July 2012

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor

2012 Maryland State Highway Mobility Report

SHA
State Highway Administration
Maryland Department of Transportation

Maryland Department of Transportation

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Foreword

Dear Transportation Professional:

The State Highway Administration is pleased to publish the first state highway mobility report. Strategically located near the center of the I-95 corridor along the East Coast of the United States, Maryland has tremendous opportunities and challenges operating transportation facilities for long-distance travel, freight movement and serving the needs of the nation's capital, Washington, DC, the greater Baltimore metropolitan area along with Western Maryland and the Eastern Shore. Geographically, Maryland ranks 42nd in size, has the Appalachian Mountains in the west, the Chesapeake Bay and the beaches of the Atlantic Coast to the east. With 5.8 million residents, the state ranks 19th in population amongst the 50 states.

Maryland's transportation assets include more than 31,000 miles of roadway, 800 miles of rail lines, transit systems with a combined ridership of over 400 million passengers per year. Additionally, the state has major marine facilities at the Port of Baltimore, 18 publicly owned airports including Baltimore/Washington International Thurgood Marshall, and over 5,000 bridges and tunnels, including critical links such as the Chesapeake Bay Bridge, the Woodrow Wilson Bridge over the Potomac River and the Fort McHenry tunnel under the Baltimore Harbor.

Visitors to the state and nation, business owners transporting long-distance freight and local goods, commuters and families all rely on quality transportation 24 hours a day, 365 days a year. With about 50 percent of traffic problems caused by crashes or unexpected incidents, information about transportation options is a valuable commodity.

Most of us think about needing traffic information in real-time. This report is a tool to look at mobility factors to support decision making and long-term strategies. With limited resources and limited expansion opportunities, Maryland's transportation professionals must look at creative ways to make the most of what we have. In addition to safety and congestion, transportation system reliability is another key indicator to ensure that we provide our customers with a great travel experience on our facilities. This report is a crucial tool to develop short, mid and long-term traffic solutions. Congratulations to the team of people who researched and wrote this report and the members of SHA's Mobility Key Performance Area council who work to improve travel in the state every day.

Sincerely,

Melinda B. Peters

Administrator

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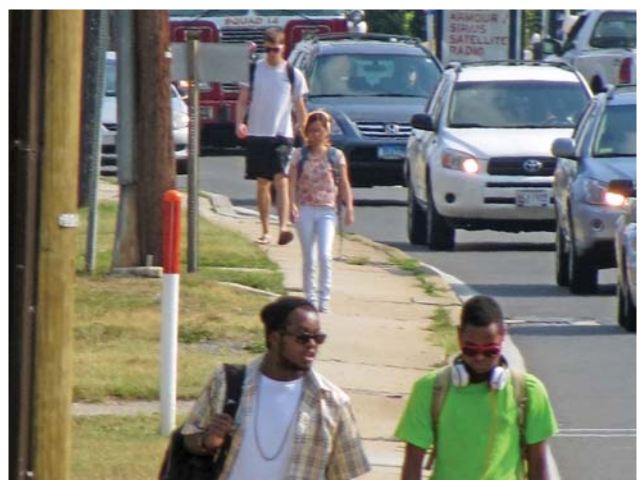
Executive Summary



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Executive Summary

The 2012 Maryland State Highway Mobility Report highlights the transportation performance of the state highway system and details the State Highway Administration's (SHA) mobility related efforts in Calendar Year 2011. Mobility is a key performance area (KPA) at SHA, which aims to "Support Maryland's Economy and Communities through enabling reliable movement of people and goods". This is the first publication of what is envisioned as an annual report in coming years which will identify successes, challenges, and strategies for improving the transportation services SHA delivers to Marylanders and the traveling public. It is anticipated to assist in SHA's performance based mobility efforts and driving investment related decisions.

Maryland transportation needs during these difficult economic times require careful and efficient management, operation and investment in the highway system. With a focus on policies, programs and projects that systematically address both recurring (everyday congestion) and non-recurring congestion (due to crashes, road closures, weather, special events etc.), SHA maintains a performance - measure - based approach to provide its users with a high quality reliable highway system. Under Governor Martin O'Malley's leadership, SHA continues to make progress in preserving and improving the state highway system, while supporting Maryland's economic competitiveness, environmental stewardship, and quality of life.

The 2012 Maryland Annual Mobility Report describes the year 2011 performance in the following four strategic focus areas: mobility and reliability, incident management and traveler information systems, multi-modalism and smart growth and freight. All of these play a vital part in the ability of the State of Maryland to provide for the needed services of its citizens and the people visiting or traveling through the State. The focus areas are also critical to the movement of goods and services and the overall economy of the state and the mid-Atlantic region.

The following are the quick facts that depict the state and the extent of congestion and reliability metrics in Maryland for the Calendar Year 2011:

- Annual vehicle miles of travel (VMT) in Maryland remained more or less flat at 56.0 billion with sections of I-270 and the Capital Beltway carrying more than 240,000 vehicles per day. 2011 VMT is about 1% less than the all time high of nearly 57 billion VMT in 2007.
- 2011 VMT on the state and toll maintained roadways was 40.2 billion, a slight decrease versus 2010 levels. VMT on all other roadways was 15.7 billion, which is similar to 2010.
- 2011 VMT in the Baltimore-Washington metropolitan region was 46.9 billion, compared to 47.0 billion in

2010. 2011 VMT in the Eastern Shore and Western Maryland was 9.2 billion, which is approximately the same as 2010 VMT.

- Analysis of the 2011 vehicle probe speed data provided by INRIX show that a total of 128 miles (8%) of the Maryland freeways/expressways experienced moderate to severe levels of congestion in the AM peak hour. Congestion levels in the PM peak hour were worse with 218 miles (13%) of the freeways/expressways experiencing moderate to severe levels of congestion. 2011 AM and PM peak hour travel conditions appear to have slightly improved compared to 2010 conditions. Approximately 95% of the congestion occurred in the Baltimore-Washington Metropolitan Region.
- On the statewide freeway/expressway network, 16% of the total morning peak hour VMT is traveled in congested conditions where as 26% of the total PM peak hour VMT is traveled in congested conditions.
- In the Baltimore-Washington metropolitan region, on an average, freeways/expressways operate 12% and 20% below the free flow speed during the AM and PM peak hours, respectively. While these percentage decreases do not appear intuitive at first glance from a roadway user perspective, this shows a snapshot of the system and is a congestion trend indicator. The peak hour speeds appear to have slightly improved in 2011 compared to 2010.
- Auto and truck drivers travelling on Maryland freeways/expressways experienced a total annual delay of 40.6 million hours and consumed 41 million gallons of extra fuel due to congestion. This translates into $1.49 Billion dollars of annual user costs due to congestion on Maryland freeways/expressways alone and does not account for the delay and fuel costs on the arterial system. The majority of the congestion cost (80%) can be attributed to auto travel delay followed by truck travel delay (11%). Wasted fuel accounted for the remaining 9% of cost.
- Reliability performance measures illustrate the variability in traffic congestion so that highway users can add the extra “buffer” time to their trip to reach their destinations on time. Travel time variability analysis was conducted using the planning time index (PTI) as a metric. The PTI is a comparison of the travel time in the worst congested conditions to free flow conditions. The 2011 analysis shows that in the AM peak hour a total of 140 miles (8%) of the freeways/ expressways of Maryland experience unreliable conditions impacting 18% of the AM peak hour VMT. In the PM peak hour, 188 miles (11%) of the freeways/expressways experience unreliable conditions impacting 26% of the PM peak VMT.

The 2011 INRIX data was used to rank the most congested segments (TTI), most unreliable segments (PTI) and the most major bottlenecks for freeways/expressways. The following are considered the most congested segments for the AM peak hour (8-9 AM) and PM peak hour (5-6 PM):

AM PEAK

- I-495 Outer Loop from I-95 to MD 97
- I-270 SB from Shady Grove Rd. to Montrose Rd.
- I-695 Outer Loop from MD 43 to Providence Rd.
- US 50 WB from MD 410 to MD 201
- I-695 Outer Loop from I-70 to US 40

PM PEAK

- I-495 Inner Loop from the American Legion Bridge to I-270
- MD 295 NB from MD 193 to MD 197
- I-695 Inner Loop from MD 139 to Providence Rd.
- I-495 Inner Loop from MD 355 to MD 97
- I-695 Inner Loop from US 40 to MD 26

The PTI index determined the most unreliable segments in the AM peak hour and PM peak hour. These were:

AM PEAK

- I-95/I-495 Inner Loop from US 1 to MD 97
- I-695 Outer Loop from MD 140 to US 40
- I-695 Outer Loop from I-95 to MD 41
- I-270 SB from Shady Grove Rd to MD 189
- US 50 WB from I-95 to MD 202

PM PEAK

- I-270 spur SB from Democracy Blvd. to I-495
- I-495 Inner Loop from Clara Barton Pkwy. to MD 185
- I-495 Outer Loop from MD 187 to Clara Barton Pkwy.
- I-695 Inner Loop from MD 139 to MD 146
- US 50 EB from MD 450 to MD 70

The bottlenecks are based on the number of occurrences, average length of queue and duration of event over the entire day. The top bottleneck locations are:

- MD 295 N @ MD 175*
- I-695 Inner Loop @ MD 26**
- I-495 Inner Loop @ I-270
- MD 295 NB @ MD 197*
- I-270 NB @ MD 80**
- I-695 Inner Loop @ MD 147
- I-270 Spur SB @ I-270
- I-95 NB @ MD 100
- I-95 SB @ I-495
- I-695 Outer Loop @ Edmondson Ave.

* Owned by National Park Service ** Under Construction

The SHA, in conjunction with local, regional, and state partners has completed numerous projects to improve mobility within the State of Maryland. Highlights of 2011 include:

- The Maryland Transportation Authority (MDTA) and the SHA opened the first section of the state's first all-electronic toll road on February 23, 2011. The initial section of the Intercounty Connector (ICC)/MD 200 connected I-370 at Shady Grove to MD 97 (Georgia Avenue)/MD 28 (Norbeck Road) in Olney. The next section from MD 97 to I-95 was opened to traffic in November 2011. This 18 mile 6-lane state-of-the-art facility provides a vital east-west connection between the I-270 and I-95 corridors in Montgomery and Prince George's Counties with interchanges at I-370 at Shady Grove Road, MD 97 (Georgia Avenue), MD 650 (New Hampshire Avenue), Briggs Chaney Road (partial) US 29 (Columbia Pike) and I-95. The $2.5 billion project was on time and within budget. The last phase, which is beginning construction, will extend the ICC from I-95 to US 1.

- SHA's traffic monitoring, traveler information, incident management and traffic management program, known as the Coordinated Highways Action Response Team (CHART), responded to and cleared more than 17,000 incidents and assisted more than 24,000 stranded motorists from Maryland roadways, saving approximately $1.1 billion in annual user costs in 2011.
- In August 2011, SHA launched the Maryland 511 traveler information service. This service, with its "Know Before You Go" theme, provides reliable travel information via the web or phone for state-maintained roadways. Available information includes travel time, incident and work zone lane closures, weather reports, connections to transit, the airport, and tourism information. This information helps Marylanders plan their travel to major events for long distance trips and for daily commutes.
- SHA partnered with State Farm® Insurance to expand CHART's emergency traffic patrol coverage hours by about 8,000 hours a year to optimize incident response along high-volume/high-incident locations. SHA collaborated with other regional agencies to increase camera video feed interoperability, adding access to camera sites throughout Maryland and improving traffic monitoring and emergency response.
- System capacity was enhanced by widening MD 237 from MD 235 to Pegg Road in St. Mary's County. MDTA reconstructed the I-95/MD 24 interchange and constructed a new interchange at MD 24/MD 924.
- Over 48 traffic signal systems were retimed accounting for improved operations at 298 signalized intersections. This resulted in an annual delay reduction of 800,000 hours equivalent to approximately $21 million dollars in annual user cost savings.
- Projects currently under construction to improve operations include widening I-70 from west of MD 85 to east of MD 144 in Frederick County, the continued widening of MD 404 and US 113 on the Eastern Shore, the I-695/MD 26 and MD 139 interchange reconstructions and the I-95 express toll lane project in Baltimore County.
- To address the growth associated with Base Realignment and Closure (BRAC), the SHA has worked with local and federal partners to provide operational improvements to MD 715 including US 40 and the MD 715 interchange near Aberdeen Proving Grounds in Harford County. Construction started in Fall 2010 and is expected to be completed in Fall 2013. An advanced utility contract is underway to relocate utilities for SHA to begin work on improvements to MD 355 at Cedar Lane in Bethesda, Montgomery County.
- As part of Governor Martin O'Malley's Smart, Green & Growing initiative, SHA is implementing programs to facilitate walking and bicycling as low-cost, environmentally friendly, and healthy transportation alternatives. The SHA has budgeted over $70 million to improve bicycle and pedestrian amenities throughout the State.

The current economic climate has precluded major mobility projects and the emphasis in recent years has been on system preservation. However, even with limited resources, SHA continues to focus on alleviating congestion hotspots through low-cost congestion related projects and strategies. SHA continues to strive to providing its customers with a high-quality reliable transportation system. With a dedicated work force using the latest advances in ITS technology, along with high-quality data driven processes, the SHA develops and implements programs and projects to provide improved mobility in a systematic and responsible manner.

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I. Introduction

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In order to sustain a high quality of life for residents of Maryland, it is important to have a successfully functioning transportation system that provides mobility and accessibility in a safe and efficient manner, thereby encouraging economic development and smart growth. It is in this context that the Maryland State Highway Administration (SHA) has identified Mobility as a key performance area (KPA) in its Business Plan. The goal of the Mobility KPA is to "Support Maryland's Economy and Communities through enabling Reliable Movement of People and Goods". With a focus on policies, programs and projects that systematically address both the recurring (everyday) and non-recurring (crashes, weather, special events) nature of congestion, SHA has adopted a performance based approach to provide its users with a high-quality, reliable highway system. A key aspect includes monitoring the system from year to year based on different performance measures, which helps in identifying areas of success as well as areas that need improvement.

Four strategic focus areas have been identified to monitor transportation operations and system effectiveness in the State of Maryland. These include: mobility and reliability, incident management and traveler information systems, multi-modalism and smart growth and freight. All of these play a vital part in the ability of the State of Maryland to provide the needed services of its citizens and the people visiting or traveling through the State. The focus areas are also critical to the movement of goods and services and the overall economy of the state and the mid-Atlantic region.

The 2012 Maryland Annual Mobility Report describes the performance of the state highway system and SHA efforts in Calendar Year 2011 in the aforementioned four strategic focus areas. This report is the first publication of what is envisioned as an annual report that will highlight successes, challenges, and strategies for improving the transportation services SHA delivers to Marylanders and the traveling public. It will also support and assist in driving investment related decisions.

The four strategic focus areas are described in the following chapters:

Mobility and Reliability

The various congestion indicators that provide the travel trends and the state of congestion on Maryland's highways are identified. Reliability focuses on the variability of travel time or speeds on freeways/expressways and is a key indicator of the stability of the highway system with regards to non-recurring congestion. Reliability measures based on INRIX vehicle probe data are described. The performance of SHA projects to address recurring congestion by means of major capital projects, signal retiming and minor congestion related projects are highlighted.

Incident Management and Traveler Information Systems

SHA's performance and ongoing efforts at CHART including incident response and clearance, 511 and other travel advisory services are detailed.

Multi-modalism & Smart Growth

Various SHA initiatives for effective transportation demand management including High Occupancy Vehicle (HOV) lanes, Park & Ride facilities etc. are reviewed. This chapter also highlights SHA efforts to offer multimodal choices to users with an emphasis on the bike and pedestrian travel that promote the Governor's Smart Green and Growing initiative.

Freight

Key aspects of freight travel on Maryland highways are described including the freight network and bottlenecks related to freight travel.

Regionally Significant Corridor Performance

This outlines the congestion facts including average and worst case travel speeds, congestion costs, bottlenecks, etc. These corridors are mostly the major freeways/ expressways that serve a significant portion of the travel demand in the state.

Bottlenecks

This chapter provides details on the top 30 congested locations, unreliable segments and bottleneck locations on Maryland freeways/expressways. The intent is to monitor the state of congestion at key locations for potential mitigation strategies that could include higher CHART emergency vehicle deployment, geometric improvements, active traffic management, etc.

II. Mobility & Reliability




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A. Introduction

Highway congestion occurs as a result of too many users trying to share a common roadway segment at the same time. The issue is that travel demand is consistently on the rise while the infrastructure in the form of roads and public transportation has not been able to keep up with the growth. This is further exacerbated by the non-recurring nature of the congestion due to crashes, vehicle breakdowns, special events and weather events. The impacts of a congested system are detrimental in several ways; from an individual user perspective to the commerce/economy and overall quality of life in the region.

Over the past few decades, Vehicle Miles Traveled (VMT) on Maryland roadways have steadily increased as a result of population growth and economic activity in the region and has far outpaced the agency's ability to increase infrastructure capacity. However, economic conditions since 2008 have partly contributed to recent decreases or stability in VMT. In 2011, congestion on Maryland's freeways and arterials remained at levels comparable with historical trends.

The following facts highlight the current state of congestion in Maryland:

- Maryland residents have the second longest average commute to work in the nation. According to the 2010 American Community Survey, Maryland residents average commute time to work is 32 minutes, compared to the national average of 25 minutes.
- Based on 2010 data, the 2011 Urban Mobility Report cites the Washington, DC and Baltimore metropolitan regions as the first and sixth most congested urban areas in the country respectively. The average D.C. area auto commuter experienced 74 hours of annual delay in 2010 while the average Baltimore commuter experienced an annual 52 hours of delay.
- Compared to other regions of the nation, Maryland has experienced relatively fewer effects from the economic downturn. This could be attributed to the fact that the state supports a large proportion of the federal and associated labor force in Washington, DC. Moreover, the economic activity due to the American Recovery and Reinvestment Act (ARRA) projects and the Base Realignment and Closure (BRAC) implementation have kept transportation demand relatively stable.
- Maryland's population in 2010 was over 5.7 million based on the 2010 U.S. Census. This is expected to increase by nearly 900,000 and produce an additional 610,000 jobs by 2030. This includes 45,000 to 60,000 direct, indirect, and induced jobs over the next several years from the BRAC implementation and other Federal Government location decisions.

From a recurring congestion standpoint, SHA's mobility efforts can primarily fall into two broad categories: major capital improvement and system preservation projects. Long-term recurring congestion related issues are typically addressed by major capacity expansion projects. As all other transportation agencies in the nation, the potential for major capacity enhancement projects in Maryland is limited due to cost, right-of-way and environmental constraints. The current economic climate has precluded major mobility projects and the major emphasis in recent years has been on system preservation. However, even with limited resources, SHA continues to focus on alleviating congestion hotspots through low-cost high-benefit system preservation programs and projects, including signal system optimization. Signal optimization projects are one of the most cost effective methods of improving traffic flow by adjusting signal timing to minimize delay and maximize vehicular throughput. Other system preservation projects include providing spot improvements (e.g. turn lanes) at failing intersections.

One of the most important elements for users of the transportation system is the ability to reasonably predict travel times. Research has established that roadway users have some level of acceptance of congestion; however, what leads to frustration and anxiety is the variability or unreliability of the system. A high degree of variability of travel times between two points on the system either leads to not meeting a schedule or requires sufficient "buffer" time to arrive on time. Late or early arrival to a destination has a cost that varies by trip purpose and nature. For example, the penalty for a late trip to the airport, a business meeting, a just-in-time truck delivery generally have high costs. Increasing reliability of the highway system leads to less uncertainty; which in turn decreases motorist frustration, allows trips to be better planned and meet expectations of the customers.

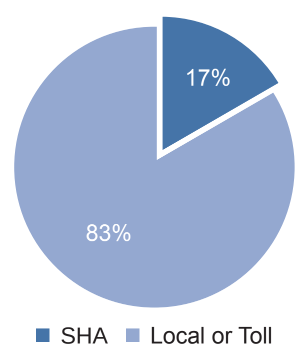
Reliability is critical in both the roadway and mass transit system. With advances in technology and data collection processes, SHA uses real time vehicle probe data from a private company, INRIX to disseminate travel time on it's overhead permanent dynamic message signs. CHART traveler information is available to motorists from public and private sources such as the 511 program. The dynamic message signs along the interstates provide traveler information both about incidents and travel times to various points. In addition, drivers can access traffic conditions from an interactive website map or private companies such as INRIX or Google.

SHA continues to leverage the latest advances in ITS technology and high quality data driven processes to develop programs and projects to address bottlenecks in a systemic and responsible manner. More than ever, SHA is advancing the concepts of planning for operations and continues a performance based approach to identify and implement congestion mitigation solutions.

B. Maryland Congestion and Reliability Indicators

SHA operates, maintains and constructs the state's highway system enabling mobility and access for people and goods from and through the State of Maryland. SHA owns and maintains the numbered, non-toll routes in Maryland's 23 counties - a total of 17,000 lane-miles and 2,576 bridges that represent the backbone of Maryland's transportation system. This infrastructure forms the majority of the National Highway System (NHS) in Maryland that connects local and county roads to major activity centers and other modes of transportation such as mass transit, the Port of Baltimore, airports and railroads. Although SHA roadways account for only 17% of the state's roadways they carry 65% of the state's traffic and 85% of its truck freight traffic. In addition, the MDTA owns and operates several facilities including I-95 in Baltimore City to the Delaware State line, I-895 including spurs to I-97 and MD 2, MD 695 from east of MD 10 to MD 151, the Hatem Bridge (US 40), the Bay Bridge (US 50/301), the Nice Bridge (US 301) and MD 200 (Intercounty Connector) throughout the State.

MARYLAND HIGHWAY MILEAGE



1. VEHICLE MILES TRAVELED (VMT)

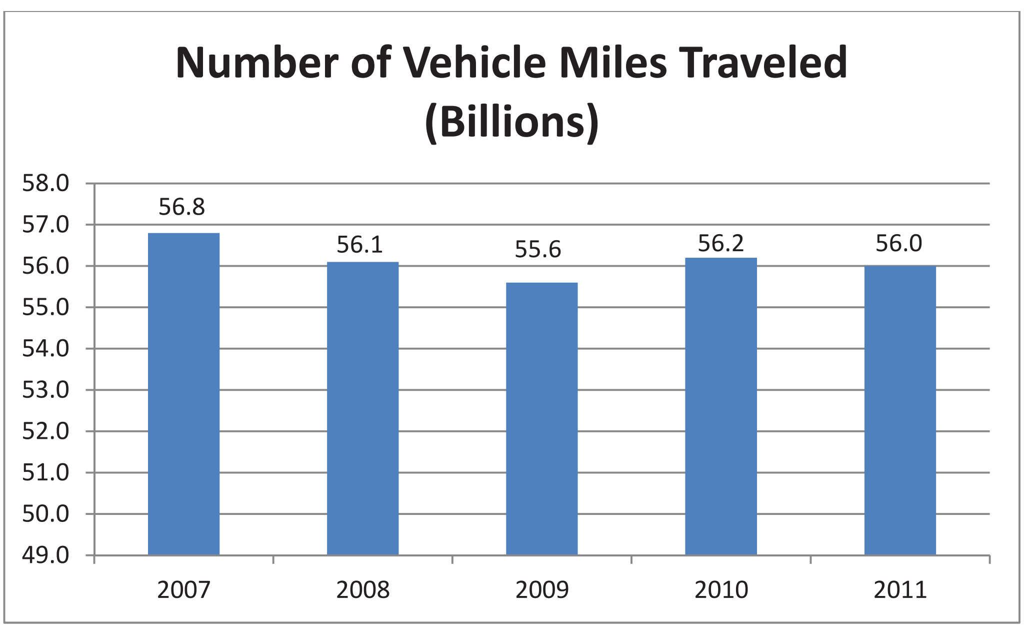
VMT is a standard measure of travel and is defined as the number of vehicles times the distance that they traverse the network. The number of Vehicle Miles Traveled (VMT) in Maryland grew steadily during the state's economic and population boom starting in the 1940's. Over the last 60 to 70 years, there have been periods where the VMT growth has slowed mostly related to economic downturns or the rise in gasoline prices. In Maryland, the growth in VMT has outpaced population growth and SHA's ability to expand the roadway network. In order to better manage the transportation system supply, various multimodal infrastructure strategies have been implemented. In addition, programs and traveler incentives to help manage the demand for transportation services are being administered to reduce VMT.

In 2011, drivers in Maryland traveled 56.0 billion vehicle miles with sections of I-270 and the Capital Beltway carrying more than 240,000 vehicles per day. VMT in 2011 is about 1% less than the all time high of nearly 57 billion VMT in 2007. The State of Maryland continues to experience higher economic activity compared to the national averages which has contributed to the fairly flat statewide VMT over the last few years.

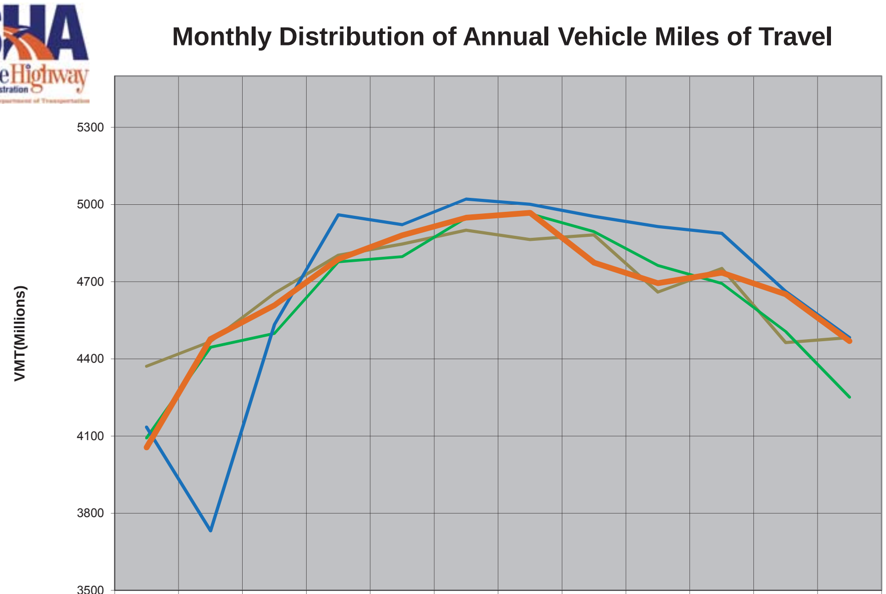
Over the last five years the amount of travel along Maryland's roadways has stabilized near 56.0 billion vehicle miles travelled per year. The 2008 economic conditions contributed to the reduction appeared to have bottomed out in 2009 with a slight increase since that time.

