage of electronic tolling, as well as utilizing ORT technology, will go a long way toward eliminating toll collection as a source of congestion on Maryland highways.

Other Strategies

Public Transit

Another way to increase the capacity within a transportation corridor is to add public transit options. Public transit includes local and commuter buses, light and commuter rail services, and even ferry crossings. A wider array of public transit options is cost effective in highly urbanized areas such as the densely populated corridors throughout the Baltimore/Washington metropolitan region.

According to the National Transit Database, from 1985 to 2005, transit ridership increased 10 percent nationwide with over 9 billion transit trips. Although the number of commuters utilizing transit is dwarfed by the number of motor vehicle commuters, and despite the fact that no transit system in the United States is financially self-supporting, the number of transit systems continues to grow. The reason that so many states and localities continue to support public transit is because of its ability to reduce congestion and its various impacts.

The recent increase in oil and gasoline prices has begun to change consumer behavior. The American Public Transportation Association announced in March 2008 that transit ridership nationwide was at its highest level in 50 years, and that since 1995, ridership has increased 32 percent; for contextual purposes, during that same time period, vehicle miles traveled increased 24 percent.

In Maryland, increasing transit opportunities has also been considered. Increasingly, when MDOT identifies a congestion corridor, transportation planners will consider the suitability of public transit additions or enhancements to accompany any increase in roadway capacity. Two of the State's most congested roadway regions – the I-95/MD-295 corridor and the inner-beltway suburbs of Washington, DC – have long been served by the Maryland Area Rail Commuter (MARC) service and the DC Metrorail system. In addition, Baltimore is served by the Maryland Transit Administration (MTA) which has a core bus and public transit system. In recent years, both of the metropolitan areas have been served by a commuter bus system that has grown in popularity, as reflected in the growth of ridership, particularly in the past year as gas prices have increased. These long-standing transit systems provide a model of multi-modal transportation solutions to the problem of congested corridors in Maryland.

The future of transit in Maryland may very well follow this multi-modal focus. Three of the largest public transit projects currently being proposed would be located adjacent to the most congested highways not already being served by transit systems. The proposed Purple Line of the DC Metrorail system would run parallel to the I-495 Beltway and would accompany the ICC in providing a multi-modal solution to the severe congestion that plagues the Capital Beltway. Emphasizing that such multi-modal connectivity is essential to the future of mobility in Maryland, most planners favor the creation of a network of dedicated bus lanes and bus rapid transit (BRT).

To reduce the rapid growth in congestion along the burgeoning I-270 corridor from Washington, DC to Frederick, policymakers and transportation officials have proposed various light rail systems to accompany the existing high occupancy vehicle (HOV) lanes and proposed lane-widening projects. In the Baltimore metropolitan area, MTA is studying the feasibility of providing a Red Line of east-west light rail and BRT. Finally, MTA in the fall of 2007 released the MARC Growth and Investment Plan that calls for the expansion of the MARC system that is estimated to cost $4 billion over the next 25 years. Ultimately, these planning efforts will be constrained by the financial costs associated with expanded public transportation.

Congestion Pricing

One method for enhancing transportation system efficiency is congestion pricing. Congestion pricing refers to the ability of highway regulators to charge motorists for use of road space at peak travel times or on more congested routes. Congestion pricing is a way to reduce congestion through behavior modification. Through simple economic adjustments, states can encourage drivers to shift drive times to off-peak hours, use other less congested routes, or use other modes of transportation altogether. In addition, congestion pricing can also generate revenue to help finance other transportation investments.

Maryland currently has two projects, I-95 north of Baltimore and the ICC, which will use congestion pricing as a way to manage demand. At this point, the roads are under construction, and as a result, the timing and structure of how congestion pricing will be implemented have not been fully developed.

High Occupancy Toll Lanes

One approach to congestion pricing is through use of HOT lanes. This method puts a price on use of particular lanes. HOT lanes give drivers the choice of paying to use a dedicated toll lane when time is of the essence. Through RFID technology, a sensor placed above entrances to the toll lane reads the motorists' sensor and deducts the toll amount from their accounts. With variable messaging signs and traffic sensing technology, the HOT lane system can alert drivers to higher or lower rates during times of increased or decreased demand. In this way, the basic forces of supply and demand continually adjust to traffic conditions and manage the highway's congestion levels. HOT lanes are particularly cost effective in locations with pervasive use of RFID card and sensor technology at toll booths, and where current under-utilization of HOV lanes would eliminate the necessity for construction of new dedicated lanes. HOT lanes may not only pay for themselves through user charges but can also provide additional capital needed for other transportation projects.

Express Toll Lanes

Another method to reduce congestion, similar to HOT lanes, is express toll lanes (ETLs). The principle behind ETLs is the same as HOT lanes, in that both charge users a higher toll at

times of greater congestion. The key difference between the two is that HOT lanes are often created by utilizing existing capacity on HOV lanes. For the majority of the time, HOV vehicles may continue to drive in HOT lanes without paying a toll. Conversely, ETLs often involve *new* lane capacity that is built alongside existing roadways. ETLs are offered as an alternative for those who are willing to pay a toll to ride on less congested roads. For this reason, they are sometimes referred to as "Lexus lanes."

The tremendous gains that RFID card technology brought to E-ZPass toll collection stations in the past decade are expected to be replicated in the coming decade through application of ETLs. ETLs are a fairly new innovation in transportation system planning in the United States. Currently, there are only a handful of highways utilizing ETLs, mostly in states on the West Coast.

In 2007, Maryland began construction of its first ETLs on 10 miles of I-95, north of Baltimore. Additionally, there are 4 other ETL projects in the planning stage, 2 others in the feasibility study stage, and 26 other proposed projects in Maryland.

Changing Use Patterns

High Occupancy Vehicle Lanes/Carpooling

Another option to assist in taking vehicles off the roadway is to promote carpooling or dedicating lanes specifically for vehicles that have more than two or three individuals in the vehicle, otherwise known as HOV lanes. HOV lanes provide lanes only for high occupancy vehicles with the idea being that these lanes will be less traveled and traffic will be able to move more freely and quickly. By designating what a HOV is, carpooling can be promoted. The idea of carpooling even without HOV lanes has proven quite successful in Northern Virginia where a network of carpooling has been in existence for several years.

Although HOV lanes have been used in Maryland and around the United States for decades, transportation studies indicate that national HOV usage rates are consistently low. Statistics confirm that Maryland and its two HOV lanes on I-270 and US 50 are no exception.

A second program that SHA oversees to encourage carpooling is Park and Ride. Feasibility of new Park and Ride facilities is being studied.

Teleworking

Congestion pricing uses pricing as a way to change the use pattern or behavior of travelers; however, there are other low cost strategies that can be used to encourage drivers to change their behavior. One such strategy is the promotion of alternative work and travel schedules. The growth of technology and the Internet allows individuals to accomplish more work outside of the office. Policies that promote telecommuting have tremendous potential for reducing congestion.

Maryland has several telework programs. MDOT operates the Telework Partnership with Employers program. At present, the program merely studies and encourages telecommuting, but various proposals of the General Assembly in the past decade have sought to encourage greater rates of telecommuting through free consulting services to private sector businesses as well as tax credits. Another program designed to take commuters off the road is the Commuter Choice program. This program provides tax credits to Maryland employers who subsidize their employees' use of transit, vanpools, or other approved commuting alternatives.

Maryland's Department of Budget and Management (DBM) is responsible for a teleworking program for State employees. The program was originally initiated as a pilot program through 2006; however, the State continues to operate this program. Through an arrangement with their respective agencies, State employees are able to work from a remote workplace or a telework center. Telework centers can be found across the State.

Another program used by the Military Department is the Maryland Distance Learning Program. This program has established remote work centers for learning. There are 10 classrooms, which are not telework centers *per se*, but can be used as such. These classrooms are used primarily to train soldiers prior to deployment. They are also used by the Military Department to conduct training for its staff. The classrooms are used for Video Teleconferencing (VTC) for deployed soldiers to see and speak to their families. They are also used to conduct meetings with National Guard Bureau and other State agencies. Units also use them to train soldiers on drill weekends. By using VTC, this reduces the number of military personnel traveling on the State's road network.

Flexible Scheduling

A policy similar to telecommuting is flexible scheduling. This policy encourages employers to allow workers to arrive and depart from the office earlier or later to take advantage of non-peak commuting hours. Similarly, the employer could allow workers to arrive before, and depart after, rush hour, as well as allow for a four-day work week. This would keep commuters off the transportation system during the most congested hours and off the system altogether one day per week.