The 2011 VMT on the state and toll maintained roadways was 40.2 billion, a drop of 4% as compared to 2010 where as VMT on all other roadways was 15.7 billion, similar to 2010.

In the Baltimore-Washington Metropolitan Region 2011 VMT was 46.9 billion, compared to 47.0 billion in 2010. The 2011 VMT for the Eastern Shore and Western Maryland was 9.1 billion, approximately the same as 2010 VMT.



The monthly distribution of VMT is depicted on the following chart. Peak travel months are June and July along Maryland roadways.

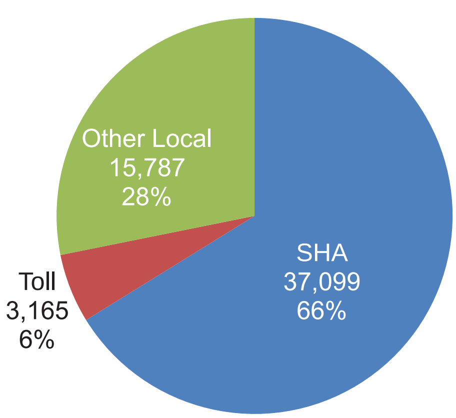


	January	February	March	April	May	June	July	August	September	October	November	December
2008 VMT (Millions)	4372	4467	4655	4803	4847	4900	4864	4882	4660	4752	4463	4483
2009 VMT (Millions)	4092	4445	4499	4777	4797	4948	4964	4895	4763	4693	4506	4251
2010 VMT (Millions)	4135	3731	4533	4960	4922	5021	5001	4954	4915	4888	4662	4483
2011 VMT (Millions)	4056	4477	4608	4788	4880	4949	4968	4775	4694	4735	4652	4469

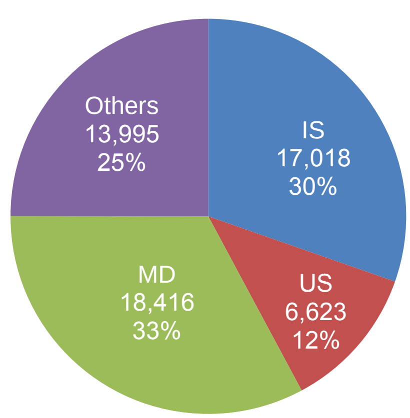
NOTE: This chart displays 2011 monthly Vehicle Miles of Travel compared with the previous years based on data collected at approximately 67 continuous count stations throughout the State.

The breakdown of 2011 VMT by ownership and by roadway type is shown in the following charts. SHA and MDTA toll facilities combined account for two thirds of the state's total VMT. More than three-fourths of the total VMT traverse on interstates, US and Maryland designated roadways.

2011 VMT BY OWNERSHIP



2011 VMT BY ROADWAY TYPE



2. FREEWAY/ EXPRESSWAY MOBILITY AND RELIABILITY METRICS

The ability to provide a comprehensive measure of congestion and reliability is provided through the unprecedented use of data by the private sector and supplemented with State resources. This data, together with analyses methodologies that have been developed and tested over time, provides a detailed “picture” of mobility for travelers using the freeway system in the State of Maryland. The private data comes from INRIX, a company that provides both real-time and historic traffic speed data collected from a wide variety of sources, including commercial vehicle fleets. The University of Maryland Center for Advanced Transportation Technology (UMD CATT) uses the INRIX speed data, together with detailed traffic volume data from the SHA to generate measures of congestion and reliability across the entire freeway system. The analysis methodology is consistent with that developed by the Texas Transportation Institute to prepare the annual national Urban Mobility Report. These congestion and reliability measures have also been closely coordinated with the Washington and Baltimore Metropolitan Planning Organizations (MPOs) to ensure regional consistency in measure definition and reporting.

C. Congestion and Reliability Measures

There are a wide variety of measures that can be used to quantify congestion and those based on travel times are popular because they are easily computed from speed data and are relatively easy to communicate to a range of audiences. One of the key measures used in this report is the Travel Time Index. The Travel Time Index (TTI) compares the average travel time of a trip during the peak hour (when congestion is the worst) to the travel time of a trip during off peak (free-flow or uncongested) conditions. The index depicts how much longer, on average, travel times are during congestion compared to light traffic. The higher the TTI number, the worse the congestion. For the purposes of the statewide and regional congestion maps presented in this report, the TTI is depicted as follows:

- Uncongested (TTI <1.15)
- Light (1.15 <TTI <1.3)
- Moderate (1.3 <TTI <2.0)
- Severe (TTI >2.0)

For example, a TTI of 1.5 indicates that a trip that will take 30 minutes in light traffic will take one and a half times longer, or 45 minutes in congested conditions. While TTI helps measure congestion, most travelers come to expect everyday congestion and plan their trips accordingly both during the peak and off peak periods. Frustration increases considerably, however, when travelers experience conditions worse than expected. When a trip that normally takes 25 minutes suddenly takes an hour driver frustration worsens. Travelers desire reliability and consistent and dependable travel times for the same trip taken at the same time on a daily basis. Even if congestion occurs during this trip, if it is predictable, the motorist can plan accordingly.

Trip reliability is measured using the Planning Time Index (PTI). The PTI represents how much total time a traveler should allow to make sure they get to their destination on time while taking into account potential impacts due to traffic incidents, or weather. A PTI of 2.0 means the total trip time under light traffic conditions should be increased by 100% to make sure of an on-time arrival. So if a trip takes 25 minutes under light traffic conditions where the PTI is 2.0 the total trip time should be increased to 50 minutes to ensure arriving on time. The lower the PTI number, the more reliable the trip while the higher the number, the less reliable (and more potentially frustrating) the trip. For the purposes of the statewide and regional congestion maps presented in this report, the PTI is depicted as follows:

- Reliable (PTI >1.5)
- Moderately Reliable (1.5 <PTI <2.5)
- Unreliable (PTI >2.5)

D. Geographic Regions

A detailed analysis has been performed at varying scales of geography to provide a comprehensive picture of congestion and reliability on the statewide Maryland freeway network. In addition to the entire state network, analysis focused on the following four major geographic regions:

1. BALTIMORE METROPOLITAN REGION

- Baltimore City
- Baltimore County
- Anne Arundel County
- Howard County
- Carroll County
- Harford County

2. WASHINGTON METROPOLITAN REGION (MARYLAND COUNTIES)

- Prince George's County
- Montgomery County
- Charles County
- Frederick County
- Calvert County
- St. Mary's County

Congestion and reliability measures are provided for the combined Baltimore – Washington Metropolitan Region.

3. EASTERN SHORE

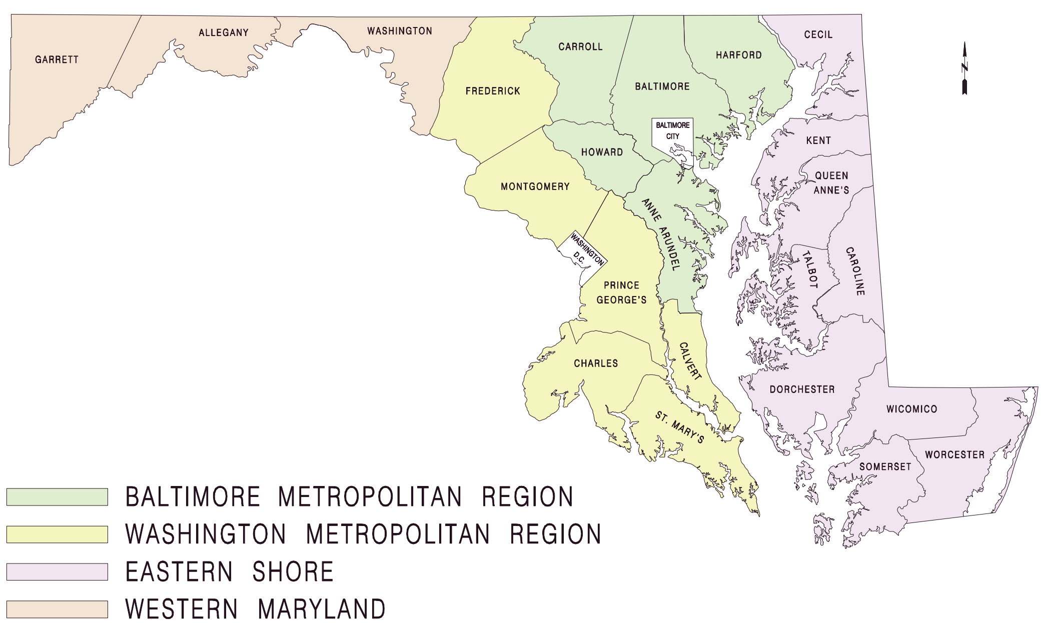
- Caroline County
- Cecil County
- Dorchester County
- Kent County
- Queen Anne's County
- Somerset County
- Talbot County
- Wicomico County
- Worcester County

4. WESTERN MARYLAND

- Allegany County
- Garrett County
- Washington County

The Eastern Shore and Western Maryland region are combined together for congestion and reliability measures reporting.

The 2011 INRIX data analyzed in this report covers 1,698 directional freeway/expressway miles that account for approximately 95% of all freeway/expressways in Maryland. This includes 1,061 directional miles of freeway/expressways in the combined Baltimore-Washington region with the remaining 637 directional miles are on the Eastern Shore and Western Maryland.



E. Congestion and Reliability Measures on the Maryland State Freeway/Expressway Network

1. STATEWIDE PEAK HOUR CONGESTION (PERCENT SYSTEM CONGESTED AND PERCENT VMT IN CONGESTED CONDITIONS)

Statewide congestion maps based on the TTI are provided for the highest volume peak hours (8-9 AM and 5-6 PM) in figures 1 and 2 respectively.

In the morning peak hour, a total of 128 highway miles (8% of the statewide freeway/expressway network) experience moderate to severe congestion (TTI >1.3). The vehicle miles traveled under congested conditions in the morning peak hour is 16% of total VMT in the morning peak hour.

In the afternoon peak hour, a total of 218 highway miles (13% of the statewide freeway/expressway network) experience moderate to severe congestion (TTI >1.3). The vehicle miles traveled under congested conditions in the afternoon peak hour is 26% of total VMT in the afternoon peak hour.

2. STATEWIDE COST OF CONGESTION

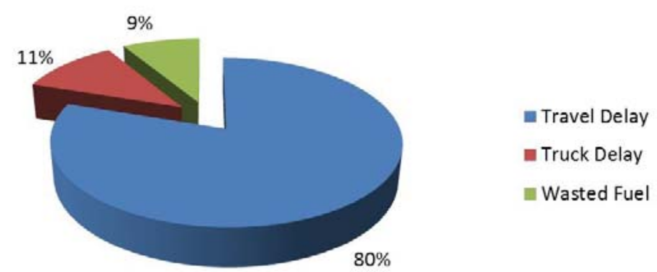
The total estimated statewide cost of congestion on the freeway/expressway network in 2011 is $1.49 Billion. The total costs can be broken down as follows:

- Auto delay cost: $1,193 Million
- Truck delay cost: $167 Million
- Wasted fuel cost: $129 Million

The following graphs show the percent breakdown of the congestion cost by source and by different regions.

PERCENT OF TOTAL STATEWIDE CONGESTION COST BY SOURCE

(TOTAL CONGESTION COST = $1.49B)



PERCENT OF TOTAL STATEWIDE CONGESTION COST BY REGION

(TOTAL CONGESTION COST = $1.49B)

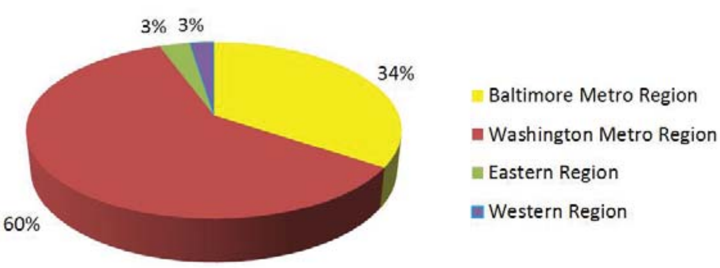


Figure 1

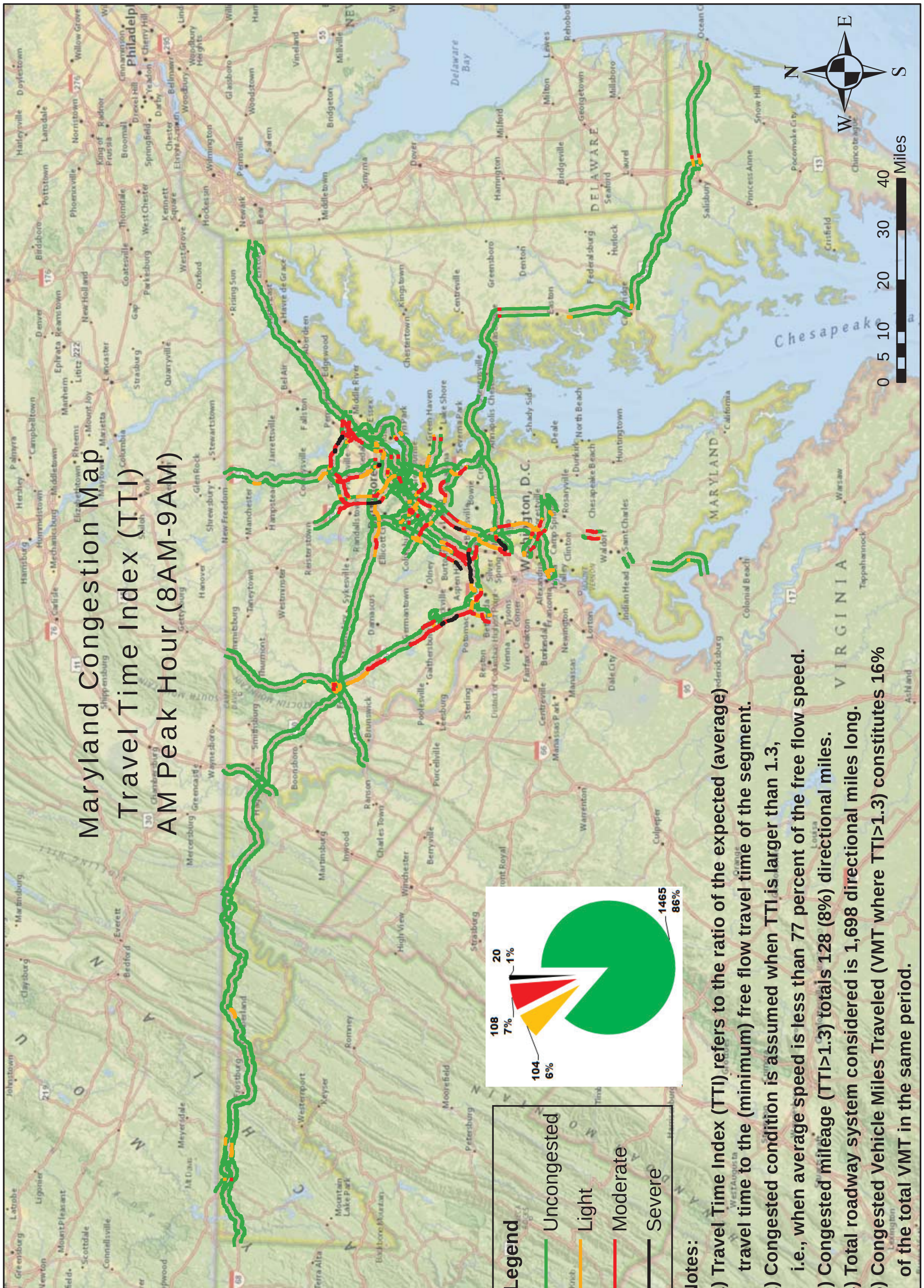
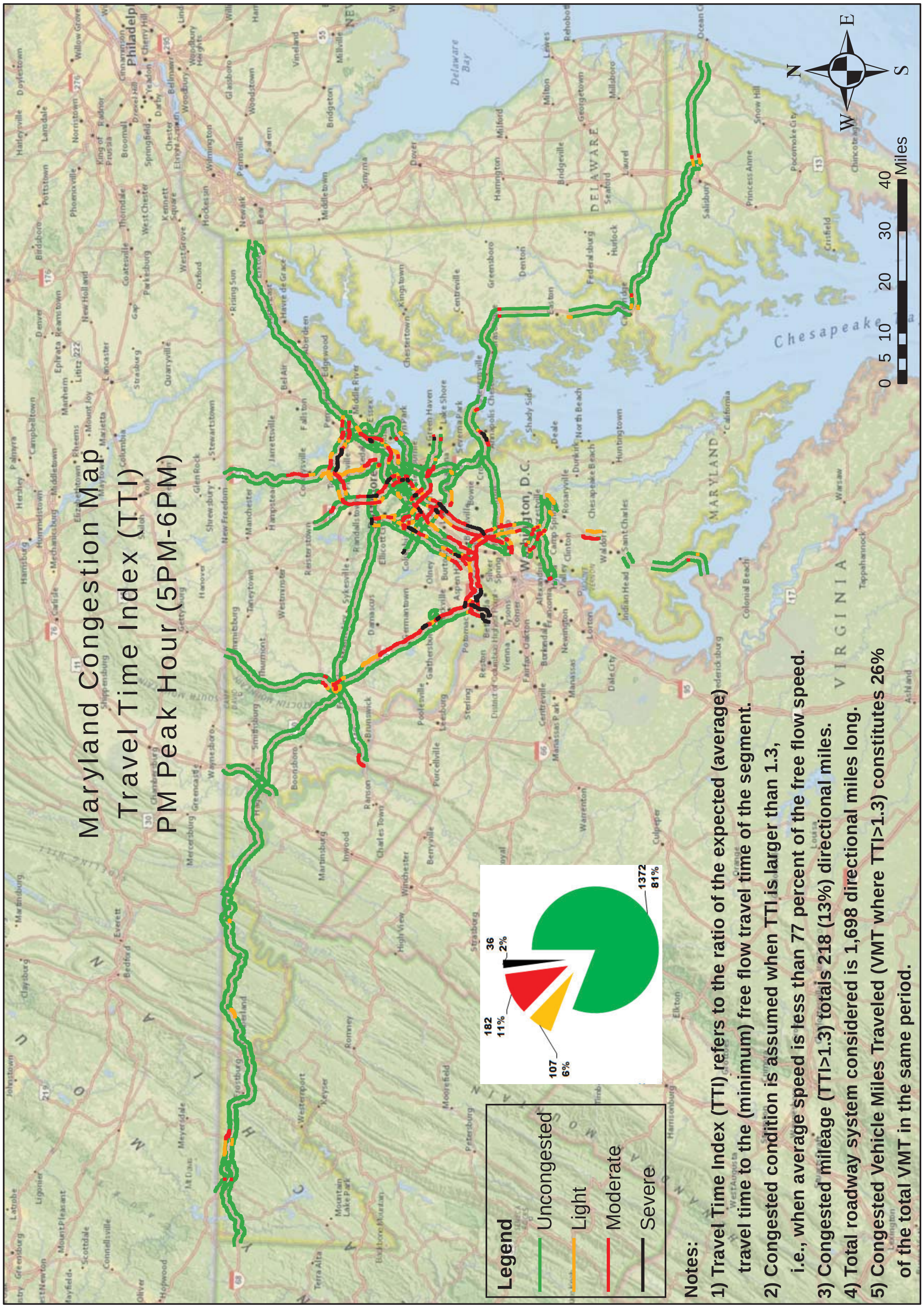

Maryland Congestion Map
Travel Time Index (TTI)
AM Peak Hour (8AM-9AM)
1465
86%
20
1%
108
7%
104
6%
Legend
Uncongested
Light
Moderate
Severe
Notes:
1) Travel Time Index (TTI) refers to the ratio of the expected (average) travel time to the (minimum) free flow travel time of the segment.
2) Congested condition is assumed when TTI is larger than 1.3, i.e., when average speed is less than 77 percent of the free flow speed.
3) Congested mileage (TTI>1.3) totals 128 (8%) directional miles.
4) Total roadway system considered is 1,698 directional miles long.
5) Congested Vehicle Miles Traveled (VMT where TTI>1.3) constitutes 16% of the total VMT in the same period.
0 5 10 20 30 40 Miles
N
S
E
W

Figure 2



Maryland Congestion Map
Travel Time Index (TTI)
PM Peak Hour (5PM-6PM)
Legend
Uncongested
Light
Moderate
Severe
1372 81%
36 2%
182 11%
107 6%
Miles
0 5 10 20 30 40
Notes:
1) Travel Time Index (TTI) refers to the ratio of the expected (average) travel time to the (minimum) free flow travel time of the segment.
2) Congested condition is assumed when TTI is larger than 1.3, i.e., when average speed is less than 77 percent of the free flow speed.
3) Congested mileage (TTI>1.3) totals 218 (13%) directional miles.
4) Total roadway system considered is 1,698 directional miles long.
5) Congested Vehicle Miles Traveled (VMT where TTI>1.3) constitutes 26% of the total VMT in the same period.

3. STATEWIDE FREEWAY PEAK HOUR RELIABILITY

Statewide reliability maps based on the Planning Time Index are provided for the peak hours (8-9 AM and 5-6 PM) in figures 3 and 4, respectively.

In the morning peak hour, a total of 140 highway miles (8% of the statewide freeway/expressway network) experience unreliable conditions (PTI >2.5). The vehicle miles traveled under these unreliable conditions in the morning peak hour is 18% of total VMT in the morning peak hour.

In the afternoon peak hour, a total of 188 highway miles (11% of the statewide freeway/expressway network) experience unreliable conditions (PTI >2.5). The vehicle miles traveled under these unreliable conditions in the afternoon peak hour is 26% of total VMT in the afternoon peak hour.

4. BALTIMORE – WASHINGTON METROPOLITAN REGION PEAK HOUR CONGESTION

Baltimore – Washington Metropolitan Region congested maps based on TTI are provided for the peak hours (8-9 AM and 5-6 PM) in figures 5 and 6, respectively.

In the morning peak hour, a total of 127 highway miles (12% of the Baltimore – Washington Metropolitan Region freeway/expressway network) experience moderate to severe congestion (TTI >1.3). The vehicle miles traveled under congested conditions in the morning peak hour is 18% of total VMT in the morning peak hour.

In the afternoon peak hour, a total of 214 highway miles (20% of the Baltimore – Washington Metropolitan Region freeway/expressway network) experience moderate to severe congestion (TTI >1.3). The vehicle miles traveled under congested conditions in the afternoon peak hour is 29% of total VMT in the afternoon peak hour.

5. BALTIMORE – WASHINGTON URBAN AREA COST OF CONGESTION

The total cost of congestion in the Baltimore – Washington Metropolitan Region on the freeway/expressway network in 2011 was $1.415 billion. The total costs can be broken down as follows:

- Auto delay cost: $1,130 Million
- Truck delay cost: $154 Million
- Wasted fuel cost: $121 Million

6. BALTIMORE – WASHINGTON METROPOLITAN REGION PEAK HOUR RELIABILITY

Baltimore – Washington Metropolitan Region reliability maps based on the PTI are provided for the peak hours (8-9 AM and 5-6 PM) in figures 7 and 8 respectively.

In the morning peak hour, a total of 140 highway miles (13% of the Baltimore – Washington Metropolitan Region freeway/expressway network) experience unreliable conditions (PTI >2.5). The vehicle miles traveled under these unreliable conditions in the morning peak hour is 20% of total VMT in the morning peak hour.

In the afternoon peak hour, a total of 188 highway miles (18% of the Baltimore – Washington Metropolitan Region freeway/expressway network) experience unreliable conditions (PTI >2.5). The vehicle miles traveled under these unreliable conditions in the afternoon peak hour is 30% of total VMT in the afternoon peak hour.

Figure 3

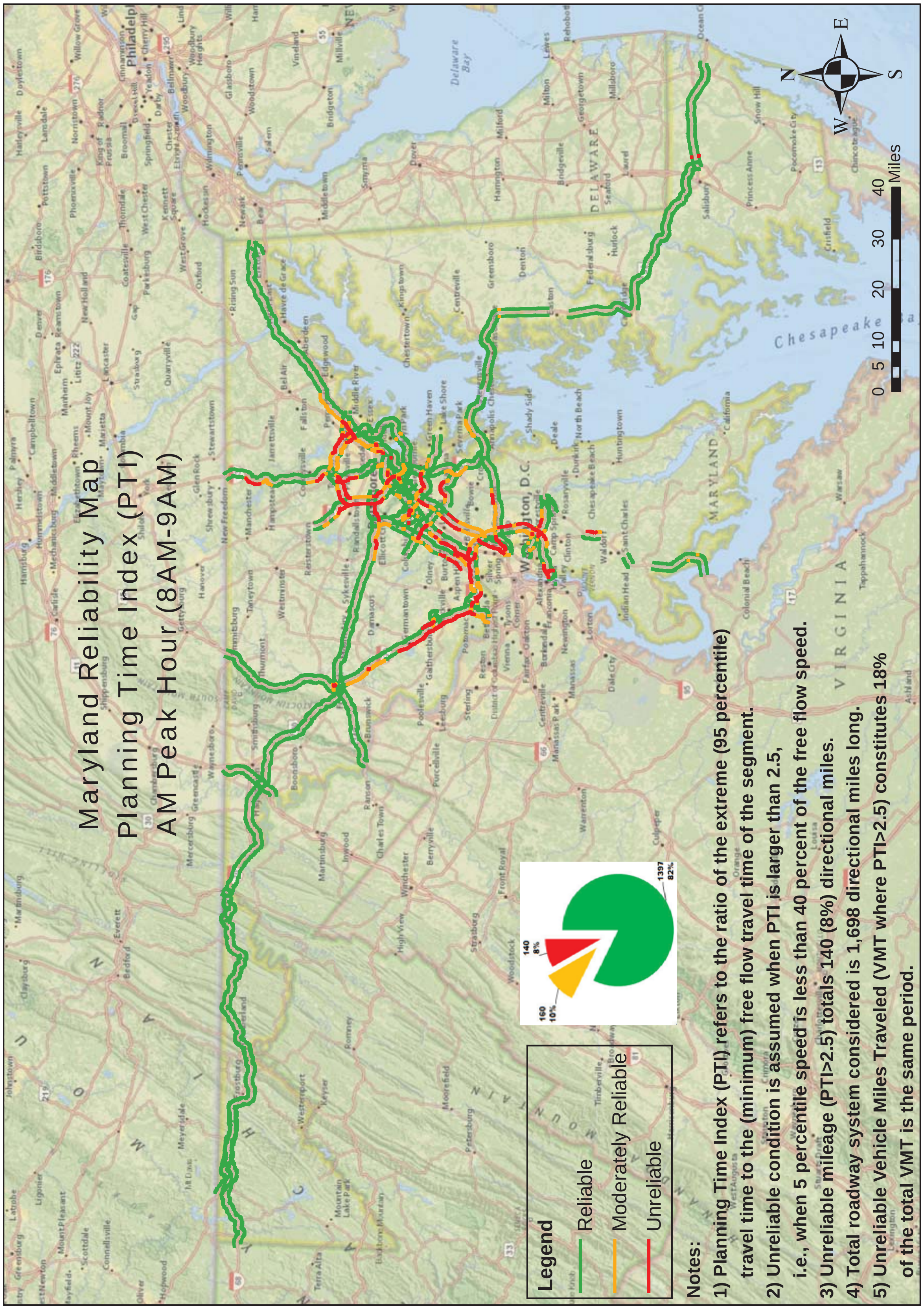

Maryland Reliability Map
Planning Time Index (PTI)
AM Peak Hour (8AM-9AM)
Legend
Reliable
Moderately Reliable
Unreliable
1397 82%
140 8%
160 10%
0 5 10 20 30 40 Miles
N
E
S
W
Notes:
1) Planning Time Index (PTI) refers to the ratio of the extreme (95 percentile) travel time to the (minimum) free flow travel time of the segment.
2) Unreliable condition is assumed when PTI is larger than 2.5, i.e., when 5 percentile speed is less than 40 percent of the free flow speed.
3) Unreliable mileage (PTI>2.5) totals 140 (8%) directional miles.
4) Total roadway system considered is 1,698 directional miles long.
5) Unreliable Vehicle Miles Traveled (VMT where PTI>2.5) constitutes 18% of the total VMT is the same period.

Figure 4

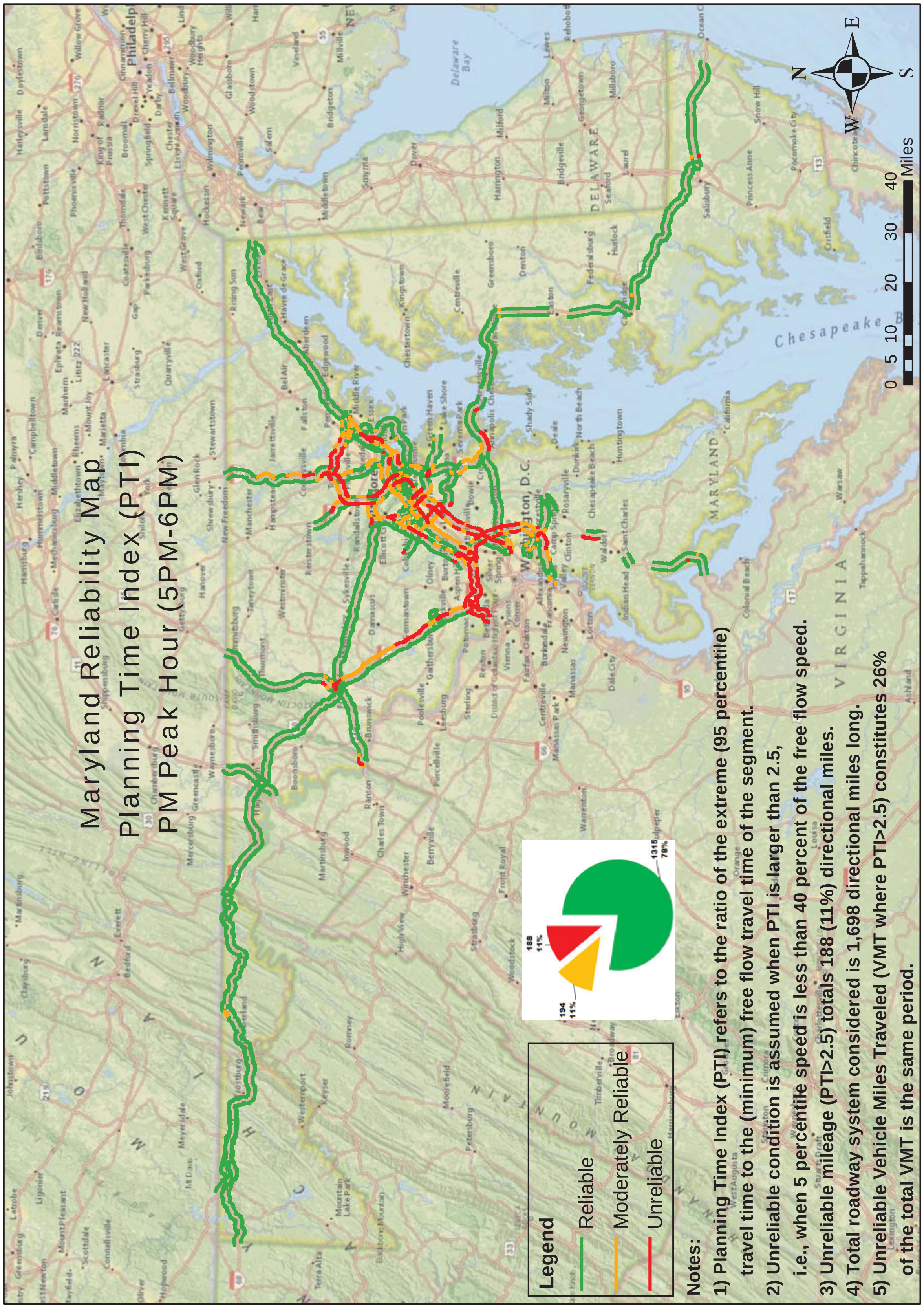

Maryland Reliability Map
Planning Time Index (PTI)
PM Peak Hour (5PM-6PM)
1315 78%
188 11%
194 11%
Legend
Reliable
Moderately Reliable
Unreliable
0 5 10 20 30 40 Miles
Notes:
1) Planning Time Index (PTI) refers to the ratio of the extreme (95 percentile) travel time to the (minimum) free flow travel time of the segment.
2) Unreliable condition is assumed when PTI is larger than 2.5, i.e., when 5 percentile speed is less than 40 percent of the free flow speed.
3) Unreliable mileage (PTI>2.5) totals 188 (11%) directional miles.
4) Total roadway system considered is 1,698 directional miles long.
5) Unreliable Vehicle Miles Traveled (VMT where PTI>2.5) constitutes 26% of the total VMT is the same period.

Figure 5

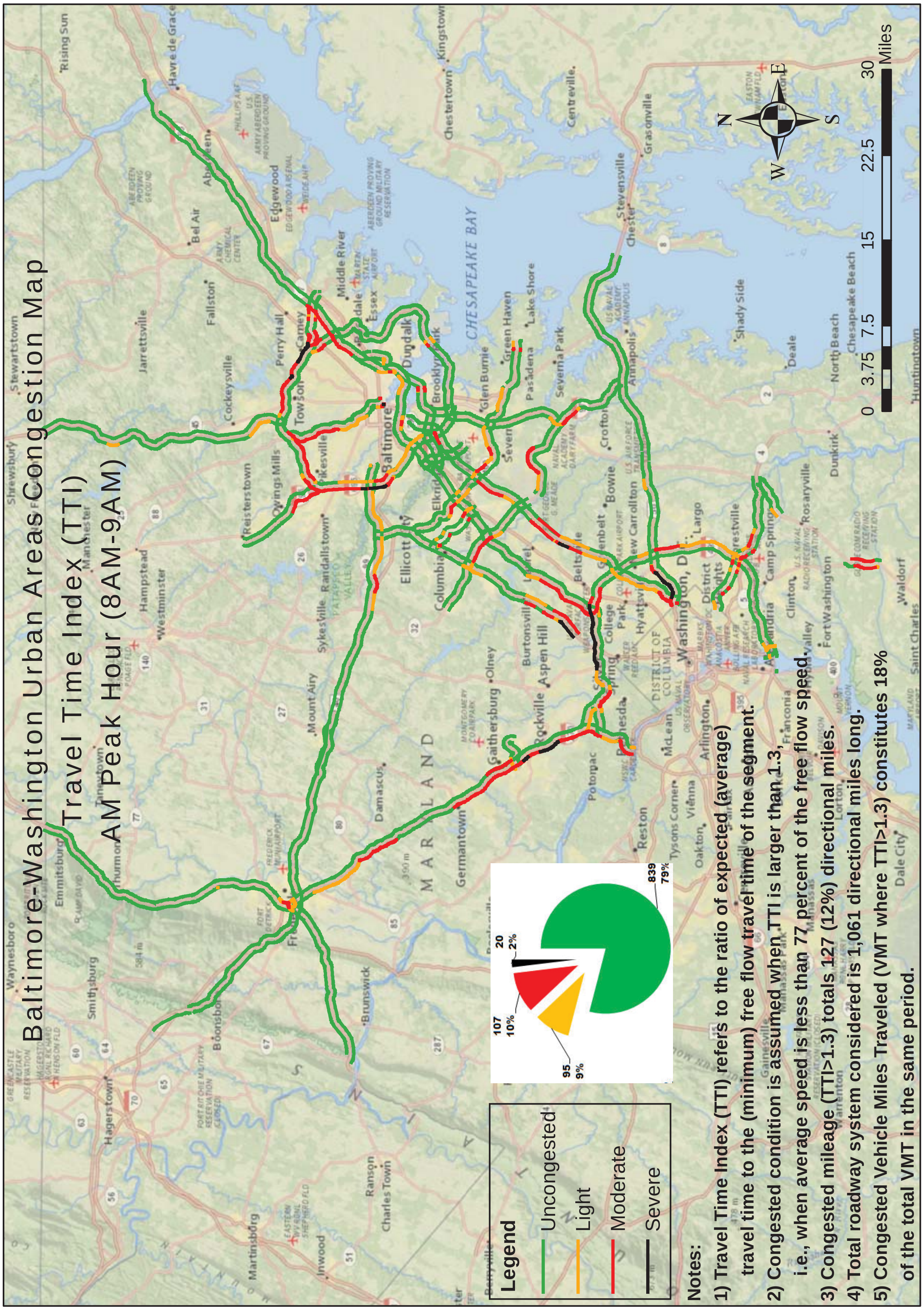

Baltimore-Washington Urban Areas Congestion Map
Travel Time Index (TTI)
AM Peak Hour (8AM-9AM)
Legend
Uncongested
Light
Moderate
Severe
839
79%
20
2%
107
10%
95
9%
Miles
0 3.75 7.5 15 22.5 30
N
S
E
W
CHESAPEAKE BAY
MARYLAND
DISTRICT OF COLUMBIA
Notes:
1) Travel Time Index (TTI) refers to the ratio of expected (average) travel time to the (minimum) free flow travel time of the segment.
2) Congested condition is assumed when TTI is larger than 1.3, i.e., when average speed is less than 77 percent of the free flow speed.
3) Congested mileage (TTI>1.3) totals 127 (12%) directional miles.
4) Total roadway system considered is 1,061 directional miles long.
5) Congested Vehicle Miles Traveled (VMT where TTI>1.3) constitutes 18% of the total VMT in the same period.

Figure 6

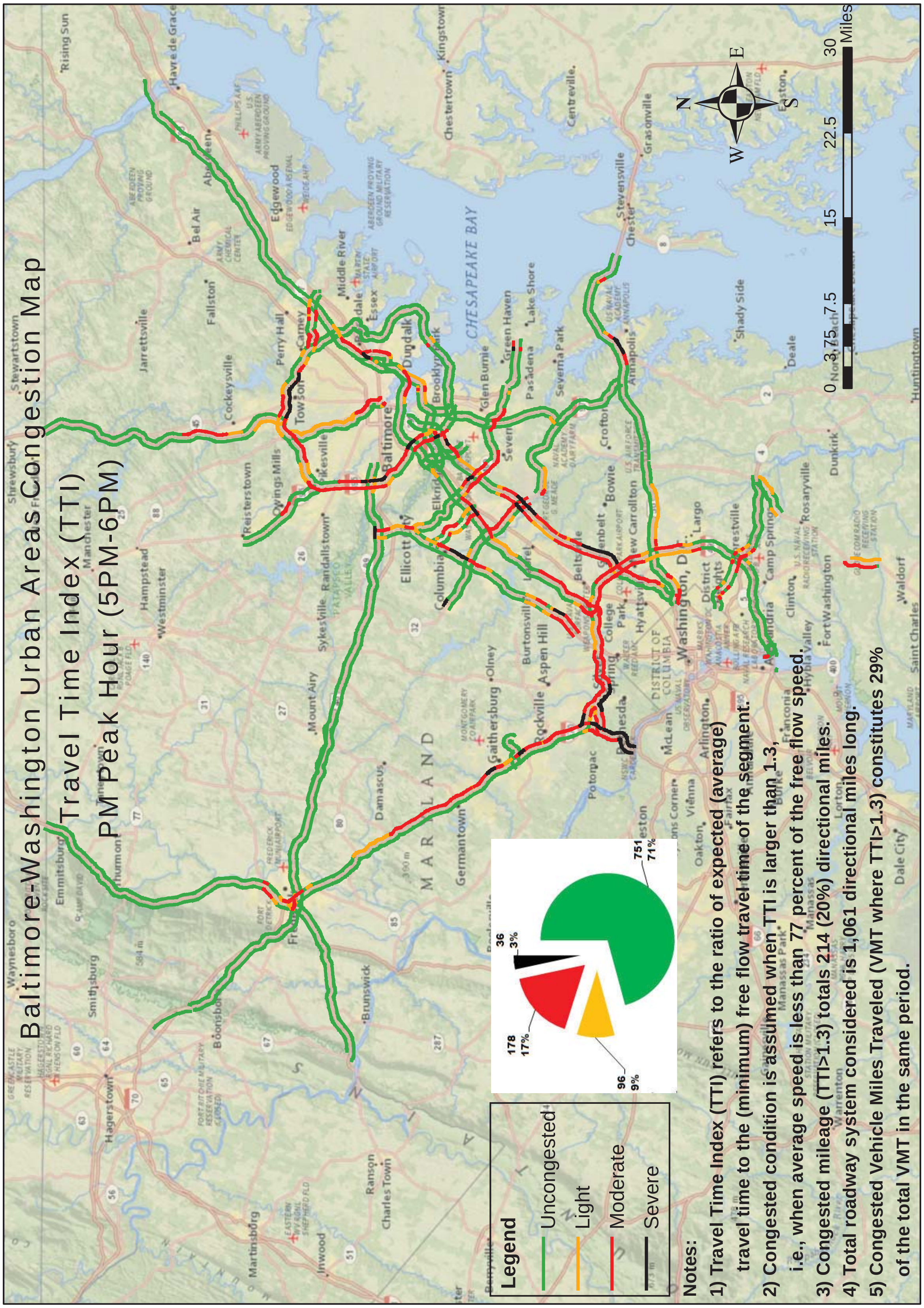

Baltimore-Washington Urban Areas Congestion Map
Travel Time Index (TTI)
PM Peak Hour (5PM-6PM)
Legend
Uncongested
Light
Moderate
Severe
751
71%
96
9%
178
17%
36
3%
0 3.75 7.5 15 22.5 30 Miles
Notes:
1) Travel Time Index (TTI) refers to the ratio of expected (average) travel time to the (minimum) free flow travel time of the segment.
2) Congested condition is assumed when TTI is larger than 1.3, i.e., when average speed is less than 77 percent of the free flow speed.
3) Congested mileage (TTI>1.3) totals 214 (20%) directional miles.
4) Total roadway system considered is 1,061 directional miles long.
5) Congested Vehicle Miles Traveled (VMT where TTI>1.3) constitutes 29% of the total VMT in the same period.

Figure 7

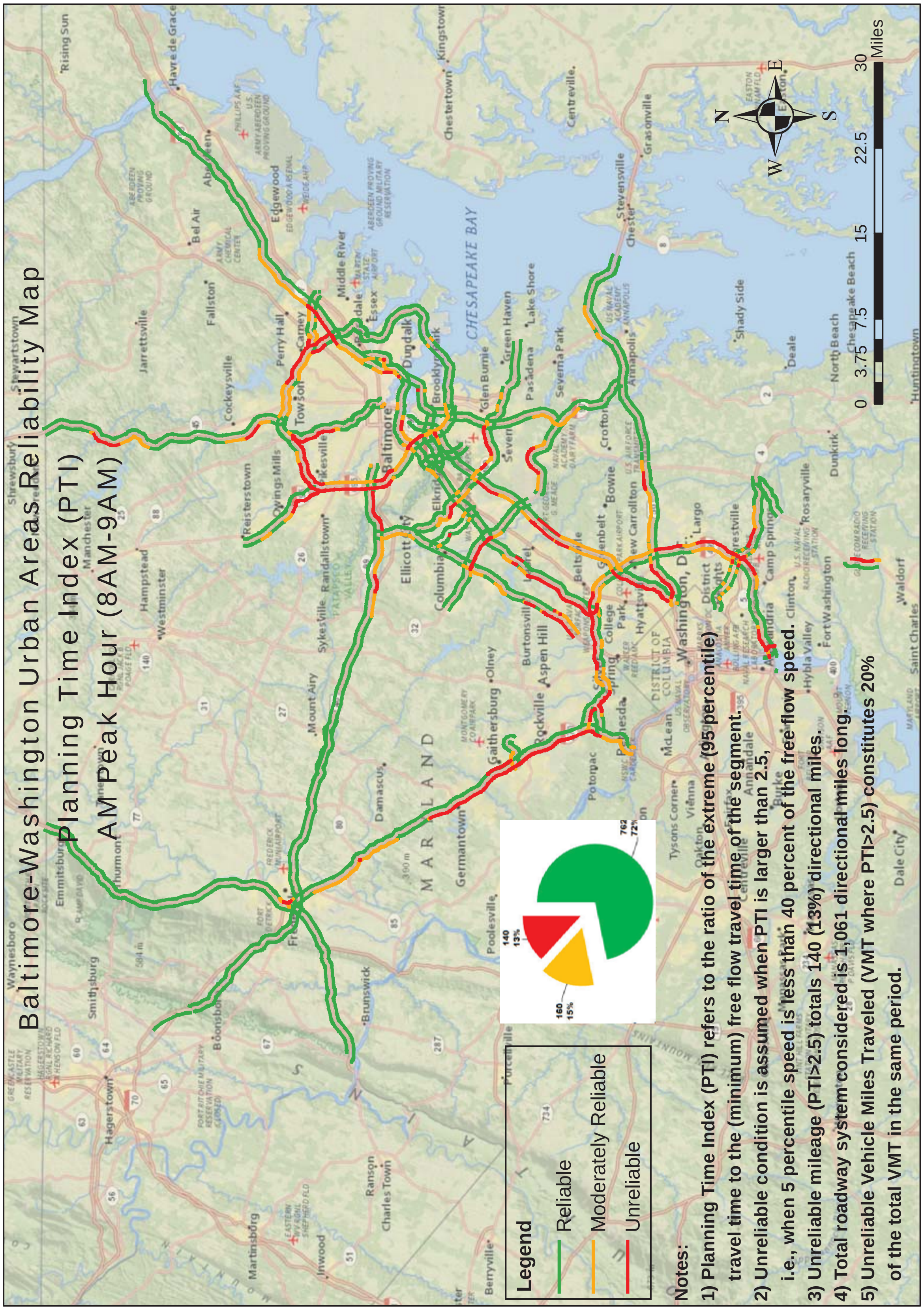
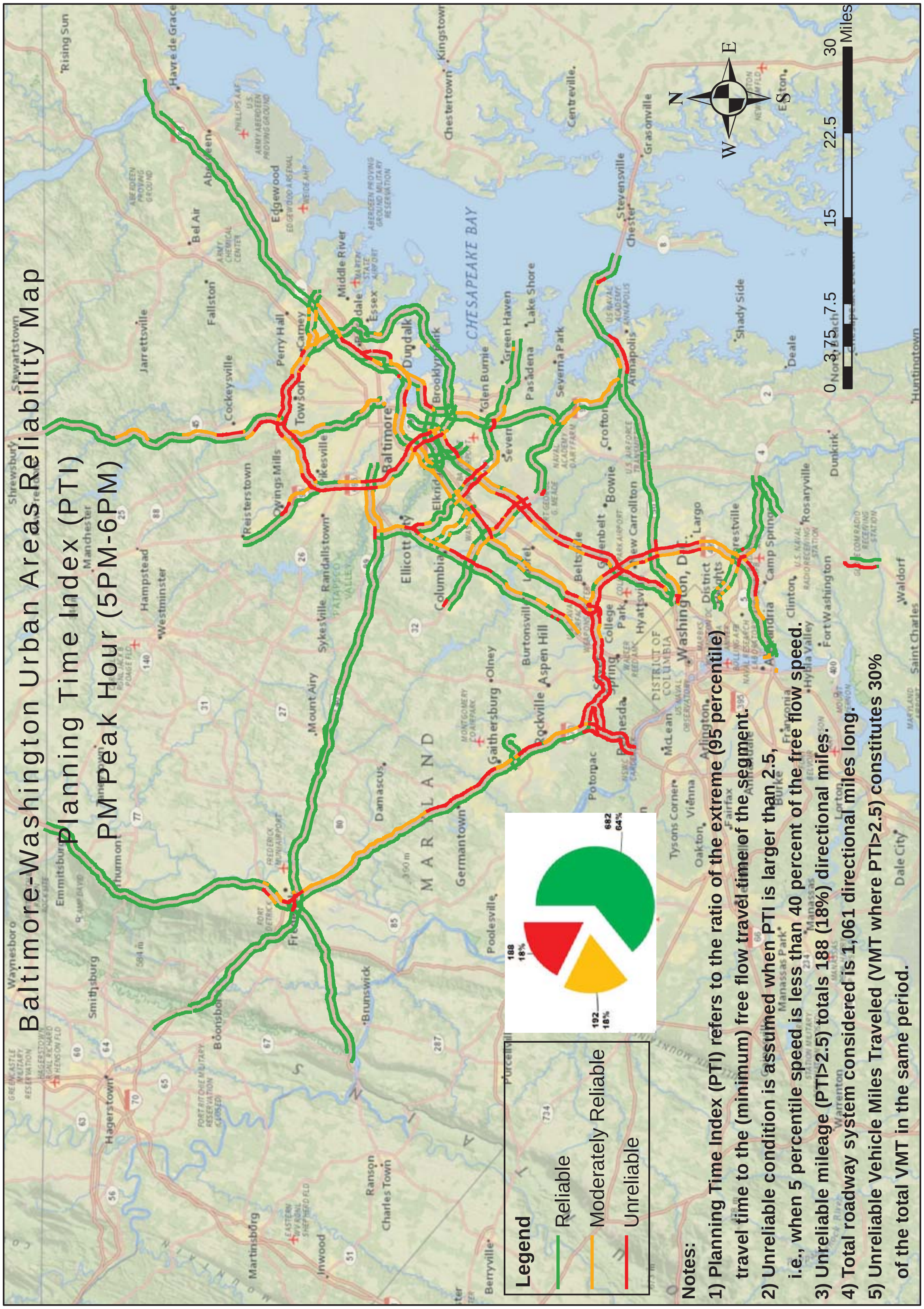

Baltimore-Washington Urban Areas Reliability Map
Planning Time Index (PTI)
AM Peak Hour (8AM-9AM)
762
72%
140
13%
160
15%
Legend
Reliable
Moderately Reliable
Unreliable
Notes:
1) Planning Time Index (PTI) refers to the ratio of the extreme (95 percentile) travel time to the (minimum) free flow travel time of the segment.
2) Unreliable condition is assumed when PTI is larger than 2.5, i.e., when 5 percentile speed is less than 40 percent of the free flow speed.
3) Unreliable mileage (PTI>2.5) totals 140 (13%) directional miles.
4) Total roadway system considered is 1,061 directional miles long.
5) Unreliable Vehicle Miles Traveled (VMT where PTI>2.5) constitutes 20% of the total VMT in the same period.
0 3.75 7.5 15 22.5 30
Miles
N
S
E
W
CHESAPEAKE BAY
Baltimore
Washington, D.C.
M A R Y L A N D

Figure 8


Baltimore-Washington Urban Areas Reliability Map
Planning Time Index (PTI)
PM Peak Hour (5PM-6PM)
Legend
Reliable
Moderately Reliable
Unreliable
682
64%
188
18%
192
18%
0 3.75 7.5 15 22.5 30 Miles
N
S
E
W
CHESAPEAKE BAY
MARYLAND
Baltimore
Washington, D.C.
Notes:
1) Planning Time Index (PTI) refers to the ratio of the extreme (95 percentile) travel time to the (minimum) free flow travel time of the segment.
2) Unreliable condition is assumed when PTI is larger than 2.5, i.e., when 5 percentile speed is less than 40 percent of the free flow speed.
3) Unreliable mileage (PTI>2.5) totals 188 (18%) directional miles.
4) Total roadway system considered is 1,061 directional miles long.
5) Unreliable Vehicle Miles Traveled (VMT where PTI>2.5) constitutes 30% of the total VMT in the same period.

7. EASTERN SHORE AND WESTERN REGION CONGESTION AND RELIABILITY

As shown in Figures 1-4, the Eastern Shore and Western Region experience only minor peak hour congestion and reliability issues. Although these regions may experience more congestion on several weekends during the AM and PM peaks only, a small number of roadway experience unreliable conditions. The total cost of auto delay, truck delay and wasted fuel amounts to approximately $82 million for the Eastern Shore and Western Region.