In Maryland, DBM provides a compressed work week option, with various options, for State employees. Options include a four-day work week, four 10-hour days, or working four 9-hour days and one half day to fulfill the 40-hour work week. There is a standard memorandum of understanding that agencies and State employees can use to formalize any work arrangement agreement.

Alternative Commuting Promotion

Another option is to promote alternative commuting modes. For example, the federal government provides a subsidy to its employees who use public transit and Maryland allows State employees to use transit for free in Baltimore City. This both reduces congestion on

highways and promotes ridership to more fully maximize the use of transit systems. This policy could be extended beyond transit to encompass other alternative commuting methods such as walking and bike riding. Federal and state governments could encourage employers to participate in such programs through the provision of tax credits or other benefits.

In Maryland, at the direction of the General Assembly, MDOT has sought to increase the number of pedestrian and bike-riding commuters. MDOT has been complying with the Bicycle and Pedestrian Access Act of 2000 through the development and implementation of its 20-Year Bicycle and Pedestrian Access Master Plan. Though commuting rates for pedestrians and bicycle riders remain very low (2.3 percent combined in 2005), MDOT has been responsible for adding miles of new trails and retrofitting sidewalks for purposes of shopping, recreation, pedestrian mobility, and exercise.

Land Use and Planning

There is some discussion among transportation and environmental officials as to how the land-use planning process can assist in helping to mitigate congestion. For example, the planning process can involve the creation of high density development around public transportation facilities, otherwise known as transit oriented development (TOD). The Federal Transit Administration has attempted to promote TOD as a way to ease the burden on roadways as well as a way to promote public transportation. Other land use and planning efforts can focus on the development of communities around highways, ensuring that there is sufficient roadway capacity for new development, or simply redirecting growth to certain areas.

Transit Oriented Development

While MDOT does not engage in land-use planning, it does communicate with relevant agencies and encourages TOD. TOD relies on mixed land uses and pedestrian-friendly urban design concepts to fuse dense residential and commercial areas with transit service points. MDOT analyzes the market readiness of particular areas to identify locations of sufficiently dense mixed-use development, and then communicates with local government to assess willingness and gauge feasibility for future transit expansion. Chapter 122 of 2008 codifies that TOD is a transportation purpose and that the Secretary of MDOT is authorized, in consultation with other State agencies and local governments, to designate a TOD. Aside from TOD, MDOT is also engaged in other programs to influence Maryland's development patterns.

Other Smart Growth Programs

In 2007, the Department of Housing and Community Development (DHCD) began to implement a new Smart Growth housing program called Smart Keys 4 Employees. This program, which replaced the previous Live Near Your Work Program, allows eligible home buyers who otherwise qualify for down payment or closing cost assistance under the Maryland Mortgage Program, and who also live within 10 miles from their work or the same jurisdiction as their employer, to receive an additional grant from DHCD. The total DHCD grant size for any

one home buyer is capped at $5,000. In addition to the distance requirement, the home must be within a Priority Funding Area. These areas are defined by the Smart Growth law in statute.

Formulating Smart Growth policies through zoning is outside the scope of MDOT policy. However, other State agencies are actively engaged in policies that directly reduce roadway congestion by influencing community development patterns. The most prominent example of this is the Workforce Housing Program being implemented by DHCD in conjunction with the Maryland Department of the Environment and the Maryland Department of Planning. Among other goals, this program is intended to subsidize the cost of an employee's housing in areas with higher rents in order to reduce the number of long distance commuters congesting Maryland highways.

Chapter 4. Financing Transportation

As previously described, there are any number of strategies that may be used to address congestion. Any discussion of these types of congestion mitigation strategies, however, must also include a discussion of transportation finance and the limited funding available for addressing congestion. For example, constructing a new road, like the InterCounty Connector, or a new transit line, can cost billions of dollars. The current six-year capital program for the Maryland Department of Transportation (MDOT) totals approximately $10.6 billion; however, this only begins to address the additional $40.0 billion in other unfunded needs identified by MDOT.

While congestion is an important issue facing the nation, an equally, if not more important issue facing the country and states is how to pay for transportation infrastructure improvements. Most transportation funding at the State and federal level is derived from the gas tax. However, State and federal gas taxes have not been increased since the early 1990s. As a result, the purchasing power of transportation revenues has declined as the price of construction materials has grown dramatically.