F. SHA Mobility Performance for Recurring Congestion Related Projects

1. MAJOR PROJECTS

In 2011, the SHA and the Maryland Transportation Authority (MDTA) opened the Intercounty Connector (ICC/ MD 200), a six lane 18 mile variably priced toll facility that connects the I-270 corridor in Montgomery County and the I-95 corridor in Prince George's County. The Intercounty Connector was first proposed as part of the Outer Beltway in the 1950s and then revised to the Intercounty Connector in the 1960s. The roadway project was revived in 2003 and through a joint effort of various state and federal agencies, the alignment was approved for construction in 2007. The first section of the ICC that connects I-370 at Shady Grove to MD 97 (Georgia Avenue)/MD 28 (Norbeck Road) in Olney opened on February 23, 2011. The next section from MD 97(Georgia Avenue) to I-95 was opened to traffic in November 2011. This state-of-the-art all electronic toll facility provides a vital east-west connection in the region with interchanges at I-370 at Shady Grove Road, MD 97 (Georgia Avenue), MD 650 (New Hampshire

Avenue), US 29 (Columbia Pike) and I-95. The $2.5 billion project was on time and within budget. The last phase, which is in design, will extend the ICC from I-95 to US 1.

Vehicular usage of the ICC has increased at a steady rate since its opening. December 2011 average weekday volumes ranged between 17,500 to 26,500. Motorists using the ICC have experienced significant savings in their travel times. A recent Metropolitan Washington Council of Governments (MWCOG) Study shows that in the peak period on average, travelers experienced a 30-35 minute savings in travel time between a trip from Rockville to BWI Airport by using ICC as opposed to using the Capital Beltway. Parallel facilities to the ICC like MD 28/MD 198, Randolph Road/Montrose Road and some segments of the Capital Beltway have also seen some congestion relief as traffic volumes have diverted to the ICC. Before/After studies are underway to monitor the performance of the ICC and its impact on the regional transportation system.

The other notable projects that officially opened to traffic in 2011 include:

1. MD 237, St. Mary's County

MD 237 was widened from two to four lanes to meet the demand caused by the previous BRAC alignment at Patuxent Naval Air Center in this fast growing area of St. Mary's County.

2. I-70/MD 355/MD 85 Frederick County

The reconstruction of the I-70/MD 355/MD 85 interchange replaces the short acceleration and deceleration lanes to improve safety. It provides a gateway into Frederick.

3. I-95/ MD 24/MD 924, Harford County

The reconstruction of the I-95/MD 24 interchange was implemented to improve safety and operations especially related to I-95 northbound motorists queuing on to the mainline of I-95. Due to the proximity of MD 24/MD 924 intersection a new interchange was constructed at that location to assist with traffic flow through the area.

2. MINOR CONGESTION RELIEF PROJECTS

SHA, through the Congested Intersection Program, addresses congestion issues at failing/near failing signalized intersections on state roadways with relatively low cost geometric improvements. Intersections that routinely suffer from daily recurring congestion are often the subject of geometric constraints. The intersections typically are funded for geometric improvements. These locations may experience frequent phase failures, turn bay spillovers, long queues blocking upstream intersections, and/or blocked turn bays.

Turn bay extensions can assist in reducing the occurrence of spillovers and blockages, while providing additional turn lanes or through lanes can reduce queues and increase intersection throughput. Projects funded in this category have cost constraints and are typically spot intersection type improvements for existing conditions (rather than corridor-wide improvements for future demand). SHA maintains a streamlined process to develop and implement projects across the state which along with congestion relief also provides safety and environmental benefits.

The congestion relief projects that were constructed in calendar year 2011 include:

1. MD 140 @ Gorsuch Road

2. MD 140 @ Sandymount Road

3. I-70 Ramp @ MD 75

These projects have resulted in improved operations at the above intersections thereby providing savings in user travel times and fuel costs.

3. SIGNAL SYSTEM OPTIMIZATION PROJECTS

Traffic signals provide for a method to control conflicting flows of motorists that pass through an intersection. At the same time, signals cause delays to motorists and increased automobile emissions. One of the most cost effective methods of reducing recurring congestion is to retime traffic signals so that they are more responsive to traffic flows. Signal optimization is used to reduce delay at intersections and corridors thereby improving safety and person throughput. SHA currently has 248 signal systems covering a total of 1,529 signals. SHA typically reviews the signal systems on roughly a three to five year cycle with an objective of reducing delay by at least 5%. The annual benefits of these changes range between $20 and $30 million with a substantial benefit and cost ratio. During the calendar year 2011, reviews were completed on 48 systems with a total of 298 signals. This included one new system as part of the construction of the I-95/MD 24/MD 924 interchange and associated intersections. These signal retiming and optimization efforts resulted in delay reduction of about 800,000 hours. With the fuel and emission savings added to the delay savings, this results in a $ 21.1 million total user cost savings with a benefit and cost ratio of approximately 41:1.

4. TRANSIT SIGNAL PRIORITIZATION PROJECTS

One method of achieving on-time performance for buses is by providing improvements at signalized intersections. This can be accomplished through the use of signal prioritization and queue jump/bypass lanes at signalized intersections. This approach allows buses the ability to continue to operate at a set pace and reduces the variation in travel times for buses over the entire route. This assists in reducing the travel time disadvantage and provides more consistent on-time performance. One of the initiatives that began in 2011 is the identification of 27 locations along US 1 and MD 193 for signal prioritization plus 7 locations for queue jump/bypasses. This is being performed as part of a Transportation Investment Generating Economic Recovery (TIGER) grant in conjunction with the Washington Metropolitan Area Transit Authority. Montgomery County is also commencing a study to identify priority corridors to implement signal prioritization or queue jumps. Corridors are being screened to determine the most beneficial locations for further study and implementation.

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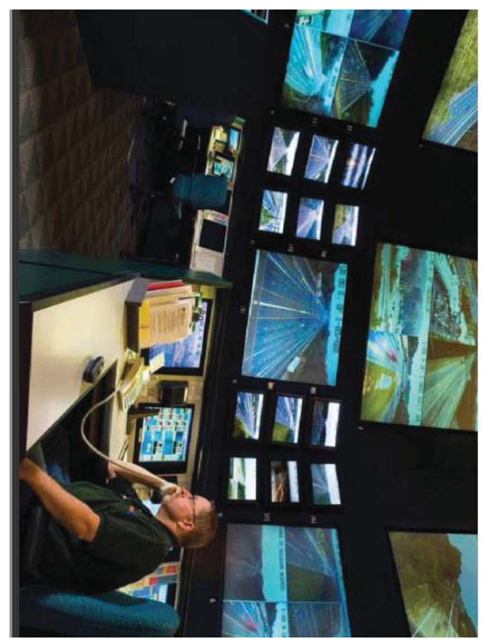
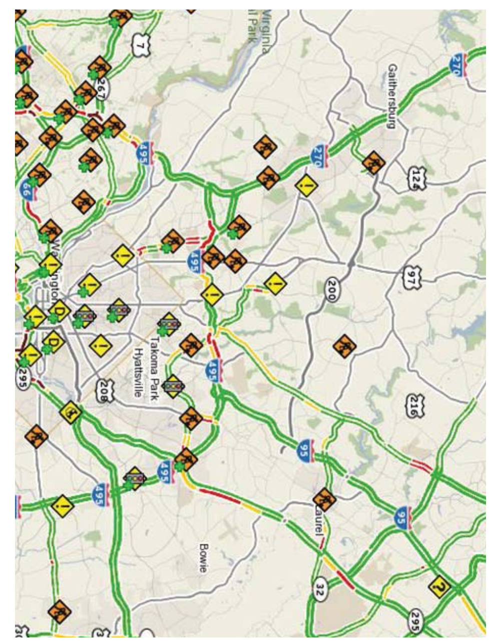
III. Incident Management & Traveler Information Systems





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III. Incident Management & Traveler Information Systems

A. Introduction

As has been observed across the nation, non-recurring congestion accounts for more than half of all congestion. Non-recurring congestion occurs due to various factors such as crashes, vehicle breakdowns, work zones, special events and weather events. The importance of avoiding crashes and providing emergency response in a timely manner is critical from both a safety and mobility standpoint. Any effort to minimize incident clearance time will not only contribute towards minimizing crash related safety impacts, but also significantly reduces the non-recurring congestion related user and agency costs in terms of travel delay, fuel consumption and emission reductions. The SHA Coordinated Highways Action Response Team (CHART) Program, a joint effort between the Maryland Department of Transportation (MDOT), the Maryland State Police (MSP) and the Maryland Transportation Authority (MDTA), seeks to improve real-time operations for Maryland's highway system through communication system integration, incident response and management, service patrols, and advanced traffic management systems. CHART's mission is to "Improve mobility and safety for the users of Maryland's highways through the application of ITS technology and interagency teamwork." CHART is involved in the following areas:

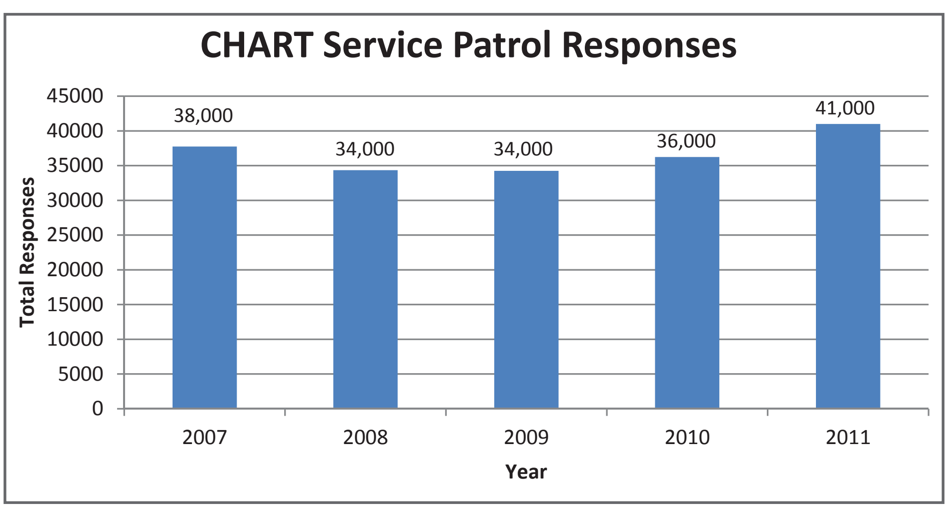
- Traveler Information
- Traffic and Roadway Monitoring
- Incident Management
- Emergency Preparedness
- Traffic Management
- Emergency Weather Operations

CHART provides services for incident management that includes improving response times and clearing incidents more quickly as well as proactively providing service patrols along major roadways. At the Statewide Operations Center (SOC) and its satellite locations, traffic is monitored through numerous intelligent transportation devices such as closed-circuit television (CCTV) cameras, speed sensors and weather stations. When an incident occurs, the necessary information is relayed to emergency service personnel tasked with responding to an incident. SHA operates emergency traffic patrols that assist drivers when their vehicle becomes disabled. With the use of various ITS technologies, travel time information is available along the major roadways to provide motorists

the anticipated travel time to a specific point ahead. With all these incident management and traveller information system initiatives, CHART has saved billions of dollars for the roadway user in terms of lost time, fuel and emissions.

B. Incident Management

The SHA CHART incident management program continues to provide safety and economic benefits for motorists and commercial traffic in Maryland. CHART remains integral to reducing overall congestion in Maryland as non-recurring congestion constitutes approximately 50% of all delays in the state. In 2011, the CHART program responded to and cleared more than 17,000 incidents and assisted more than 24,000 stranded motorists. This effort has yielded a reduction of 41.7 million vehicle-hours of incident delay which corresponds to an annual user cost savings of $1.1 billion. In addition, timely response and efficient management has also been shown to reduce secondary incidents and potential incidents. SHA recently partnered with State Farm Insurance to expand CHART's emergency traffic patrol coverage. The daily patrols are supplementing CHART's current coverage and optimizing incident response in identified

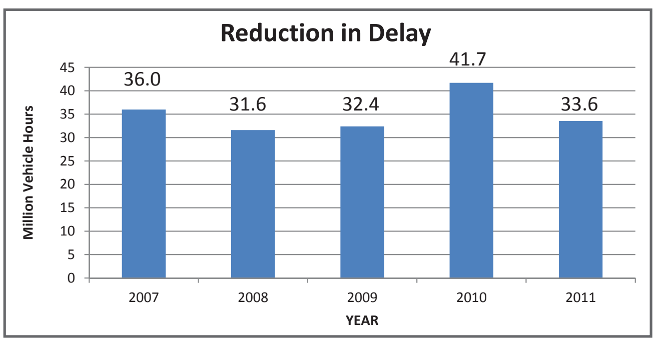


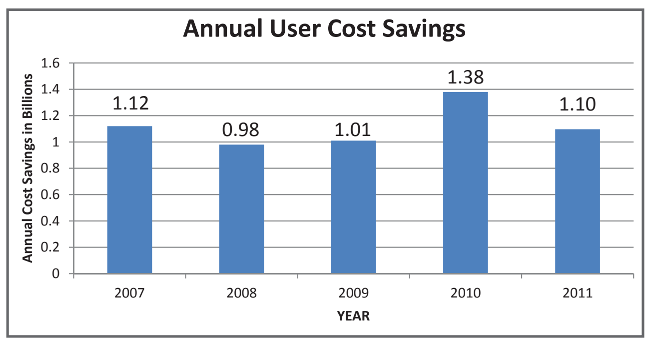
high-volume/high-incident locations. There are currently 24 full-time and 6 part-time Emergency Traffic Patrols (ETP's) in the Baltimore, Frederick and Washington metropolitan areas that offer various types of motorist assistance on the freeways.

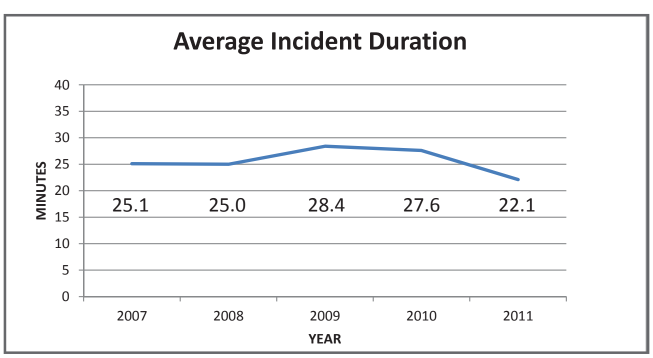
C. Incident Clearance Times

Once the traffic and roadway monitoring system has identified a problem, an immediate response is initiated to clear the incident and re-open lanes as quickly as possible, while protecting the safety of those involved in the incident, the emergency personnel responding and other travelers in the vicinity. CHART operates a nationally recognized incident management program which depends heavily on the cooperation and teamwork developed among SHA, MSP and MDTA. The tools used for incident management include:

- Emergency Traffic Patrols (ETP's) used to provide emergency motorist assistance and to clear disabled vehicles from the travel lanes.
- Emergency Response Units (ERU's) used to set up traffic control at crash locations.
- Freeway Incident Traffic Management (FITM) Trailers, pre-stocked with traffic control tools such as detour signs, cones, and trailblazer signs used to quickly set up pre-planned detour routes when incidents require full roadway closure.
- A "Clear the Road" policy which provides for the rapid removal of vehicles from the travel lanes rather than waiting for a private tow service or time consuming off-loading of disabled trucks which are blocking traffic.
- An Information Exchange Network (IEN) clearinghouse, provided by an I-95 Corridor Coalition workstation at the SOC, shares incident and traveler information to member agencies along the Corridor.







The goal is to reduce the duration of incidents and therefore the amount of delay that motorists experience. This in turn provides user cost savings to the motorists. This is shown by the graphs below which indicate that over 33 million vehicle hours are saved in delay which amounts to 1.1 billion dollars in user cost savings. Incident durations have been reduced to 22.1 minutes on average substantially assisting traffic operations. (Note 2011 data is preliminary.)

D. Intelligent Transportation Systems

The various ITS devices deployed throughout the state constitute the backbone of the CHART system. These include:

- 80+ Dynamic Message Signs
- 35+ Traveler Advisory Radios
- 200+ Speed Detectors
- 500+ CCTV Cameras which includes video feeds from other regional agencies
- 50+ Roadway Weather Information Systems

Some of the other capabilities that CHART employs are:

- Traveler Information: CCTV Camera Video Sharing with First Responders and Internet (www.traffic.md.gov)
- Traffic and Roadway Monitoring: Cell phone #77, iCCTV and Public/Private Partnerships
- Incident Management: Emergency Traffic Patrols, CHART Operations Center and Emergency Response Units
- Emergency Preparedness: Redundant Power and Communication, Decentralized Communications and Department of Transportation Emergency Operations (DOTOPs)
- Traffic Management: Special Event and Work Zone Management
- Emergency Weather Operations: Automatic Vehicle Location Fleet Management System and resource tracking system

In 2011, CHART deployed and integrated 4 new closed – circuit television (CCTV) cameras, 3 new dynamic message signs and 2 remote microwave traffic sensors. With the use of INRIX vehicle probe data, CHART is now able to post travel time information on 39 Dynamic Message Signs (DMS). MDTA also uses the CHART system to post travel time information on 8 DMS and toll rate information on another 10 DMS. As part of the effort to enhance Maryland's traveler information services, CHART deployed the Maryland 511 Travel Information System in August 2011. This system provides useful, high-quality, timely and comprehensive travel information. Maryland 511 is a multi-platform system providing information via a menu-driven, automated telephone service, internet web site, mobile web platform, and social media services.

IV. Multimodalism & Smart Growth

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A. Transit Oriented Development

One proven strategy for reducing VMT while accounting for population and job growth is to integrate dense land-uses with a multi-modal transportation system. Transit-Oriented Development (TOD) creates a destination around transit stations where residents and employees can conveniently walk, bike or take transit. This is accomplished by having a mix of civic, office, retail, and housing land-uses in conjunction with a complete transportation system.

In 2008, Governor Martin O'Malley signed legislation that created TOD designations within Maryland. This designation allows the TOD projects to get prioritization for funds and resources, financing assistance, tax credits, prioritization for the location of State offices, and support from the SHA on access improvements. Since 2008, 14 sites have been designated and one additional site is currently pending.

In addition to the TOD designation, the Maryland Department of Transportation and its sister agencies have two major new light rail lines in design, the Red Line in the Baltimore region and the Purple Line in the Washington region. Once complete, these new transit lines will provide increased accessibility and mobility for tens of thousands of Maryland residents. In addition, Montgomery County has partnered with SHA and Maryland Transit Administration (MTA) to begin planning on three new Bus Rapid Transit lines, on Veirs Mill Road, Georgia Avenue, and the Corridor Cities Transitway (CCT). The CCT will provide a connection from the end of the Red Line at Shady Grove to the future Life Science City in Gaithersburg and to Germantown.

Rendering of Proposed State Center TOD

B. Complete Streets

As the suburbs continue to urbanize, the right-of-way for transportation improvements have become restricted. In response, the SHA began the process to formalize a complete streets policy and a person throughput measure in 2011.

The Complete Streets policy strives to create a transportation system that balances all users of the roadway, including pedestrians, transit, bicyclists, and motorists. This policy will impact all divisions of SHA and how projects are developed from concepts to final design. A related effort to help create a balanced transportation system is the person throughput measure. This new measure will look at the level of service based upon the number of people that pass through an intersection as opposed to the more common number of vehicles. This would provide justification for projects that may allow fewer vehicles through the intersection in favor of a bus that may carry upwards of 40 people. With the formal adoption of the Complete Streets policy and the Person Throughput Measure and future implementation guidelines, the SHA will both be able to increase the efficiency and capacity of the network within the existing right-of-way constraints.

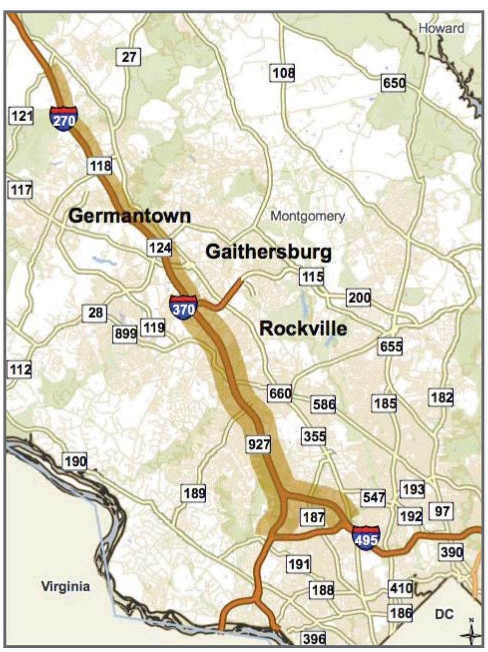
C. HOV Performance

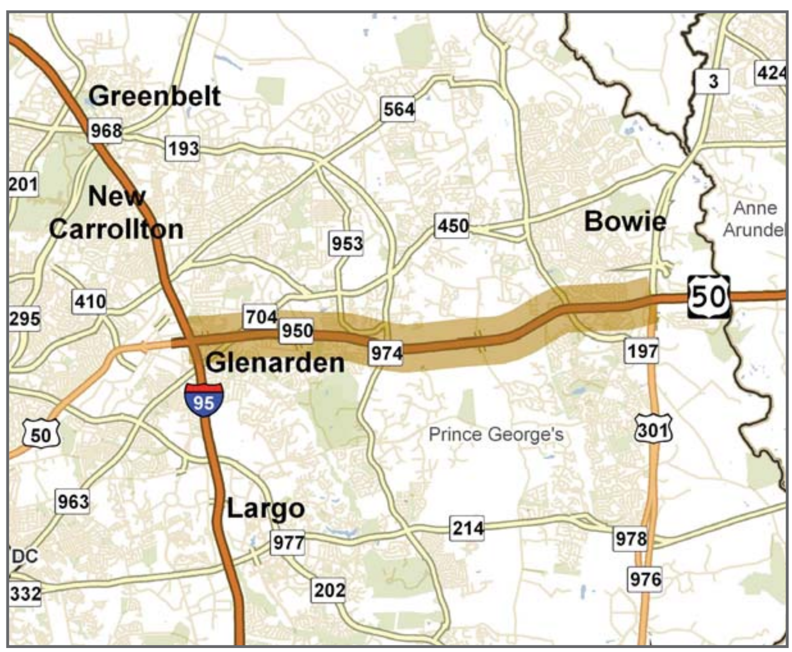
The maximization of person throughput on the highway system can be accomplished using a variety of techniques. One proven technique has been the use of High Occupancy Vehicle (HOV) lanes. HOV lanes offer a travel time savings for multiple occupant vehicles over single occupant vehicles by restricting access to vehicles that have two or more occupants.

HOV lanes are utilized on two corridors in Maryland:

- I-270 - I-495 to MD 121 (Northbound)
- I-270 - MD 117 to I-495 (Southbound)
- US 50 - US 301 to I-95

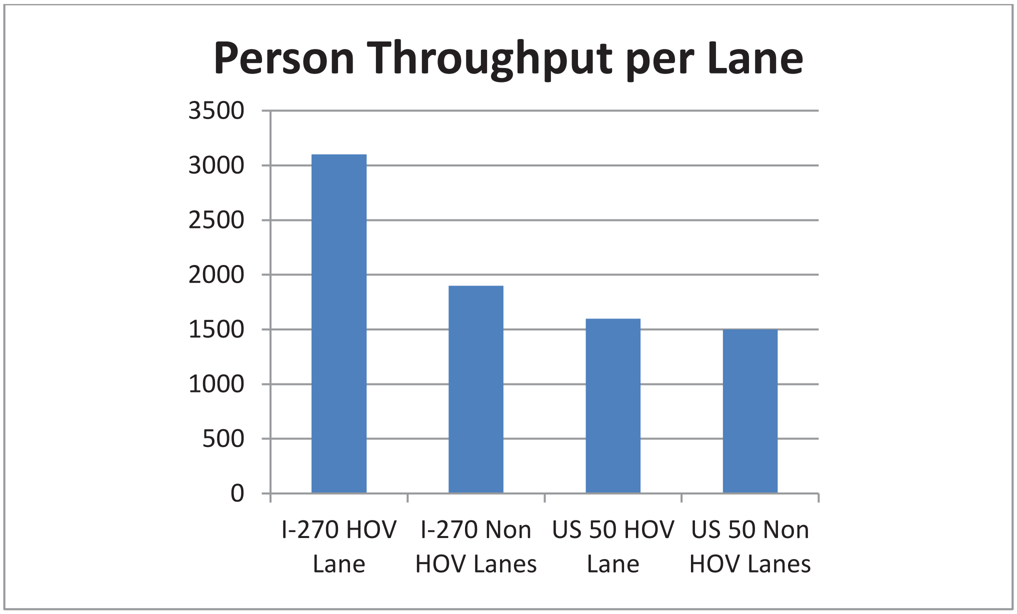
The I-270 HOV lanes operate southbound from 6:00 to 9:00 AM and northbound from 3:30 to 6:30 PM while the US 50 HOV lanes operate 24 hours-a-day. The HOV lanes are restricted to two plus occupants per vehicle. Transit vehicles, motorcycles, or plug-in hybrid vehicles are also permitted in HOV lanes (permit required). Partnered with Park and Ride lots, the HOV lanes increase the throughput within these corridors and provide a viable alternative transportation mode for commuters in Maryland.





HOV Facilities Person Throughput

HOV Lanes Versus Non HOV Lanes



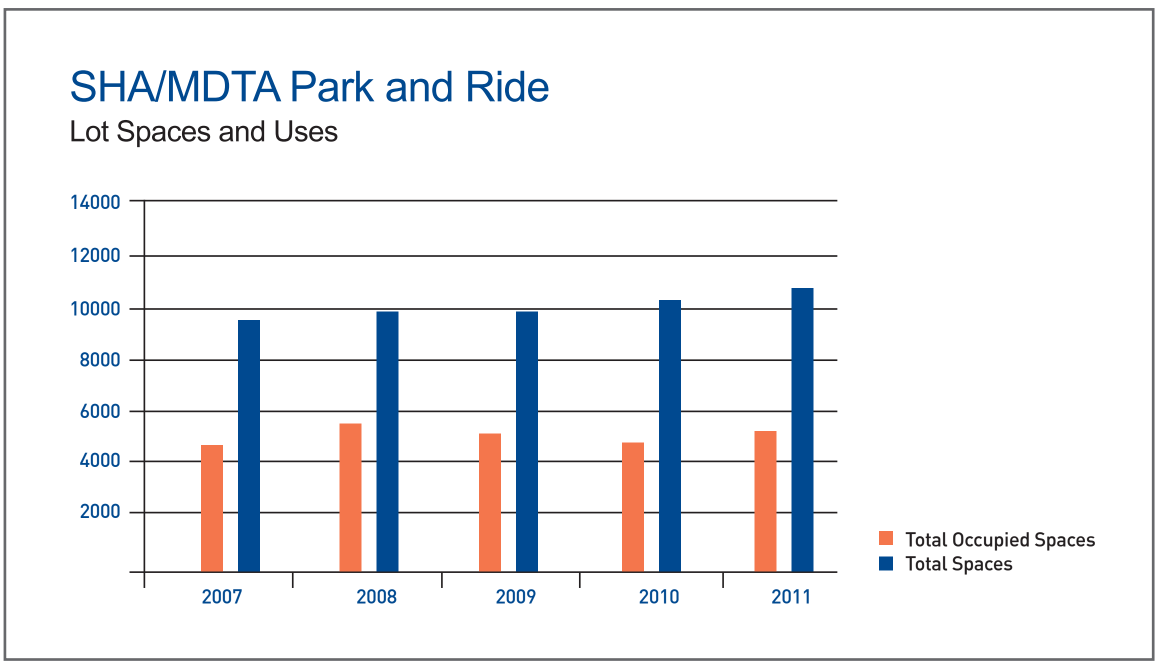
The person throughput for I-270 and US 50 is higher in the HOV lanes than the non-HOV or general purpose lanes even though the number of vehicles traversing the HOV lanes is lower.

D. Park and Ride Lots

The SHA, the Maryland Transportation Authority (MDTA) and the Maryland Transit Administration (MTA) all promote methods to reduce the number of single vehicle occupant drivers on the roadway through the use of Park and Ride lots. The SHA and MDTA operate Park and Ride lots in 20 of the 23 counties consisting of 103 designated lots with 12,510 parking spaces combined. In 2011, the SHA constructed 265 additional spaces at the following locations:

- MD 665 @ Riva Road (150 additional spaces)
- US 340 @ Mt Zion Rd (new west lot)
- US 50 @ MD 404 (new west lot)
- I-70 @ MD 65 (75 additional spaces)

The overall average usage for all the SHA/MDTA park and ride lots is approximately 60% with over 7,000 spaces that are being used.



The Washington Metropolitan Area Transit Authority (WMATA) also operates Park and Ride lots in Montgomery and Prince George's Counties which include connections to their transit services. In Montgomery County, WMATA has eight lots consisting of 13,884 spaces with an average occupancy of 82% in Fiscal Year 2011. The Grosvenor, Rockville, Glenmont, and Forest Glen lots are currently exceeding capacity. In Prince George's County, WMATA has 15 lots consisting of 24,383 spaces with an average occupancy of 75% in Fiscal Year 2011.

E. Bicycle and Pedestrian Accommodations

1. BICYCLE AND PEDESTRIAN PRIORITY AREA (BPPA)

Safe and efficient bicycle and pedestrian accommodations are important to creating a transportation network that accommodates all users of the road. These facilities become increasingly important in urban areas and at transit stations where there are significant numbers of pedestrians and cyclists. One tool available to local communities to help with the prioritization of pedestrian and bicycle improvements is to partner with the Maryland Department of Transportation and SHA on designating an area as a bicycle and pedestrian priority area. The designation allows the state, counties and municipalities to emphasize bicycle and pedestrian improvements as priority modes and requires a plan be developed in cooperation between the counties and SHA. In 2011, MDOT and SHA officially designated the White Flint Area around the Washington Metro station as the first state BPPA. In addition, in 2011, SHA has been developing the policy and the plan framework. Once the framework is complete, SHA will begin work with Montgomery County to develop the bicycle and pedestrian plan for White Flint.

2. BICYCLE LIBRARY

The SHA, through the Innovative Contracting Division, is developing a GIS database library of bikeway improvements along all state roads that are not prohibited for bicycle use. This library of roadway conditions will be stored and referenced as improvements, such as resurfacing and other capital projects, are proposed and/or implemented for each roadway. This library will allow SHA to systematically develop and implement a bicycle network as improvements are made to the roads.

The concepts include base mapping from the Bicycle Portal, and detailed investigation into the shoulder widths, posted speeds, truck volumes, existing features, roadway geometry, pedestrian generators, and other elements. The existing shoulder widths and other roadway features are compared to the current Bicycle Policy criteria to determine if bike lanes or other bicycle improvements are recommended. It shall include the identification of transition areas at intersections, entrances, and acceleration, deceleration, and bypass lanes where the existing shoulders may narrow for a certain distance.

3. BICYCLE AND PEDESTRIAN PROGRAMS

The SHA has a number of different system preservation funds dedicated for the planning, design, and construction of bicycle and pedestrian facilities. These include:

ADA Retrofit

The primary purpose of the ADA Retrofit program is to upgrade pedestrian facilities to meet ADA guidelines. ADA retrofit projects are completed at locations of existing pedestrian facilities where no other project is planned. These projects are prioritized at roadways within ½ mile radius of transit stops, public facilities, government facilities, and considering the number of pedestrian-related crashes. In Calendar Year 2011, SHA upgraded over 9.5 miles of sidewalk to ADA compliance through program expenditures of $8.3 million for engineering and construction.

Pedestrian Access to Transit

The primary purpose of this fund is to provide safe, ADA-compliant access for pedestrians to public transportation along state roadways where there are no other projects in development. SHA collaborates with the MTA and other local and regional transit agencies, as well as local jurisdictions, to identify and prioritize needed improvements. Improvements are also prioritized based on pedestrian related crash data in the vicinity of transit stops and from requests by citizens, local jurisdictions, and elected officials. The program focuses funding within one-half mile of an existing transit hub, or within a master-planned transit-oriented development. In Calendar Year 2011, SHA upgraded 78 bus stops to ADA compliance and upgraded or constructed over 4 miles of sidewalk through program expenditures of $4.3 million for engineering and construction.

Sidewalk Retrofit

The Sidewalk Retrofit program advances the SHA's vision of multi-modal transportation by providing pedestrian facilities and enhancing access along urban state routes in existing communities as viable and safe modes of transportation. The goals of this program are improving mobility for the general population and persons with disabilities, reducing existing or potential public safety risks, and removing barriers that impede the free movement of citizens. While these projects generally consist of new sidewalks constructed as part of a request from the local government, they may also be constructed due to high incidences of pedestrian related crashes at a location.

Bicycle Retrofit

The Bicycle Retrofit program ensures bicycling remains a viable transportation option by identifying projects along state roadways that will enhance bicycle mobility and safety while having little or no environmental or private property (right-of-way) impacts. These improvements may include simple enhancements to safety such as signing and marking corridors for bicycle access, restriping wide curb lanes or shoulders as bike lanes, repurposing existing lanes to provide accommodations for bicyclists, or creating new off-road bike trails parallel to a roadway.

V. Freight

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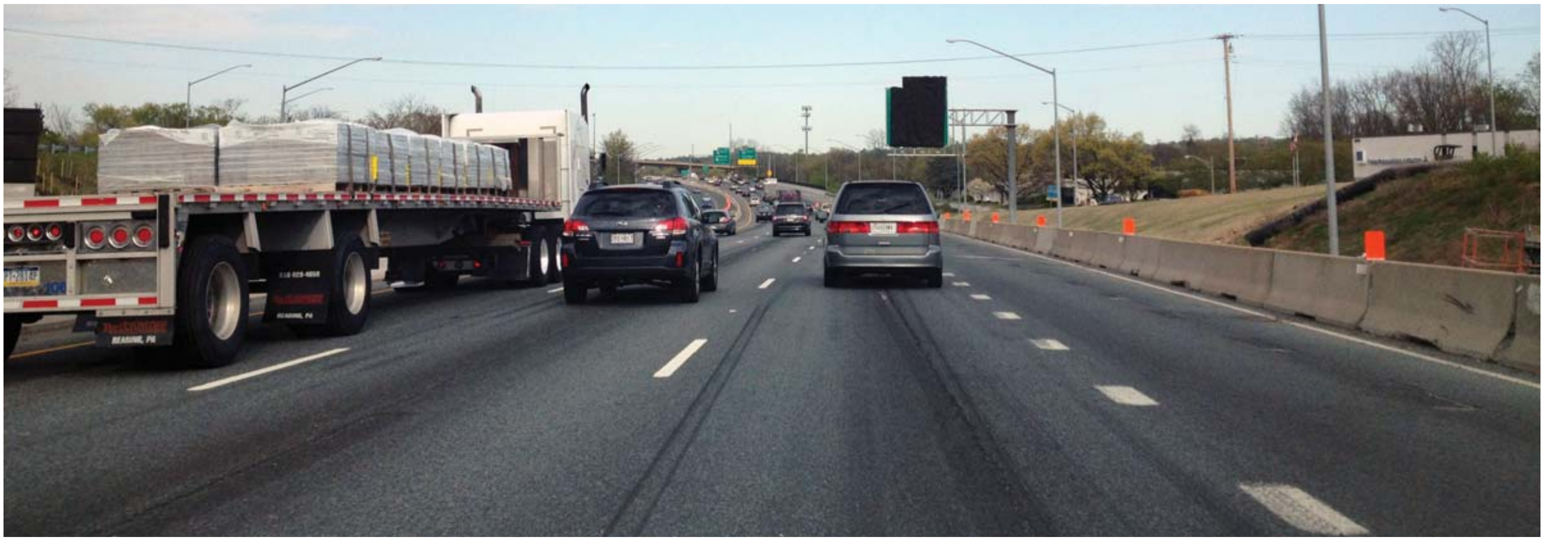

A. Introduction

Maryland's economy continues to be vibrant. It provides a diverse set of economic strengths ranging from its many different sectors to the high education of its residents. In order to accommodate the economic health of the state, the movement of goods and services plays a vital role. This directly relates to the transportation system including the port, rail system and air cargo airports. With freight activity anticipated to more than double by 2035, Maryland is working with railroad partners to address concerns in the infrastructure including aging assets, landside capacity issues and choke points. These choke points include locations where double decker trains cannot travel due to tunnel restrictions.

MARYLAND FREIGHT NETWORK COVERAGE

Ultimately, the key component in the movement of freight is the roadway network. Freight movement is estimated to be over 380 billion dollars in value accounting for over 340 million tons that primarily move through the highway system from major intermodal freight connections like the Port of Baltimore, the Dundalk Marine Terminal, Seagirt Marine Terminal, BWI Thurgood Marshall Airport and other regional distribution centers. For example, approximately 85% of the freight that enters the port departs on trucks to reach their final destination. In addition to the movement of goods in or around Maryland, its position as a “through” state especially related to the key corridors of I-95 and I-81 will continue to require that freight congestion be minimized. To facilitate optimal freight movement in Maryland certain federal and state highway have been designated as the Maryland Truck Route System. The Maryland Truck Route System is approximately 900 miles long and includes all Interstates (481 miles) six segments of U.S. Routes (320 miles) and 8 segments of Maryland state routes (99 miles).

In 2011, the SHA and MDTA initiated the development of a Freight Implementation Plan that will serve as a guide for planning and project development and to provide direction for future transportation investments to enhance the safe and efficient movement of commercial vehicle freight.

B. Freight Performance Indicators

The American Transportation Research Institute (ATRI) and the Federal Highway Administration (FHWA) Office of Freight Management and Operations monitor freight significant highways as part of the Freight Performance Measures (FPM) initiative. A central aspect of these monitoring activities is the identification and quantification of major chokepoints and bottlenecks along highways that are critical to the nation’s freight transportation system. Following is the list of Maryland interstate locations that were identified in the freight bottleneck list based on truck travel related GPS data during weekdays in 2010.

TOP 5 FREIGHT BOTTLENECKS ON INTERSTATE SYSTEM IN MARYLAND

National Congestion Ranking	Location Description	Peak Average Speed	Non-Peak Average Speed	Non-Peak/Peak Ratio
51	I-95 at I-495 (North), Washington, DC	38	53	1.41
56	I-495 at I-270 (East)	31	51	1.63
78	I-95 at I-695 (South), Baltimore	48	54	1.13
91	I-95 at I-395, Baltimore	48	52	1.08
100	I-95 at I-695 (North), Baltimore	47	55	1.15

Source: FHWA - Office of Freight Management and Operations and ATRI FPM Initiative

VI. Regionally Significant Corridor Performance

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VI. Regionally Significant Corridor Performance

In addition to statewide and regional congestion and reliability reporting, summary reports on these measures are provided for the following “key corridors”:

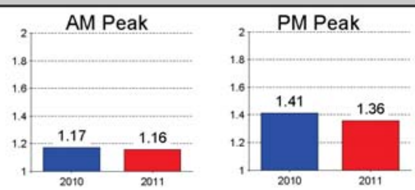
- I-495 Capital Beltway
- I-695 Baltimore Beltway
- I-95 (Capital Beltway to I-695 North)
- I-95 (I-695 North to Delaware State Line)
- I-70
- I-270
- US-50 (D.C line to William Preston Lane (Bay Bridge))
- MD-295
- I-97
- I-81
- I-83
- I-795
- I-895

It should be noted that the list of bottlenecks for each roadway is based upon a drop in speed over the free flow speed. The bottlenecks are based on congestion causing this except for a few sections of I-70 where geometric constraints (e.g. vertical grades) and at the Fort McHenry Tunnel (I-95), Harbor Tunnel (I-895) and the William Preston Lane Bridge (US 50) (toll plazas) are the basis for the change in speeds. Further refinement is anticipated in the future for these sections.

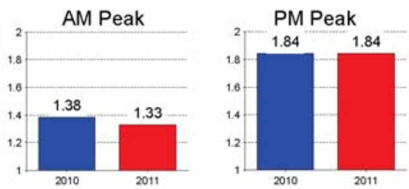
495 Capital Beltway

Trends[a]

Travel Time Index[b]
measure of average delay

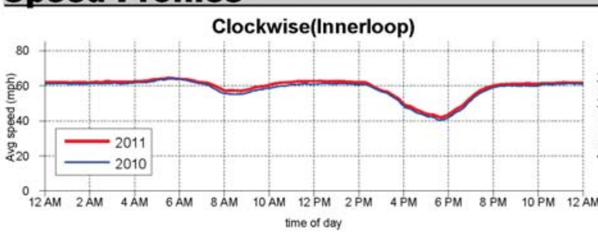


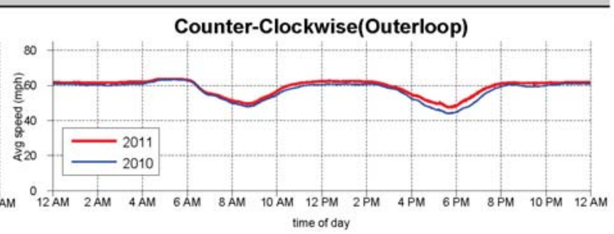
Planning Time Index[c]
measure of worst-case delay



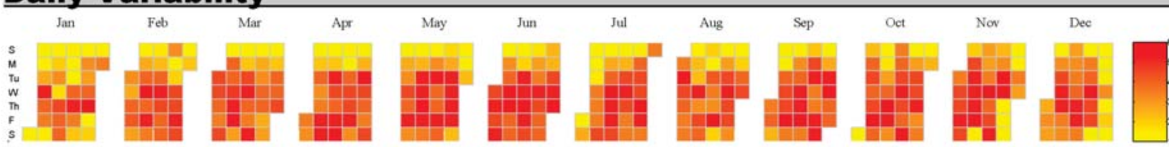
42 center miles carrying 183,000 vehicles every day

Speed Profiles[d]





Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
3	I-495 CW @ I-270 Spur	Innerloop	273	228	230	194	114	6.2	6.5	5	-2
18	I-495 CW @ MD-450/Annapolis Rd/Exit 20	Innerloop	85	102	79	90	92	7.5	2.1	24	-6
20	I-495 CW @ MD-4/Pennsylvania Ave/Exit 11	Innerloop	45	38	110	65	99	11.0	2.1	41	-21
21	I-495 CCW @ MD-185/Connecticut Ave/Exit 33	Outerloop	66	79	86	62	120	6.3	2.0	18	3
23	I-495 CW @ Exit 27	Innerloop	95	126	91	63	108	5.5	1.9	19	4
25	I-495 CCW @ MD-97/Georgia Ave/Exit 31	Outerloop	95	137	117	209	93	3.8	1.7	35	-10
30	I-495 CW @ MD-202/Landover Rd/Exit 17	Innerloop	36	51	56	59	94	8.7	1.5	28	2
36	I-495 CW @ MD-650/New Hampshire Ave/Exit28	Innerloop	80	63	85	62	109	4.6	1.4	25	11
37	I-495 CCW @ Greenbelt Metro Dr/Exit 24	Outerloop	60	68	58	65	95	6.5	1.3	40	-3
40	I-495 CCW @ I-270/Exit 35	Outerloop	73	45	75	78	95	5.6	1.3	23	17

Notes

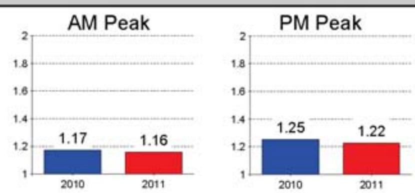
a - **Peak Hours** are considered as 8-9am and 5-6pm..
b - **Travel Time Index** (TTI) is the ratio of the *average* travel time during the peak hour to the time required under free flow.
c - **Planning Time Index** (PTI) is the ratio of the *worst-case* travel time (95th percentile) during peak hour to the free-flow time.
d - Typical work day speeds, calulcuated as the average speed of all weekdays for the entire year and shows it as varies by time-of-day.
e- Variability of worst-case travel experience along facility for each day of year, shown as plot of PTI by day of week and month, showing seasonal and weekly trends.
f - Top 10 bottlenecks on the facility, ranked by impact factor.
Impact factor is multiplication of total annual number of bottleneck occurences by their average duration and by their average length.
Bottlenecks are said to occur when speeds drop below 60% of free-flow speed for a period longer than 5 minutes.
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

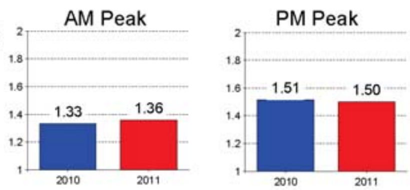
Baltimore Beltway

Trends[a]

Travel Time Index[b]
measure of average delay

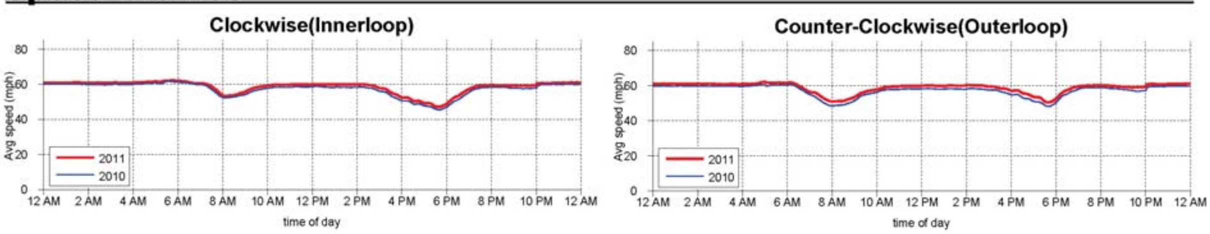


Planning Time Index[c]
measure of worst-case delay

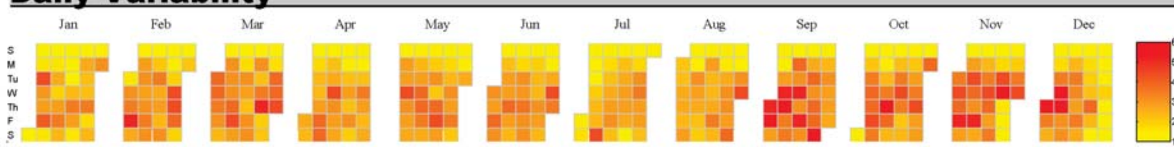


53 center miles carrying 127,000 vehicles every day

Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
2	I-695 CW @ MD-26/Exit 18	Innerloop	143	180	248	196	120.5	7.7	6.6	7	-5
6	I-695 CW @ MD-147/Harford Rd/Exit 31	Innerloop	94	92	81	102	142.0	10.5	4.8	9	-3
10	I-695 CCW @ Edmondson Ave/Exit 14	Outerloop	92	127	132	134	105.8	6.1	2.9	17	-7
15	I-695 CCW @ MD-144/Frederick Rd/Exit 13	Outerloop	24	98	36	135	95.5	10.7	2.2	132	-117
27	I-695 CW @ MD-41/Perring Pkwy/Exit 30	Innerloop	84	102	80	58	84.0	6.9	1.6	14	13
28	I-695 CCW @ US-1/Southwestern Blvd/Exit 12	Outerloop	110	3	79	85	53.3	12.2	1.6	8	20
32	I-695 CCW @ MD-139/Charles St/Exit 25	Outerloop	132	195	204	151	65.8	3.9	1.5	38	-6
45	I-695 CW @ I-83/MD-25/Exit 23	Innerloop	97	106	97	79	71.5	4.9	1.2	47	-2
75	I-695 CW @ MD-43/Whitemarsh Blvd/Exit 31	Innerloop	102	42	30	114	58.3	10.0	0.7	90	-15
82	I-695 CW @ Security Blvd/Exit 17	Innerloop	58	84	25	25	78.8	4.5	0.7	154	-72

Notes

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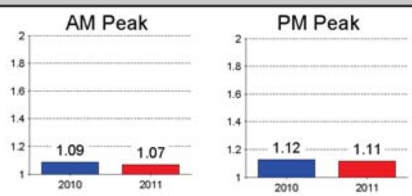
b - **Travel Time Index** (TTI) is the ratio of the *average* travel time during the peak hour to the time required under free flow.
c - **Planning Time Index** (PTI) is the ratio of the *worst-case* travel time (95th percentile) during peak hour to the free-flow time.
d - Typical work day speeds, calulcuated as the average speed of all weekdays for the entire year and shows it as varies by time-of-day.
e- Variability of worst-case travel experience along facility for each day of year, shown as plot of PTI by day of week and month, showing seasonal and weekly trends.
f - Top 10 bottlenecks on the facility, ranked by impact factor.
Impact factor is multiplication of total annual number of bottleneck occurences by their average duration and by their average length.
Bottlenecks are said to occur when speeds drop below 60% of free-flow speed for a period longer than 5 minutes.
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

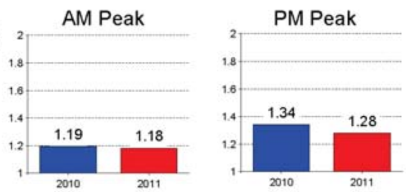
I-95 (Part 1)

Trends[a]

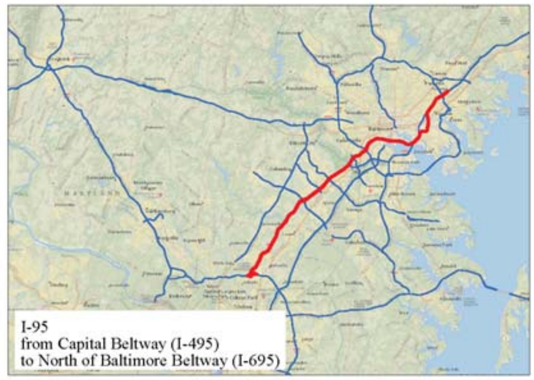
Travel Time Index[b]
measure of average delay



Planning Time Index[c]
measure of worst-case delay

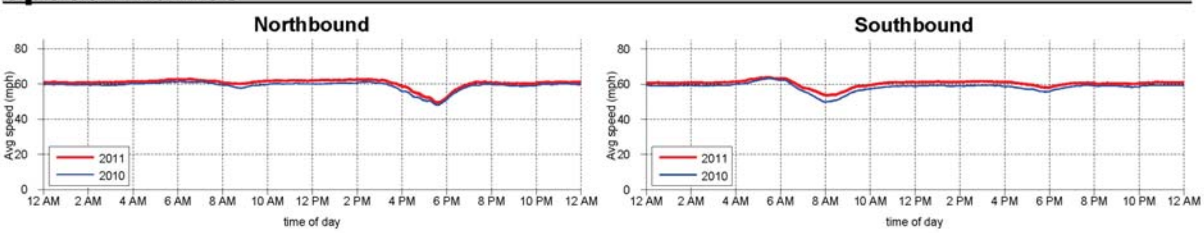


41 center miles carrying 155,000 vehicles every day

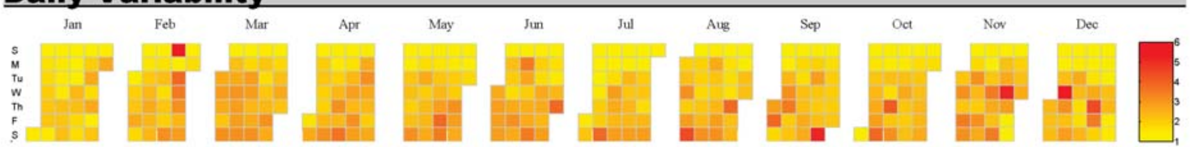


Operated by MDTA from I-695 South to I-695 North

Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
8	I-95 N @ MD-100/Exit 43	Northbound	77	126	109	110	113.8	7.1	3.2	21	↓ -13
9	I-95 S @ I-495/Exit 27-25	Southbound	149	180	178	181	96.8	6.1	2.9	10	↓ -1
51	I-95 S @ I-895/62nd St/Exit 62	Southbound	66	113	187	77	60.8	6.7	1.0	66	↓ -15
56	I-95 N @ MD-198/Exit 33	Northbound	53	55	88	29	81.8	5.3	0.9	53	↑ 3
61	I-95 S @ Fort McHenry Tunnel	Southbound	933	97	93	73	36.3	3.1	0.8	26	↑ 35
67	I-95 E @ I-95 (Baltimore) (East)	Eastbound	184	522	510	574	24.8	1.7	0.8	137	↓ -70
89	I-95 N @ I-695/Exit 64	Northbound	52	33	113	63	66.0	4.2	0.6	75	↑ 14
99	I-95 N @ Keith Ave/Exit 56	Northbound	48	571	533	740	22.8	1.1	0.5	502	↓ -403
100	I-95 N @ I-695/Exit 49	Northbound	30	32	34	53	60.8	6.5	0.5	44	↑ 56
102	I-95 N @ Fort McHenry Tunnel Toll Plaza	Northbound	0	539	531	482	20.3	1.5	0.5	763	↓ -661