Transportation financing in Maryland was partially addressed during the 2007 special session. A portion of the sales tax was dedicated to transportation, and the titling tax rate was increased from 5 to 6 percent, among other revenue raising measures. In total, State revenues were increased approximately $400 million annually to begin to address what MDOT has identified as a $40 billion backlog of unfunded projects. During the 2008 session, Chapter 10 of 2008 altered the portion of the sales tax dedicated to the transportation trust fund for five years, resulting in new revenues for transportation totaling $350 million annually. While the increase in State funding will assist in addressing the backlog of projects, there is still insufficient revenue for new major construction projects. MDOT has indicated that the first $250 million of the revenue increase is dedicated to maintaining the current road and transit network, with the remaining $100 million to be used for new construction projects.

MDOT also receives federal funding for transportation through the federal Highway Trust Fund (HTF) where federal gas tax receipts are deposited and then distributed to states. Current estimates from the Congressional Budget Office and the Office of Management and Budget indicate that outlays from the HTF are exceeding the revenue collected. As a result, the HTF is anticipated to have a negative cash balance in federal fiscal 2009, which by federal law is not allowed. The net effect is that absent an increase in revenues, either in terms of an increase in the federal gas tax, other tax increases, or transfers from the general fund, federal funding for transportation is likely to be reduced. Expenditures will likely need to be reduced 20 percent to equal the current level of revenue. Beginning this fall, Congress will need to address the next transportation reauthorization and funding levels; however, given the reticence to increase the gas tax, the level of federal aid the State will receive under the next reauthorization is uncertain.

Given the funding constraints for transportation at the State and federal level, it is likely that any congestion mitigation strategy will require a broad approach that includes, if not focuses on, low cost strategies and changing commuting behaviors.

Conclusion and Recommendations

Congestion is a national transportation issue and a variety of national congestion measures clearly indicate that Maryland and its two metropolitan areas have some of the worst congestion in the country. Similar to other states, the cause of congestion in Maryland is related to population and economic growth outpacing growth in the transportation network, and the increasing use of the roadway network. As a result of congestion, individuals are spending longer amounts of time in their automobiles, freight and other goods are delayed, and there are also environmental and health impacts.

The two most common congestion mitigation strategies focus on the construction of highway and public transit alternatives; however, other, less expensive alternatives exist. Research does not indicate that there are clear benefits to the construction or emphasis of one mode of transportation over another. Furthermore, research indicates that road capacity can only reduce the overall level of congestion if the pace of construction exceeds the rate of population growth.

What is clear is that to address congestion, there needs to be multiple strategies undertaken that focus on operational efficiencies, preservation of the existing system, large scale capital investment in new and enhanced roadways and public transportation lines, and behavior modification. The Maryland Department of Transportation (MDOT) is undertaking a number of effective congestion mitigation efforts; however, there is no broad State mobility plan to assist in guiding these individual efforts.

During the 2008 session, the budget committees adopted narrative in the 2008 *Joint Chairmen's Report* that requires MDOT and the State Highway Administration to develop and submit a State plan by November 14, 2008, to address congestion. The plan is to outline what can be done to address congestion and must address the following issues:

- the long-term outlook of congestion in the State;
- what steps are currently being taken to address congestion beyond road or transit activities;
- how the additional revenues provided during the 2007 special session will be used to address congestion; and
- how highway and/or transit investment decisions are based upon the need to address congestion.

The additional funding necessary to fully address congestion in Maryland is unlikely to be identified in the near term. Accordingly, and affordable congestion plan will emphasize lower cost strategies such as intelligent transportation systems, electronic toll

lanes, encouraging the use of public transit, high occupancy vehicle lanes, teleworking, and flexible scheduling. These lower cost strategies may prove to be as effective as new road construction to address congestion in the short-term.

The General Assembly may want to consider introducing legislation that would require an annual status report on the steps that are being taken to address congestion in Maryland as part of the annual Consolidated Transportation Plan. Such a reporting mechanism could require MDOT and other State agencies (such as the Department of Planning and the Department of Housing and Community Development) to consider, across all modes, what strategies should be undertaken to address congestion and mobility in the State.