Notes

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c - **Planning Time Index** (PTI) is the ratio of the *worst-case* travel time (95th percentile) during peak hour to the free-flow time.
d - Typical work day speeds, calulcuated as the average speed of all weekdays for the entire year and shows it as varies by time-of-day.
e- Variability of worst-case travel experience along facility for each day of year, shown as plot of PTI by day of week and month, showing seasonal and weekly trends.
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Bottlenecks are said to occur when speeds drop below 60% of free-flow speed for a period longer than 5 minutes.
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

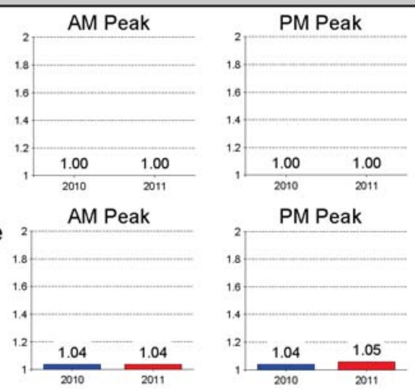
Based on speed data from INRIX and volume data from State Highway Administration

I-95 (Part 2)

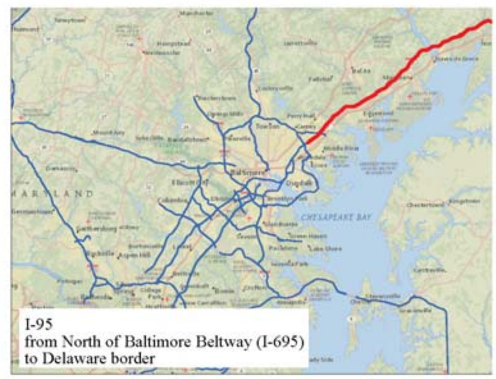
Trends[a]

Travel Time Index[b]
measure of average delay

Planning Time Index[c]
measure of worst-case delay

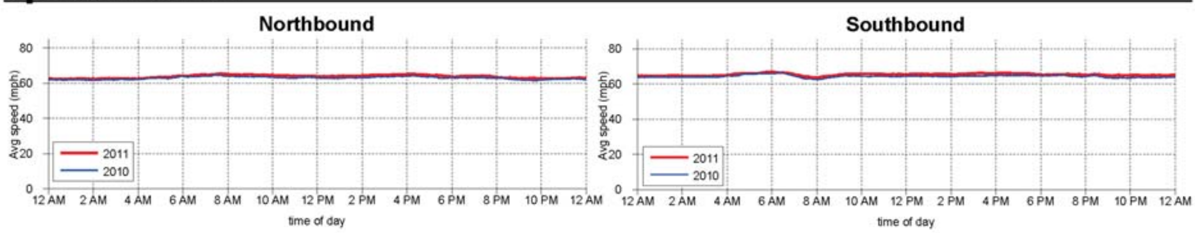


45 center miles carrying 105,000 vehicles every day

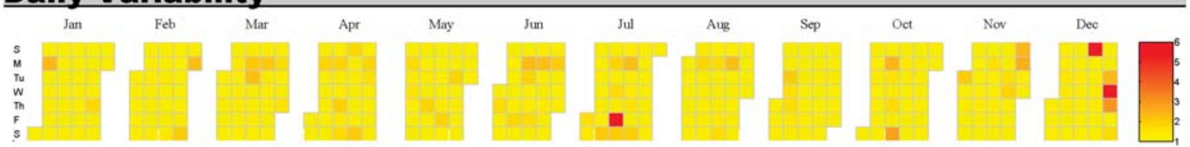


Operated by MDTA

Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
11	I-95 N @ MD-43/Whitemarsh Blvd/Exit 67	Northbound	48	64	68	62	128.8	9.1	2.7	31	-20
14	I-95 S @ MD-24/Exit 77	Southbound	18	47	61	67	117.0	13.2	2.4	42	-28
98	I-95 N @ MD-152/Exit 74	Northbound	10	17	20	11	73.5	12.1	0.5	100	-2
103	I-95 N @ Tydings Memorial Brg Toll Plaza	Northbound	44	117	120	126	28.3	7.8	0.5	105	-2
121	I-95 S @ MD-155/Exit 89	Southbound	13	25	25	80	50.5	4.9	0.4	206	-85
152	I-95 S @ MD-543/Exit 80	Southbound	13	15	26	5	54.3	18.3	0.3	397	-245
167	I-95 S @ Maryland House	Southbound	14	13	23	9	61.8	10.0	0.3	444	-277
183	I-95 N @ MD-279/Exit 109	Northbound	17	6	23	3	39.7	14.8	0.2	374	-191
205	I-95 N @ MD-24/Exit 77	Northbound	26	58	47	87	43.3	2.5	0.2	130	75
207	I-95 N @ MD-22/Exit 85	Northbound	7	14	26	17	68.3	5.4	0.2	255	-48

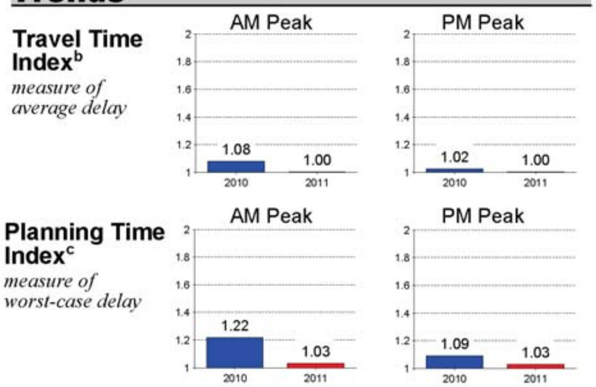
Notes

a - **Peak Hours** are considered as 8-9am and 5-6pm..
b - **Travel Time Index** (TTI) is the ratio of the *average* travel time during the peak hour to the time required under free flow.
c - **Planning Time Index** (PTI) is the ratio of the *worst-case* travel time (95th percentile) during peak hour to the free-flow time.
d - Typical work day speeds, calulcuated as the average speed of all weekdays for the entire year and shows it as varies by time-of-day.
e- Variability of worst-case travel experience along facility for each day of year, shown as plot of PTI by day of week and month, showing seasonal and weekly trends.
f - Top 10 bottlenecks on the facility, ranked by impact factor.
Impact factor is multiplication of total annual number of bottleneck occurences by their average duration and by their average length.
Bottlenecks are said to occur when speeds drop below 60% of free-flow speed for a period longer than 5 minutes.
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

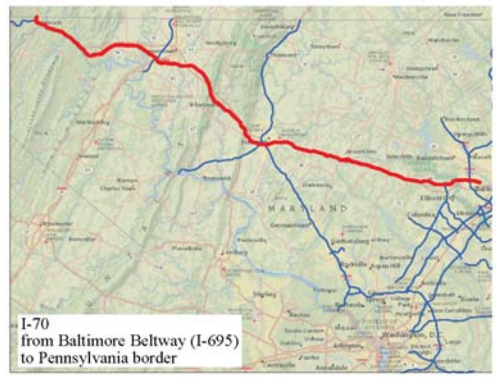
Based on speed data from INRIX and volume data from State Highway Administration

I-70

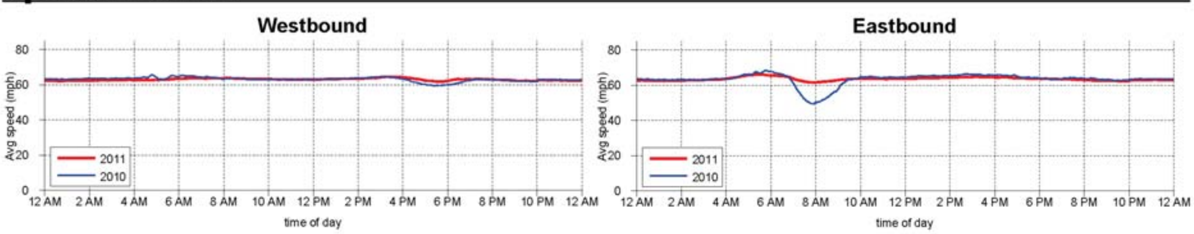
Trends[a]



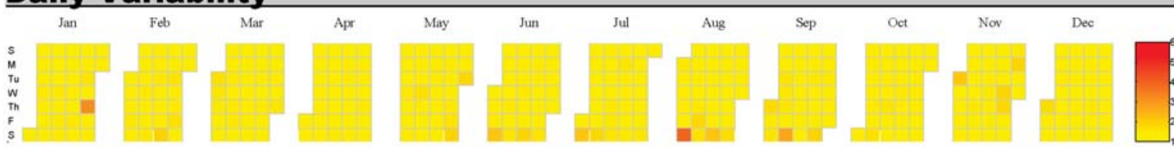
91 center miles carrying 54,000 vehicles every day



Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
50	I-70 E @ US-29/Exit 87	Eastbound	78	66	124	103	58.5	5.9	1.0	60	-10
70	I-70 E @ I-695/Exit 91	Eastbound	151	131	115	117	43.5	3.6	0.7	61	9
96	I-70 W @ US-29/Exit 87	Westbound	74	84	86	77	89.8	2.0	0.5	136	-40
116	I-70 W @ MD-632/Downsville Pike/Exit 28	Westbound	16	23	39	19	67.5	7.2	0.4	256	-140
127	I-70 E @ MD-17/Exit 42	Eastbound	37	16	31	35	60.3	6.1	0.4	435	-308
128	I-70 W @ MD-66/Exit 35	Westbound	23	30	39	19	61.5	8.4	0.4	220	-92
158	I-70 E @ Frederick/Washington Co Line	Eastbound	38	85	130	159	23.8	4.4	0.3	798	-640
168	I-70 W @ US-15/US-340/Exit 52	Westbound	43	57	55	33	83.5	2.4	0.3	243	-75
178	I-70 W @ Frederick/Washington Co Line	Westbound	16	35	28	45	35.3	12.0	0.2	784	-606
208	I-70 W @ MD-17/Exit 42	Westbound	14	14	21	5	54.0	7.7	0.2	468	-260

Notes

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Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

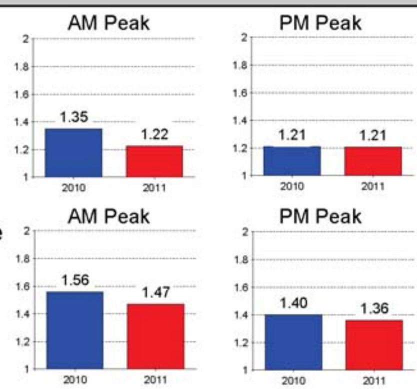
Based on speed data from INRIX and volume data from State Highway Administration

I-270

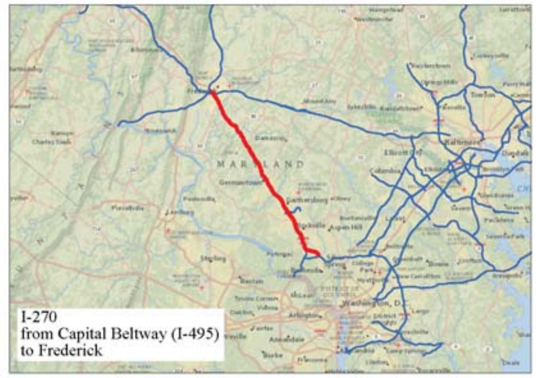
Trends[a]

Travel Time Index[b]
measure of average delay

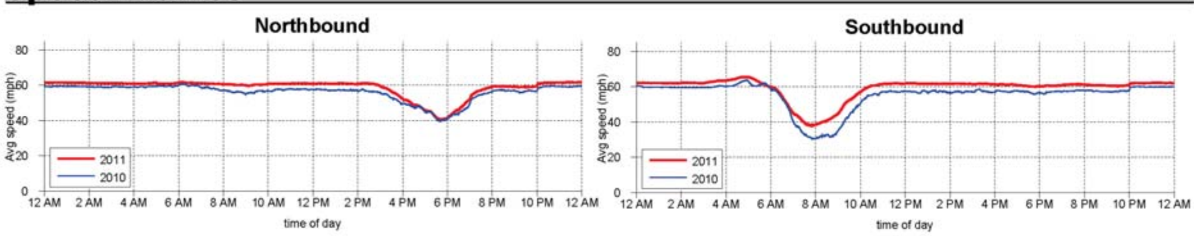
Planning Time Index[c]
measure of worst-case delay



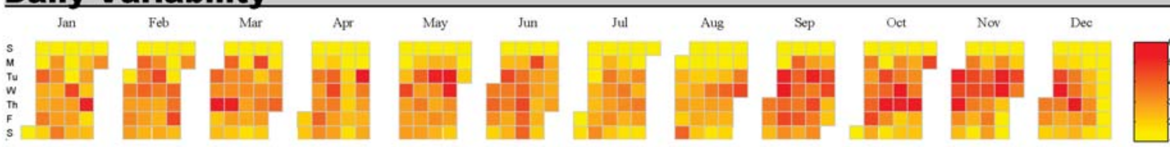
41 center miles carrying 171,000 vehicles every day



Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
5	I-270 N @ MD-80/Exit 26	Northbound	86	120	194	172	102.0	10.9	5.4	77	-72
7	I-270 Spur S @ I-270	Southbound	137	177	128	150	64.8	11.6	3.5	232	-225
12	I-270 S @ I-495/MD-355	Southbound	144	142	164	159	89.3	6.3	2.7	11	1
13	I-270 N @ I-70/US-40	Northbound	117	105	95	122	75.5	10.1	2.5	39	-26
16	I-270 S @ MD-109/Exit 22	Southbound	145	159	144	103	80.8	5.2	2.2	96	-80
22	I-270 N @ MD-109/Exit 22	Northbound	68	82	73	60	81.8	10.4	1.9	68	-46
26	I-270 N @ MD-85/Exit 31	Northbound	30	25	41	33	107.5	12.6	1.7	109	-83
31	I-270 S @ Montrose Rd	Southbound	88	51	0	0	79.0	13.7	1.5	285	-254
35	I-270 N @ MD-117/Exit 10	Northbound	0	75	0	114	96.5	8.4	1.4		
44	I-270 N @ Middlebrook Rd/Exit 13	Northbound	89	47	51	89	93.8	5.7	1.2	116	-72

Notes

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Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

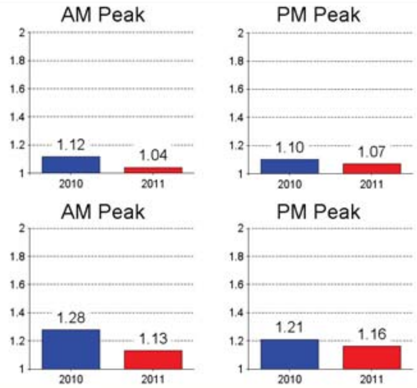
Based on speed data from INRIX and volume data from State Highway Administration

50 US-50

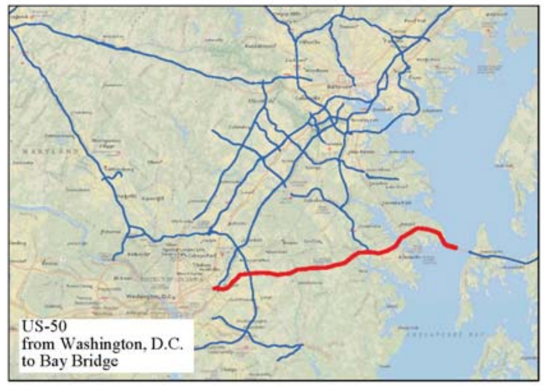
Trends[a]

Travel Time Index[b]
measure of average delay

Planning Time Index[c]
measure of worst-case delay

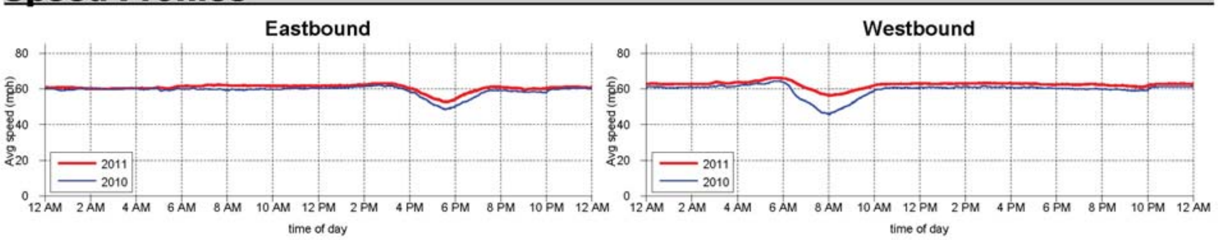


38 miles carrying 97,000 vehicles every day

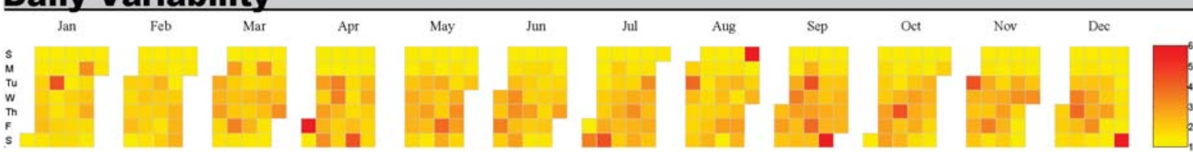


William Preston Lane (Bay Bridge) operated by MDTA

Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
19	US-50 W @ MD-295/Baltimore Washington Pkwy	Westbound	108	107	118	85	99.8	5.9	2.1	52	-33
53	US-50 W @ William Preston Lane Brg	Westbound	19	72	108	24	47.5	8.7	1.0	371	-318
62	US-50 E @ Severn River Bridge	Eastbound	53	90	80	67	101.0	3.1	0.8	201	-139

Notes

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Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

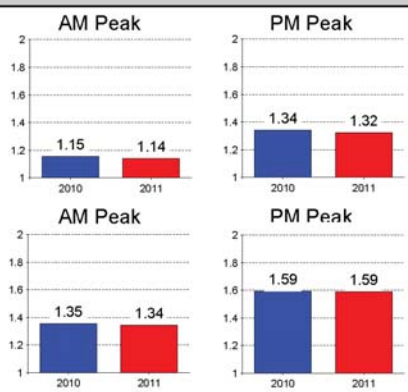
MD-295

MARYLAND 295

Trends[a]

Travel Time Index[b]
measure of average delay

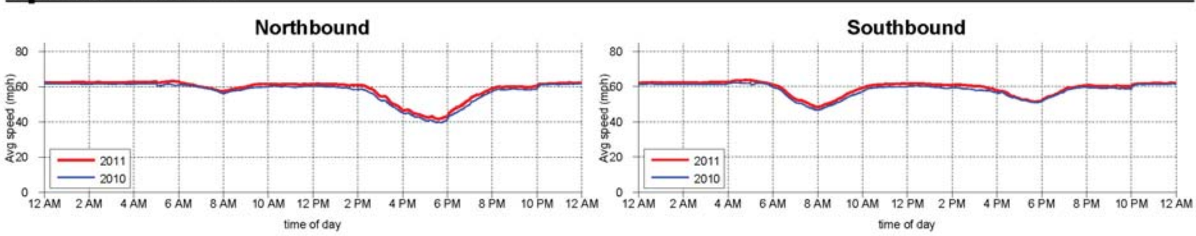
Planning Time Index[c]
measure of worst-case delay



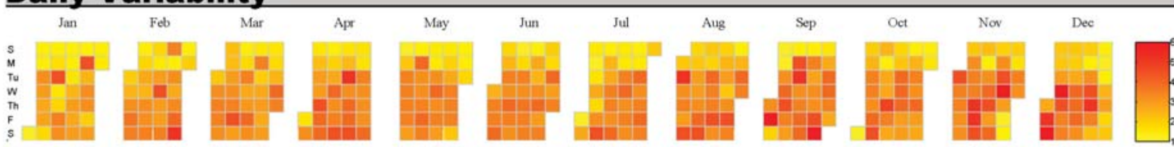
30 center miles carrying 95,000 vehicles every day

Operated by NPS from Washington DC line to MD 175

Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
1	MD-295 N @ MD-175	Northbound	108	112	156	119	156.5	10.3	7.2	6	-5
4	MD-295 N @ MD-197/Exit 11	Northbound	163	112	108	128	175.5	7.6	6.2	4	0
17	MD-295 S @ MD-193	Southbound	82	95	102	134	84.0	7.4	2.1	37	-20
24	MD-295 S @ Powder Mill Rd	Southbound	115	143	139	118	80.5	4.3	1.7	29	-5
29	MD-295 N @ I-695	Northbound	97	125	105	88	90.8	6.0	1.5	30	-1
33	MD-295 S @ MD-32	Southbound	113	113	145	80	127.3	2.5	1.4	178	-145
38	MD-295 N @ Canine Rd	Northbound	53	78	61	47	85.0	6.9	1.3	33	5
46	MD-295 N @ MD-198	Northbound	42	57	59	53	89.0	6.4	1.1	69	-23
48	MD-295 N @ Powder Mill Rd	Northbound	93	134	136	103	67.8	3.6	1.1	76	-28
60	MD-295 S @ MD-198	Southbound	104	102	115	81	76.5	3.1	0.8	70	-10

Notes

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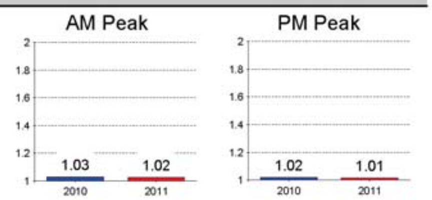
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

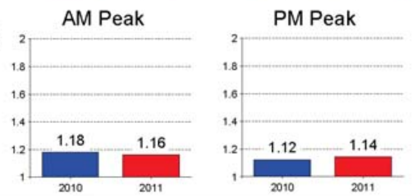
I-97

Trends[a]

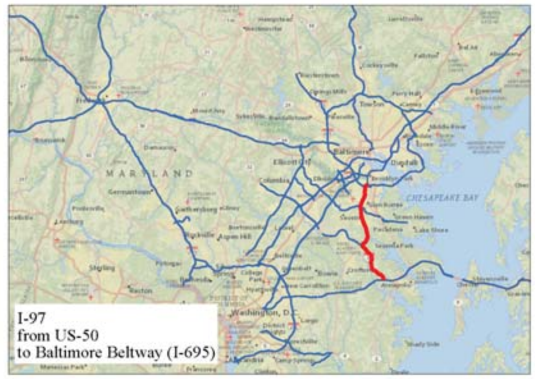
Travel Time Index[b]
measure of average delay



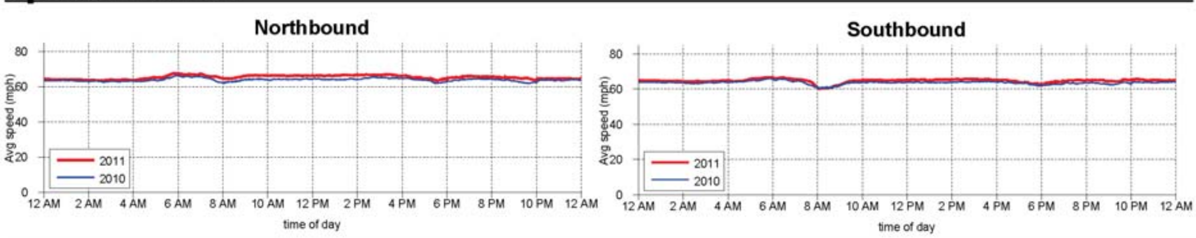
Planning Time Index[c]
measure of worst-case delay



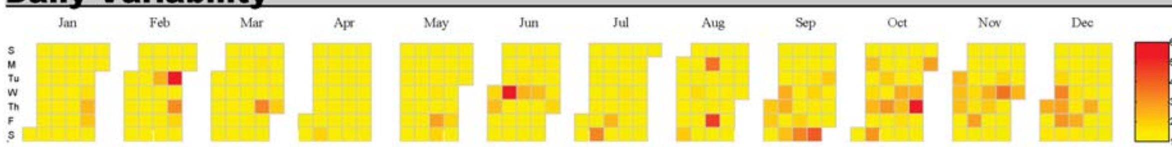
18 center miles carrying 104,000 vehicles every day



Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
78	I-97 S @ US-301/US-50	Southbound	13	31	34	33	76.3	8.2	0.7	262	-184
151	I-97 S @ MD-178/Exit 5	Southbound	51	108	79	99	45.0	2.4	0.3	480	-329
162	I-97 N @ I-695/Exit 17	Northbound	36	112	261	176	31.3	1.6	0.3	359	-197
236	I-97 N @ MD-178/Exit 5	Northbound	15	34	51	20	29.8	4.6	0.1	419	-183
295	I-97 S @ MD-3/Exit 7	Southbound	38	25	14	14	39.3	3.2	0.1	168	127
373	I-97 N @ Benfield Blvd/Exit 10	Northbound	15	5	7	3	64.0	5.3	0.1	616	-243
406	I-97 N @ MD-32/Exit 7	Northbound	8	1	7	8	46.8	6.0	0.0	649	-243
437	I-97 N @ MD-3 Bus/New Cut Rd/Exit 12	Northbound	19	7	15	18	28.0	2.9	0.0	529	-92
462	I-97 N @ I-895 Spur	Northbound	16	4	2	4	44.3	4.2	0.0	335	127
536	I-97 N @ MD-174/Quarterfield Rd/Exit 13	Northbound	15	3	13	6	30.8	2.5	0.0	456	80

Notes

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Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

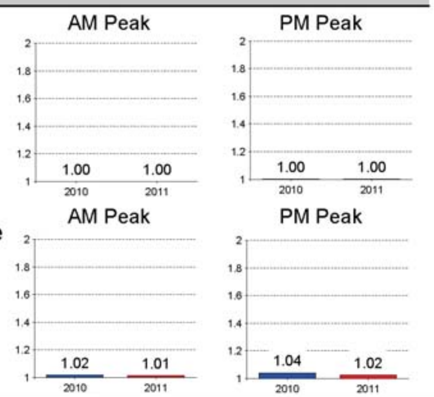
Based on speed data from INRIX and volume data from State Highway Administration

I-81

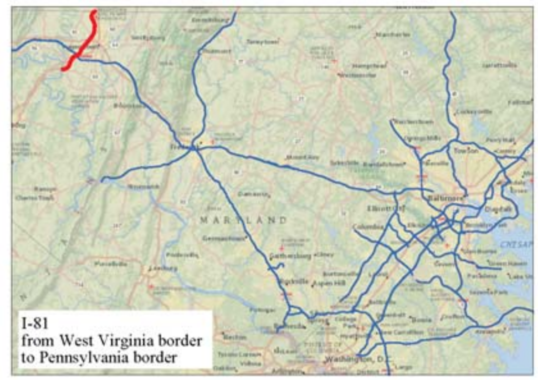
Trends[a]

Travel Time Index[b]
measure of average delay

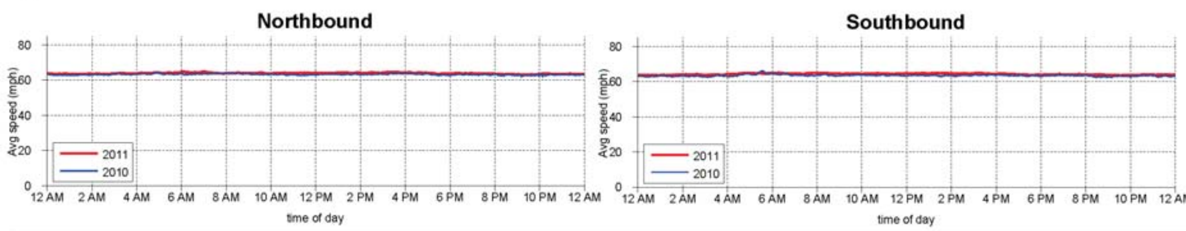
Planning Time Index[c]
measure of worst-case delay



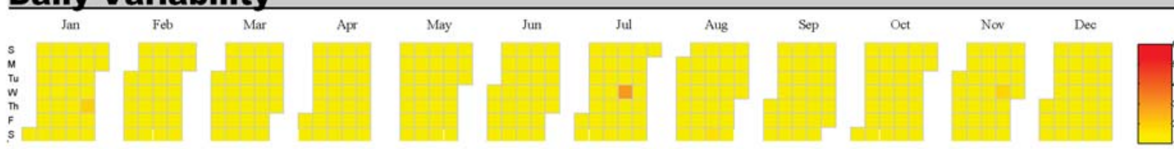
12 center miles carrying 59,000 vehicles every day



Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
424	I-81 N @ US-40/Exit 6	Northbound	9	13	4	7	47.8	2.9	0.0	850	-426
502	I-81 S @ Halfway Blvd/Exit 5	Southbound	11	8	8	10	32.0	2.7	0.0	777	-275
542	I-81 N @ MD-58/Exit 7	Northbound	8	4	4	4	39.5	5.1	0.0	893	-351
571	I-81 S @ Maugansville Rd/Exit 8	Southbound	13	6	1	1	28.0	2.5	0.0	960	-389
586	I-81 N @ Maugans Ave/Exit 9	Northbound	6	5	4	2	32.8	2.7	0.0	867	-281
618	I-81 N @ I-70/Exit 3	Northbound	14	4	7	0	28.0	1.7	0.0	907	-289
625	I-81 S @ US-11/Exit 2	Southbound	11	2	3	0	40.0	3.4	0.0	994	-369
637	I-81 N @ Maugansville Rd/Exit 8	Northbound	15	6	4	1	44.0	3.3	0.0	1001	-364
645	I-81 S @ US-40/Exit 6	Southbound	11	5	1	10	22.3	1.5	0.0	866	-221
657	I-81 S @ I-70/Exit 3	Southbound	14	8	5	6	27.8	1.6	0.0	982	-325

Notes

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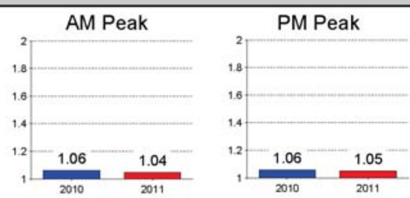
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

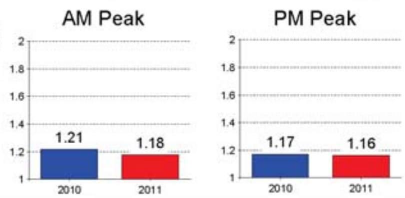
I-83

Trends[a]

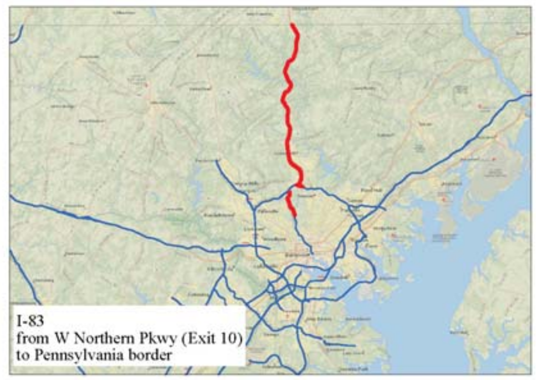
Travel Time Index[b]
measure of average delay



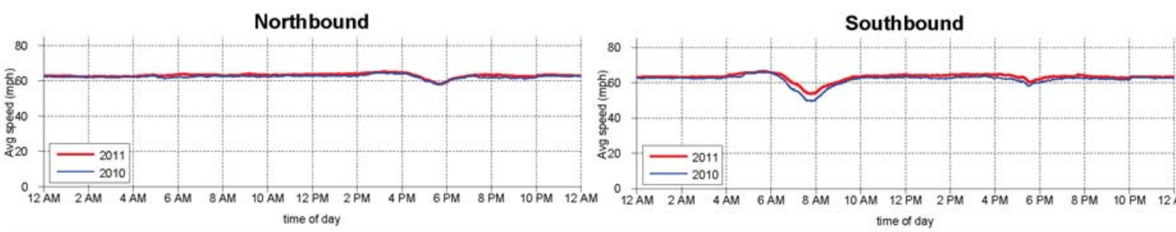
Planning Time Index[c]
measure of worst-case delay



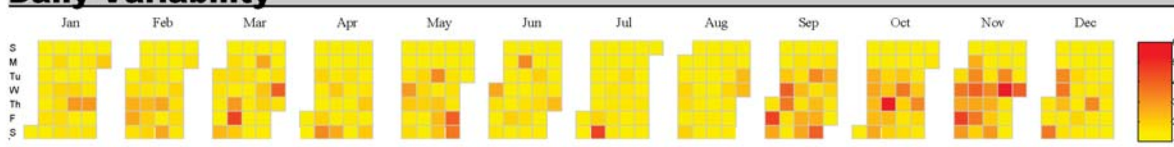
27 center miles carrying 84,000 vehicles every day



Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
65	I-83 S @ I-695	Southbound	0	162	116	129	67.0	3.4	0.8	123	-58
68	I-83 S @ Belfast Rd/Exit 24	Southbound	62	55	33	61	63.3	6.7	0.8	173	-105
90	I-83 N @ Belfast Rd/Exit 24	Northbound	51	52	47	70	60.0	4.6	0.6	257	-167
126	I-83 N @ I-695/Jones Falls Expy/Exit 23	Northbound	0	31	50	73	58.3	4.7	0.4		
176	I-83 S @ Timonium Rd/Exit 16	Southbound	70	66	57	50	44.0	2.7	0.2	368	-192
182	I-83 S @ Fayette St/Exit 1	Southbound	0	491	1056	971	51.7	0.2	0.2		
211	I-83 S @ US-1/North Ave/Exit 6	Southbound	0	17	35	64	42.3	4.1	0.2		
232	I-83 S @ MD-137/Mount Carmel Rd/Exit 27	Southbound	31	33	24	30	38.5	3.8	0.2	373	-141
233	I-83 S @ MD-25/Falls Rd/Exit 8	Southbound	0	24	61	79	35.0	2.6	0.2		
239	I-83 S @ Shawan Rd/Exit 20	Southbound	40	26	21	32	25.0	5.7	0.1	703	-464

Notes

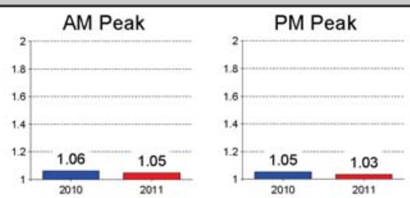
a - **Peak Hours** are considered as 8-9am and 5-6pm..
b - **Travel Time Index** (TTI) is the ratio of the *average* travel time during the peak hour to the time required under free flow.
c - **Planning Time Index** (PTI) is the ratio of the *worst-case* travel time (95th percentile) during peak hour to the free-flow time.
d - Typical work day speeds, calulcuated as the average speed of all weekdays for the entire year and shows it as varies by time-of-day.
e- Variability of worst-case travel experience along facility for each day of year, shown as plot of PTI by day of week and month, showing seasonal and weekly trends.
f - Top 10 bottlenecks on the facility, ranked by impact factor.
Impact factor is multiplication of total annual number of bottleneck occurences by their average duration and by their average length.
Bottlenecks are said to occur when speeds drop below 60% of free-flow speed for a period longer than 5 minutes.
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

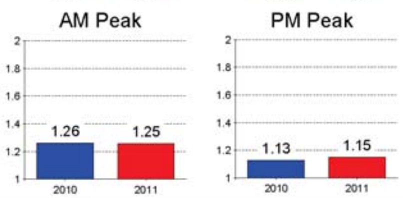
I-795

Trends[a]

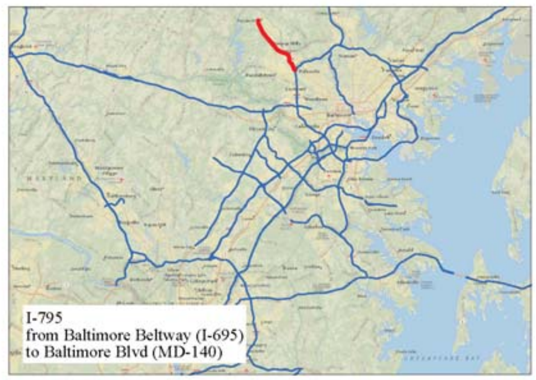
Travel Time Index[b]
measure of average delay



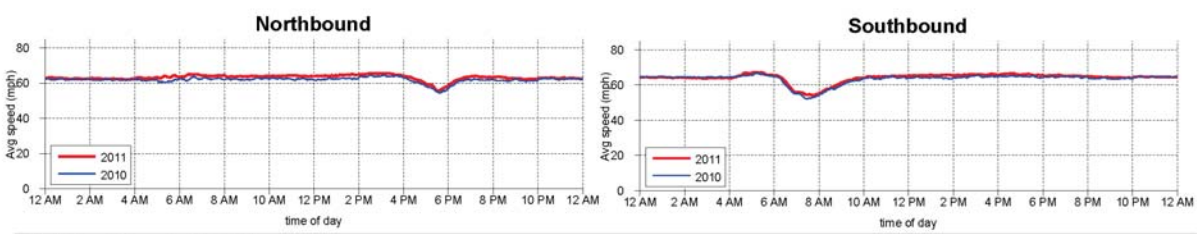
Planning Time Index[c]
measure of worst-case delay



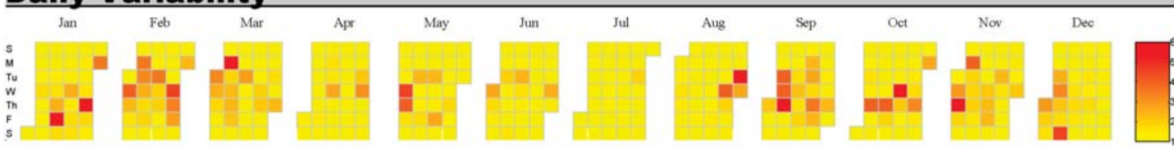
9 center miles carrying 77,000 vehicles every day



Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
112	I-795 S @ Owings Mills Blvd/Exit 4	Southbound	166	18	8	4	36.0	4.1	0.4	833	-721
217	I-795 N @ Owings Mills Blvd/Exit 4	Northbound	66	54	49	58	35.8	2.3	0.2	467	-250
327	I-795 N @ Franklin Blvd/Exit 7	Northbound	13	13	19	39	38.0	3.0	0.1	584	-257
339	I-795 N @ MD-128/MD-140/MD-30/Exit 9	Northbound	30	14	12	10	27.8	3.8	0.1	562	-223
383	I-795 S @ Franklin Blvd/Exit 7	Southbound	52	33	63	67	24.0	1.3	0.1	801	-418

Notes

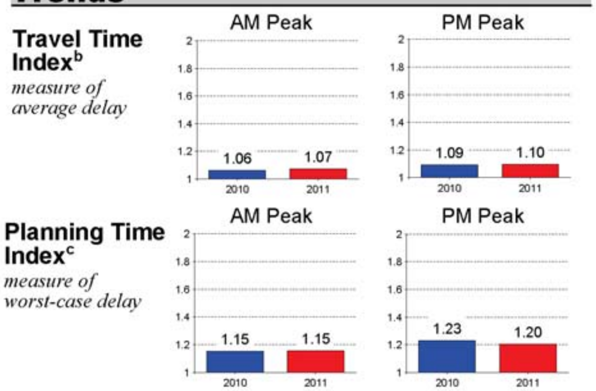
a - **Peak Hours** are considered as 8-9am and 5-6pm..
b - **Travel Time Index** (TTI) is the ratio of the *average* travel time during the peak hour to the time required under free flow.
c - **Planning Time Index** (PTI) is the ratio of the *worst-case* travel time (95th percentile) during peak hour to the free-flow time.
d - Typical work day speeds, calulcuated as the average speed of all weekdays for the entire year and shows it as varies by time-of-day.
e- Variability of worst-case travel experience along facility for each day of year, shown as plot of PTI by day of week and month, showing seasonal and weekly trends.
f - Top 10 bottlenecks on the facility, ranked by impact factor.
Impact factor is multiplication of total annual number of bottleneck occurences by their average duration and by their average length.
Bottlenecks are said to occur when speeds drop below 60% of free-flow speed for a period longer than 5 minutes.
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

2012 Maryland State Highway Mobility Report

I-895

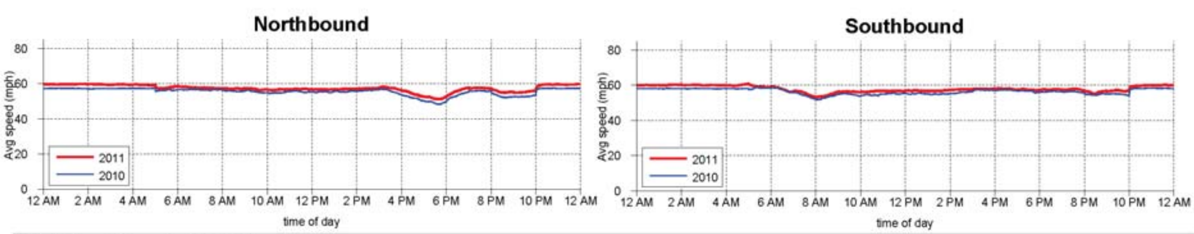
Trends[a]



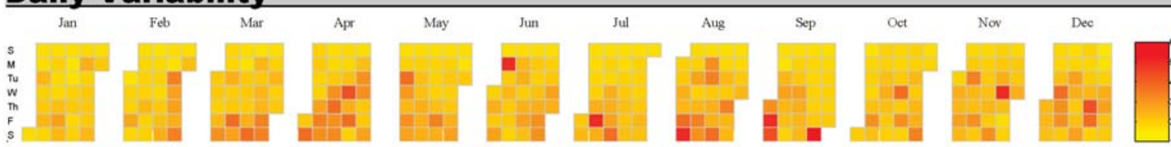
16 center miles carrying 51,000 vehicles every day

Operated by MDTA

Speed Profiles[d]



Daily Variability[e]



Top Bottlenecks[f]

2011 Rank	LOCATION	Direction	Number of Occurences Q1	Q2	Q3	Q4	Average Duration (minute)	Average Length (mile)	Impact Factor	2010 Rank	Change
59	I-895 N @ I-95/62nd St/Exit62	Northbound	206	357	267	132	64.3	1.8	0.9	57	2
106	I-895 N @ Holabird Ave/Exit 10	Northbound	258	81	64	33	55.0	3.6	0.5	84	22
114	I-895 N @ Harbor Tunnel Toll Plaza	Northbound	198	1304	1222	1336	32.5	0.3	0.4	227	-113
161	I-895 S @ Moravia Rd/Exit 14	Southbound	207	394	295	102	29.0	1.1	0.3	106	55
191	I-895 S @ Holabird Ave/Exit 10	Southbound	101	127	106	98	39.5	1.4	0.2	202	-11
268	I-895 S @ Harbor Tunnel Toll Plaza	Southbound	202	1223	1225	1248	37.0	0.1	0.1	745	-477
292	I-895 S @ MD-2/Potee St/Exit 7	Southbound	138	126	120	44	30.3	1.1	0.1	299	-7
334	I-895 N @ Frankfurst Ave/Shell Rd/Exit 8	Northbound	70	43	43	41	34.8	1.3	0.1	291	43
363	I-895 S @ Frankfurst Ave/Shell Rd/Exit 8	Southbound	81	351	423	721	20.5	0.3	0.1	525	-162
388	I-895 S @ Childs St/Exit 9	Southbound	22	7	10	7	31.3	3.6	0.1	452	-64

Notes

a - **Peak Hours** are considered as 8-9am and 5-6pm..
b - **Travel Time Index** (TTI) is the ratio of the *average* travel time during the peak hour to the time required under free flow.
c - **Planning Time Index** (PTI) is the ratio of the *worst-case* travel time (95th percentile) during peak hour to the free-flow time.
d - Typical work day speeds, calulcuated as the average speed of all weekdays for the entire year and shows it as varies by time-of-day.
e- Variability of worst-case travel experience along facility for each day of year, shown as plot of PTI by day of week and month, showing seasonal and weekly trends.
f - Top 10 bottlenecks on the facility, ranked by impact factor.
Impact factor is multiplication of total annual number of bottleneck occurences by their average duration and by their average length.
Bottlenecks are said to occur when speeds drop below 60% of free-flow speed for a period longer than 5 minutes.
Q1: Jan-Mar Q2: Apr-Jun Q3: Jul-Sep Q4: Oct-Dec

Based on speed data from INRIX and volume data from State Highway Administration

VII. Bottlenecks

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A. Top 30 Congested Segments

The Travel Time Index (TTI) was measured for the AM peak hour (8-9 AM) and PM peak hour (5-6 PM). The TTI reflects a comparison between the average travel time in the peak hour versus the travel time in free flow conditions. The higher the TTI the longer a persons trip will be during that time period. The following tables reflect the AM peak hour and PM peak hour top 30 congested locations. The locations are broken down by INRIX in such a manner that multiple segments exist between each interchange.

TOP 30 CONGESTED SEGMENTS AM PEAK

2011 Rank	Location	Road	Direction	TTI
1	I-495 CCW MD 650 to MD 193 @ MD 650	I-495	Outer Loop	4.12
2	I-495 CCW Prince George's Co/L to MD 650	I-495	Outer Loop	3.79
3	I-495 CCW MD 650 to MD 193	I-495	Outer Loop	3.66
4	I-495 CCW MD 650 to MD 193 @ MD 193	I-495	Outer Loop	3.25
5	I-495 CCW US 29 TO MD 97 @ US 29	I-495	Outer Loop	3.23
6	I-495 CCW MD 193 to US 29	I-495	Outer Loop	3.14
7	I-495 CCW I-95 to Prince George's Co\L @ I-95	I-495	Outer Loop	3.02
8	I-270 S Shady Grove Rd to MD 28 CD Lanes	I-270	Southbound	2.83
9	I-270 S Shady Grove Rd to MD 28	I-270	Southbound	2.83
10	I-695 CCW MD 147 to MD 41 @ MD 147	I-695	Outer Loop	2.61
11	I-270 S MD 28 to MD 189	I-270	Southbound	2.54
12	I-695 CCW to I-70 to US 40 @ I-70	I-695	Outer Loop	2.49
13	I-270 S MD 28 to MD 189 @ MD 189	I-270	Southbound	2.46
14	US 50 W MD 459 to MD 201 @ MD 459	US-50	Westbound	2.44
15	US 29 S Randolph Rd to Stewart Lane	US-29	Southbound	2.42
16	I-270 S MD 28 to MD 189 CD Lanes	I-270	Southbound	2.42
17	I-495 CCW US 29 to MD 97 @ MD 97	I-495	Outer Loop	2.39
18	I-270 S MD 189 to Montrose Rd CD Lanes	I-270	Southbound	2.38
19	I-270 S MD 189 to Montrose Rd	I-270	Southbound	2.38
20	US 50 W MD 202 to MD 459	US-50	Westbound	2.37
21	I-695 CCW MD 542 to Providence Rd @ Providence Rd	I-695	Outer Loop	2.34
22	MD 295 S MD 198 to Prince George's Co/L*	MD-295	Southbound	2.33
23	I-695 CCW MD 43 to MD 147	I-695	Outer Loop	2.27
24	I-270 S MD 28 to MD 189 @ MD 28 CD Lanes	I-270	Southbound	2.27
25	I-695 CCW MD 147 to MD 41 @ MD 41	I-695	Outer Loop	2.24
26	MD 43 W Walther Blvd. to I-695	MD-43	Westbound	2.22
27	US 50 W MD 410 to MD 202	US-50	Westbound	2.16
28	I-695 CCW MD 542 to Providence Rd @ MD 542	I-695	Outer Loop	2.16
29	US 50 W MD 459 to MD 201 @ MD 201	US-50	Westbound	2.12
30	I-695 CCW I-70 to US 40 @ US 40	I-695	Outer Loop	2.11

CW - Clockwise CCW - Counterclockwise

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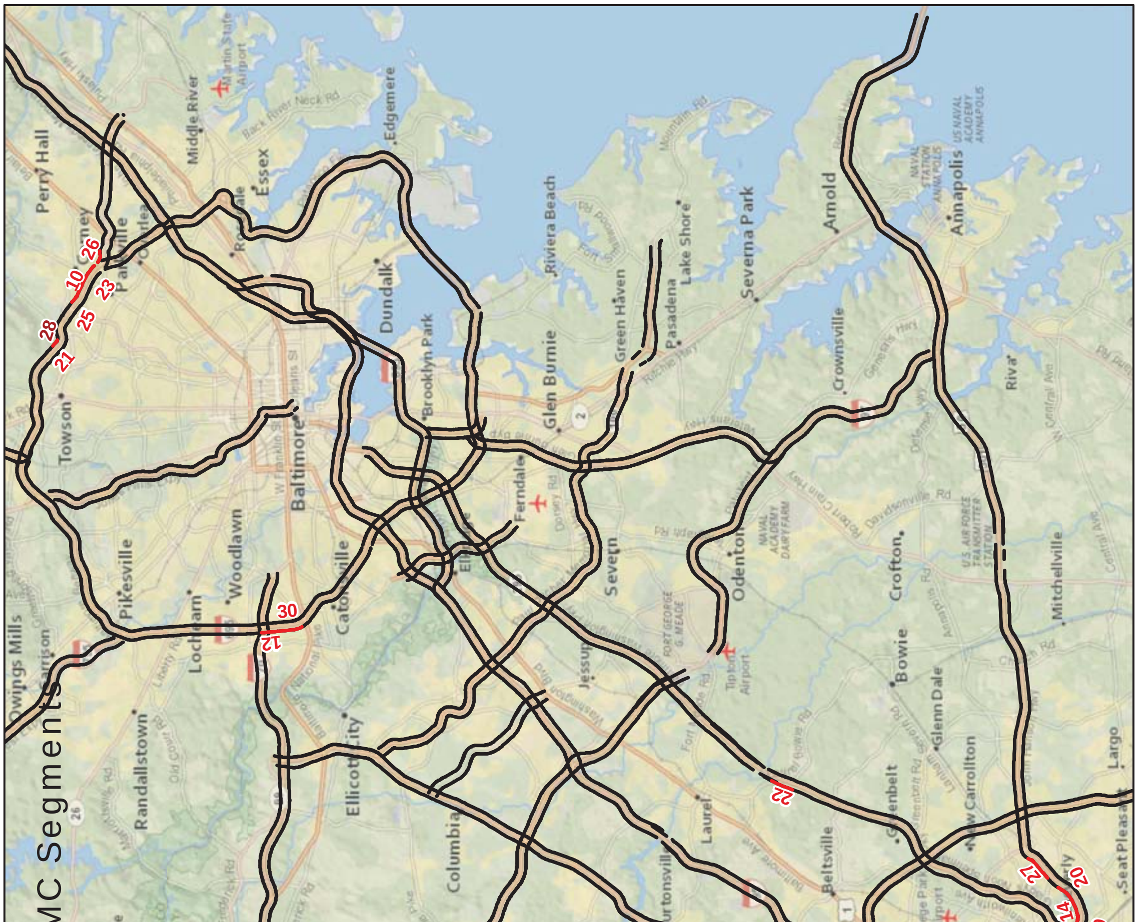
Maryland Top 30 Congested TMC Segments
AM Peak Hour
0 1.5 3 6 9 12
Miles
N
E
S
W

TOP 30 CONGESTED SEGMENTS PM PEAK

2011 Rank	Location	Road	Direction	TTI
1	I-495 CW Clara Barton Pkwy to MD 190	I-495	Inner Loop	3.64
2	I-495 CW MD 190 to I-270Y @ MD 190	I-495	Inner Loop	3.50
3	MD 32 W Great Star Dr to MD 108	MD-32	Westbound	3.49
4	I-495 CW Clara Barton Pkwy to MD 190 @ MD 190	I-495	Inner Loop	3.49
5	I-495 CW MD 190 to I-270Y	I-495	Inner Loop	3.30
6	MD-295 N Powder Mill Rd to MD 197*	MD-295	Northbound	3.27
7	I-695 CW MD 139 to MD 45 @ MD 45**	I-695	Inner Loop	3.14
8	I-695 CW MD 45 to MD 146 @ MD 45	I-695	Inner Loop	2.99
9	I-695 CW MD 45 to MD 146 @ MD 146	I-695	Inner Loop	2.84
10	I-495 CW MD 187 to MD 355	I-495	Inner Loop	2.77
11	MD 295 N Goddard Rd to Powder Mill Rd*	MD-295	Northbound	2.75
12	I-495 CW Virginia St/L to Clara Barton Pkwy	I-495	Inner Loop	2.70
13	I-495 CW MD 355 to MD 185 @ MD 355	I-495	Inner Loop	2.66
14	I-695 CW US 40 to I-70	I-695	Inner Loop	2.63
15	I-495 CW Clara Barton Pkwy to MD 190 @ Clara Barton Pkwy	I-495	Inner Loop	2.63
16	I-695 CW MD 122 to MD 26**	I-695	Inner Loop	2.60
17	I-270 N MD 187 to I-270Y @ MD 187	I-270	Northbound	2.58
18	I-270 Spur N I-495 to Democracy Blvd	I-270 Spur	Northbound	2.56
19	I-495 CW MD 355 to MD 185 @ MD 185	I-495	Inner Loop	2.54
20	I-695 CW MD 45 to MD 146	I-695	Inner Loop	2.52
21	I-495 CW MD 185 to MD 97	I-495	Inner Loop	2.48
22	I-270 N MD 187 to I-270Y @ I-270	I-270	Northbound	2.46
23	I-270 N MD 124 to Middlebrook Rd	I-270	Northbound	2.46
24	US-29 MD 32 to Broken Land Pkwy	US-29	Northbound	2.44
25	I-695 CW MD 139 to MD 45 @ MD 139**	I-695	Inner Loop	2.44
26	MD-295 N MD 193 to Goddard Rd*	MD-295	Northbound	2.43
27	I-70 W US 29 to Marriottsville Rd	I-70	Westbound	2.41
28	I-695 CW MD 146 to Providence Rd	I-695	Inner Loop	2.40
29	I-270 N MD 187 to I-270Y @ MD 187	I-270	Northbound	2.38
30	I-495 CW Virginia St/L to Clara Barton Pkwy @ Clara Barton Pkwy	I-495	Inner Loop	2.38

CW - Clockwise   CCW - Counterclockwise

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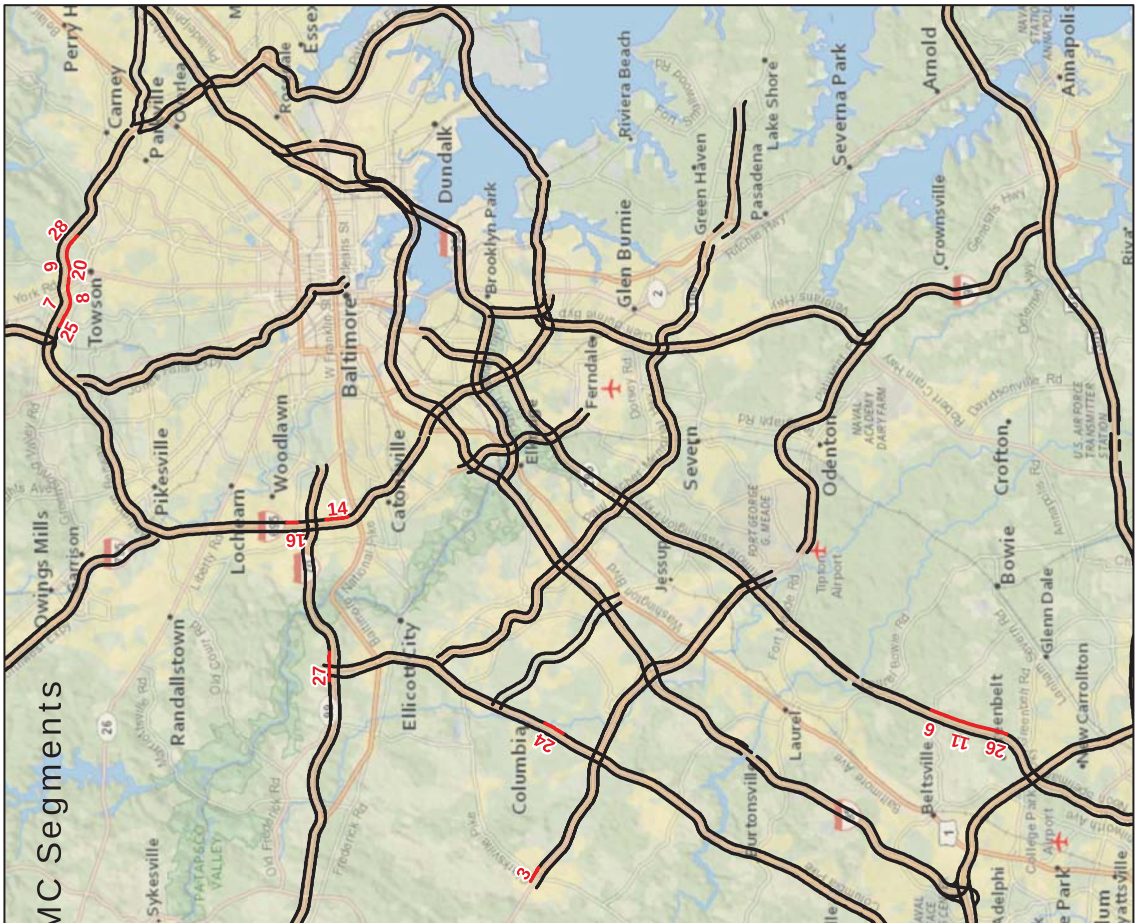

Maryland Top 30 Congested TMC Segments
PM Peak Hour
Miles

B. Top 30 Unreliable Segments

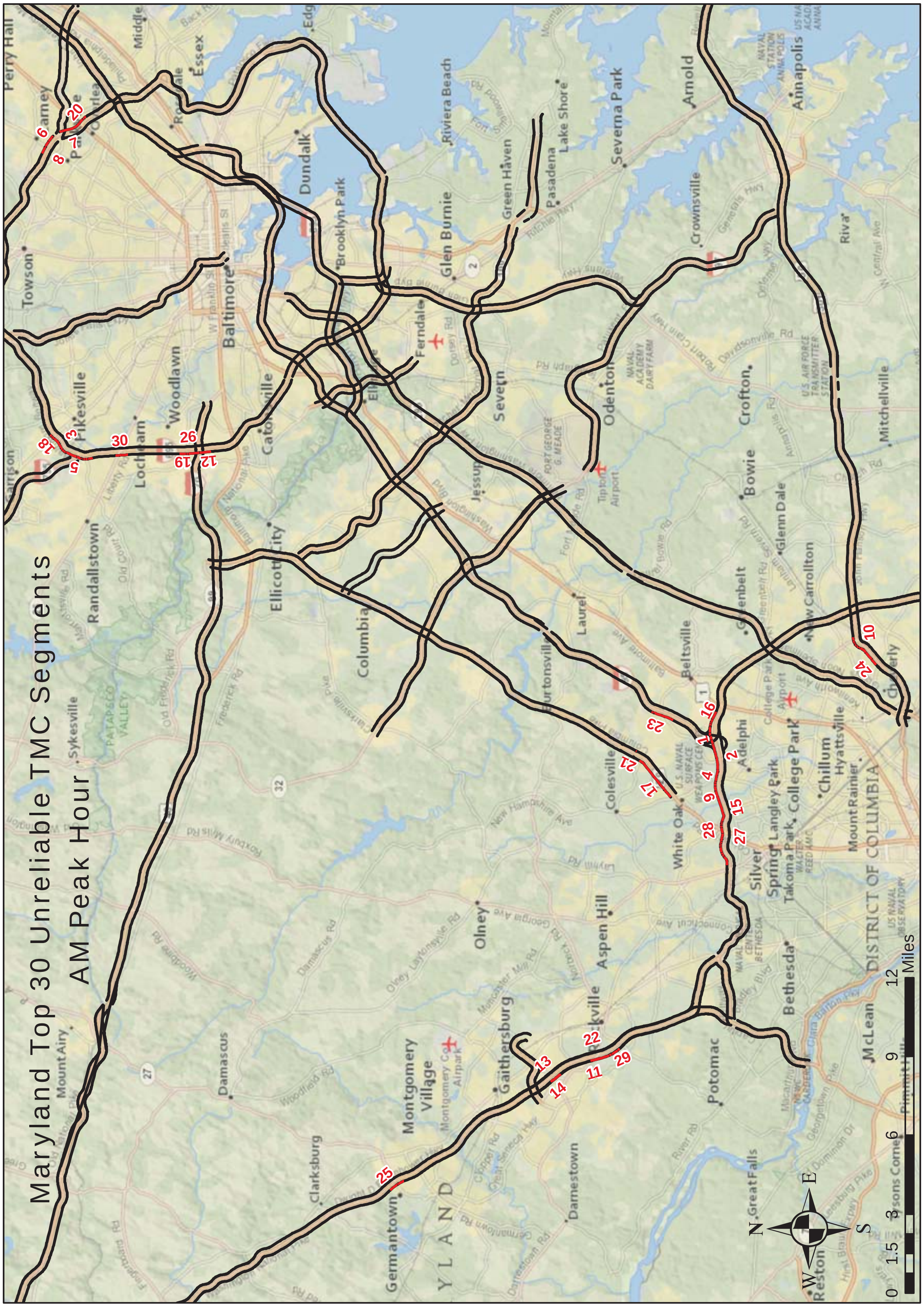
The measure of the amount of travel time a motorist should plan on allowing to arrive at their destination on time while taking into account potential impacts due to such elements as weather is referred to as the Planning Time Index (PTI). The PTI was calculated for the AM peak hour (7-8 AM) and the PM peak hour (5-6 PM) for expressways/freeways. The results of the analysis as shown in the following tables for the top 30 locations for the AM and PM peak hour. The sections are defined based on the INRIX data limits which define multiple sections between interchanges.

TOP 30 UNRELIABLE SEGMENTS AM PEAK

2011 Rank	Location	Road	Direction	PTI
1	I-495 CCW I-95 to Prince George's CO/L @ I-95	I-495	Outer Loop	10.05
2	I-495 CCW Prince George's CO/L to MD 650 @ MD 650	I-495	Outer Loop	9.63
3	I-695 CCW MD 140 to I-795 @ I-795	I-695	Outer Loop	9.06
4	I-495 CCW MD 193 to MD 650 @ MD 650	I-495	Outer Loop	9.04
5	I-695 CCW I-795 to MD 26*	I-695	Outer Loop	7.73
6	I-695 CCW MD 43 to MD 147	I-695	Outer Loop	7.70
7	I-695 CCW US 1 to MD 43	I-695	Outer Loop	7.37
8	I-695 CCW MD 147 to MD 41	I-695	Outer Loop	7.20
9	I-495 CCW MD 650 to MD 193	I-495	Outer Loop	7.05
10	US 50 W I-95 On Ramp to MD 410	US-50	Westbound	6.93
11	I-270 S MD 28 to MD 189 @ MD 28	I-270	Southbound	6.92
12	I-695 CCW I-70 to US 40 @ I-70	I-695	Outer Loop	6.75
13	I-270 S Shady Grove Rd to MD 28 @ Shady Grove Rd	I-270	Southbound	6.68
14	I-270 S Shady Grove Rd to MD 28	I-270	Southbound	6.68
15	I-495 CCW MD 650 to MD 193 @ MD 193	I-495	Outer Loop	6.64
16	I-495 CCW US 1 to I-495	I-495	Outer Loop	6.61
17	US-29 S Randolph Rd to Stewart La	US-29	Southbound	6.60
18	I-695 CCW MD 140 to I-795 @ MD 140	I-695	Outer Loop	6.42
19	I-695 CCW MD 26 to MD 122 @ MD 122	I-695	Outer Loop	6.34
20	I-695 CCW I-95 to US 1	I-695	Outer Loop	6.32
21	US-29 S Fairland Rd to Randolph Rd	US-29	Southbound	6.13
22	I-270 S MD 28 to MD 189	I-270	Southbound	5.74
23	I-95 S MD 212 to I-95/I-495	I-95	Southbound	5.72
24	US 50 W MD 410 to MD 202	US-50	Westbound	5.64
25	I-270 S Father Hurley Blvd to MD 118	I-270	Southbound	5.64
26	I-695 CCW MD 122 to I-70	I-695	Outer Loop	5.62
27	I-495 CCW US 29 to MD 97	I-495	Outer Loop	5.52
28	I-495 CCW MD 193 to US 29	I-495	Outer Loop	5.48
29	I-270 S MD 28 to MD 189 @ MD 189	I-270	Southbound	5.38
30	I-695 CCW MD 26 to MD 122 @ MD 26*	I-695	Outer Loop	5.16

CW - Clockwise CCW - Counterclockwise

** Under Construction*

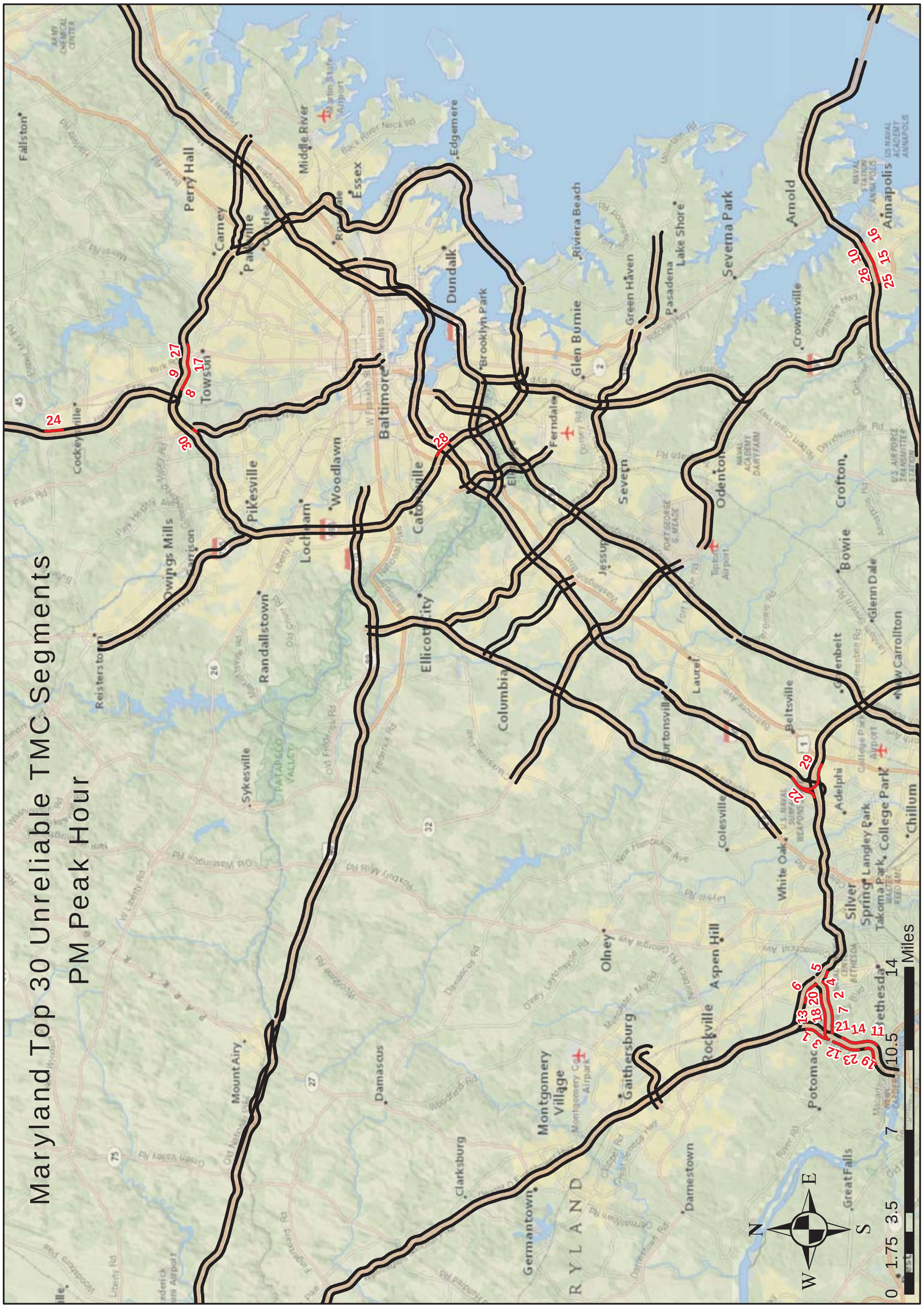

Maryland Top 30 Unreliable TMC Segments
AM Peak Hour

TOP 30 UNRELIABLE SEGMENTS PM PEAK

2011 Rank	Location	Road	Direction	PTI
1	I-270 Spur S Democracy Blvd to I-495 @ Democracy Blvd	I-270 Spur	Southbound	9.70
2	I-495 CW I-270Y to MD 187 near MD 187	I-495	Inner Loop	9.58
3	I-270 Spur S Democracy Blvd to I-495 @ I-495	I-270 Spur	Southbound	8.91
4	I-495 CW MD 187 to MD 355	I-495	Inner Loop	8.61
5	I-495 CW MD 355 to MD 185	I-495	Inner Loop	8.51
6	I-270 S MD 187 to I-495	I-270	Southbound	7.81
7	I-495 CW I-270Y to MD 187 near I-270	I-495	Inner Loop	7.72
8	I-695 CW MD 139 to MD 45 @ MD 139*	I-695	Inner Loop	7.66
9	I-695 CW MD 139 to MD 45 @ MD 45*	I-695	Inner Loop	7.48
10	US-50 E MD 2 to MD 70 @ MD 2	US-50	Eastbound	7.35
11	I-495 CW Clara Barton Pkwy to MD 190 @ Clara Barton Pkwy	I-495	Inner Loop	6.93
12	I-495 CCW I-270Y to MD 190	I-495	Outer Loop	6.91
13	I-270 Spur S I-270 to Democracy Blvd	I-270 Spur	Southbound	6.88
14	I-495 Clara Barton Pkwy to MD 190 @ MD 190	I-495	Inner Loop	6.61
15	US-50 E MD 450 to MD 2 @ MD 2/Jennifer Rd	US-50	Eastbound	6.48
16	US-50 E MD 2 to MD 70 @ MD 70	US-50	Eastbound	6.46
17	I-695 CW MD 45 to MD 146 @ MD 45	I-695	Inner Loop	6.46
18	I-495 CCW MD 187 to I-270 @ I-270 Spur	I-495	Outer Loop	6.37
19	I-495 CCW MD 190 to Clara Barton Pkwy at Cabin John Pkwy	I-495	Outer Loop	6.34
20	I-495 CCW MD 187 to I-270Y @ MD 187	I-495	Outer Loop	6.10
21	I-495 CW MD 190 to I-270Y	I-495	Inner Loop	5.92
22	I-95 S I-495 to MD 212	I-95	Southbound	5.77
23	I-495 CCW MD 190 to Clara Barton Pkwy	I-495	Outer Loop	5.76
24	I-83 N Warren Rd to Shawan Rd	I-83	Northbound	5.74
25	US-50 E MD 665 to MD 450	US-50	Eastbound	5.66
26	US-50 E MD 450 to MD 2 @ MD 450	US-50	Eastbound	5.66
27	I-695 CW MD 45 to MD 146 @ MD 146	I-695	Inner Loop	5.65
28	I-695 CW US 1AL to I-95	I-695	Inner Loop	5.63
29	I-95 CW I-495 to US 1	I-495	Inner Loop	5.56
30	I-695 CW Greenspring Ave to I-83	I-695	Inner Loop	5.56

CW - Clockwise CCW - Counterclockwise

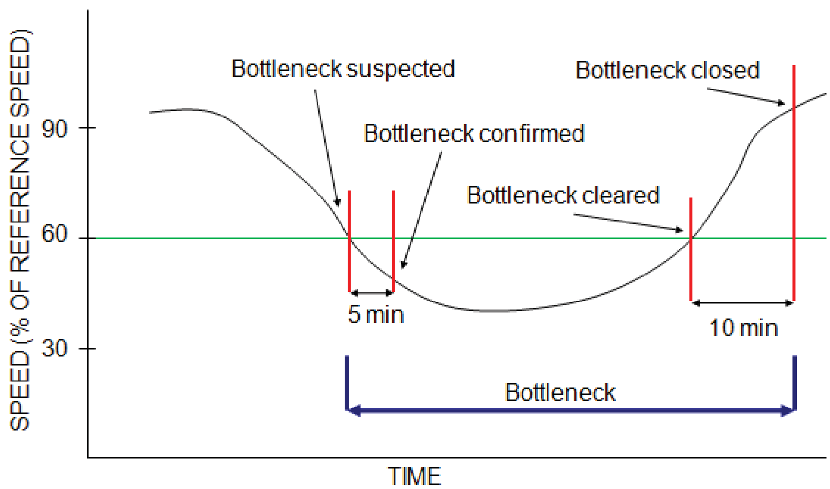
** Under Construction*


Maryland Top 30 Unreliable TMC Segments
PM Peak Hour
0 1.75 3.5 7 10.5 14
Miles

C. Top 30 Bottleneck Locations

The top 30 bottleneck locations were identified for Maryland in 2011. The ranking is based on speed observations that are used to calculate their occurrence. The ranking of the segments is performed by comparing the duration, intensity and frequency with which the bottlenecks occur during an entire average weekday.

A bottleneck, as defined by the Vehicle Probe Project (VPP) Suite, occurs when, “the speeds observed for a roadway segment drop below 60% of the free flow speed for a period greater than 5 minutes. Adjacent roadway segments meeting this condition are joined together to form a bottleneck queue. The duration of the bottleneck is calculated till the time speeds are greater than 60% for more than 10 minutes.” This definition uses minute-to-minute speeds available across the state highway system to determine congestion patterns. This is graphically shown below:



The analysis is based on INRIX probe data for interstates and major roadways within Maryland available through the Vehicle Probe Project. The ranking is based on impact factors (computed as a number of times a bottleneck occurs on a particular segment, times its duration and the average queue length).

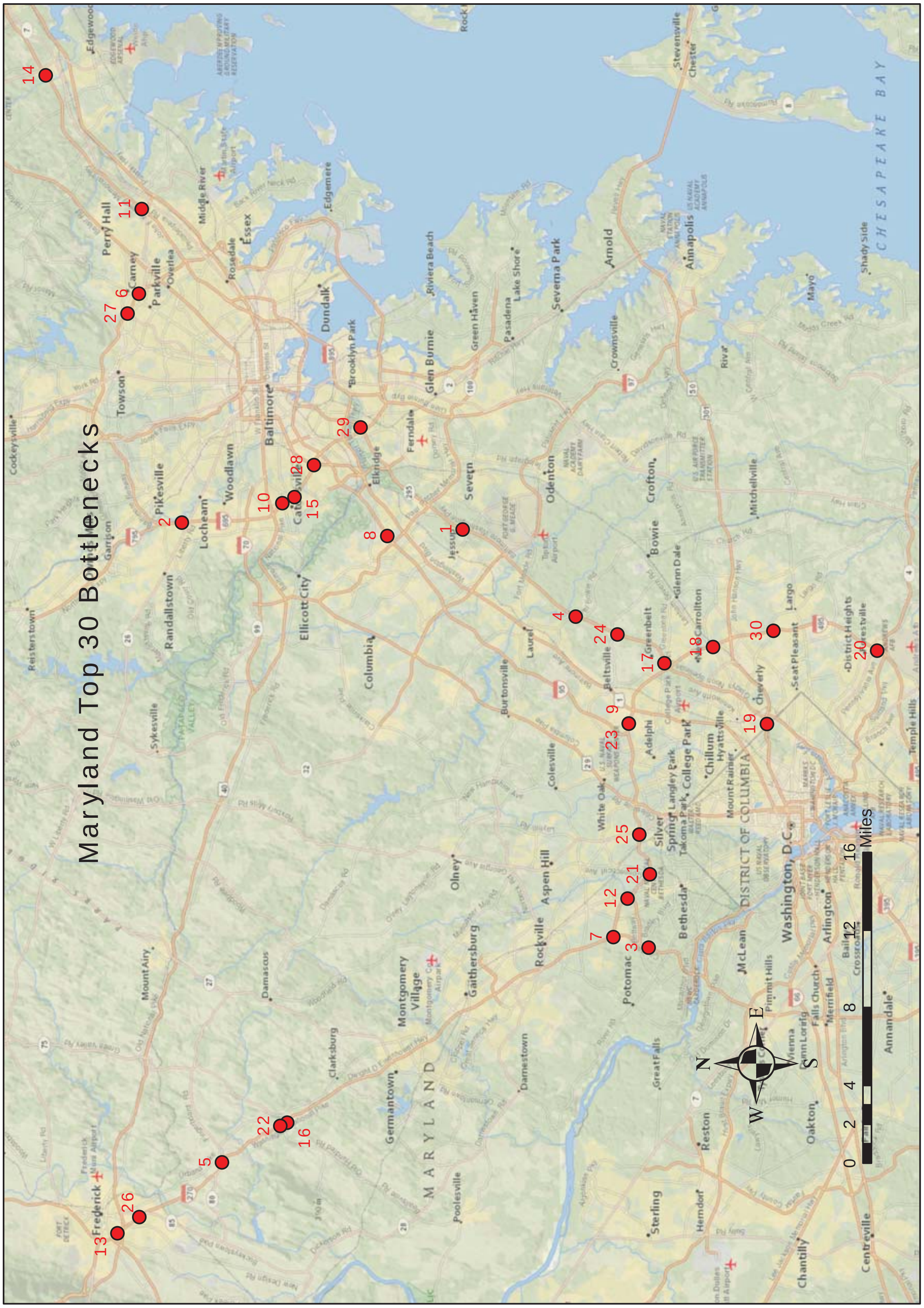
2011 Rank	Location	Road	Direction	# Occurrences Q1	Q2	Q3	Q4	Average Duration (min)	Impact Factor	2010 Rank	Rank Change
1	*MD-295 N @ MD-175*[2]	MD-295	Northbound	108	112	156	119	157	**718076**	6	**-5**
2	I-695 CW @ MD-26/Exit 18**	I-695	Inner Loop	143	180	248	196	121	**660556**	7	**-5**
3	I-495 CW @ I-270 Spur	I-495	Inner Loop	273	228	230	194	114	**654987**	5	**-2**
4	MD-295 N @ MD-197/Exit 11[2]	MD 295	Northbound	163	112	108	128	176	**618418**	4	**0**
5	I-270 N @ MD-80/Exit 26**	I-270	Northbound	86	120	194	172	102	**542582**	77	**-72**
6	I-695 CW @ MD-147/Harford Rd/Exit 31	I-695	Inner Loop	94	92	81	102	142	**481417**	9	**-3**
7	I-270 Spur S @ I-270	I-270	Southbound	137	177	128	150	65	**346994**	*	*****
8	I-95 N @ MD-100/Exit 43	I-95	Northbound	77	126	109	110	114	**315409**	21	**-13**
9	I-95 S @ I-495/Exit 27-25	I-95	Southbound	149	180	178	181	97	**286954**	10	**-1**
10	I-695 CCW @ Edmondson Ave/Exit 14	I-695	Outer Loop	92	127	132	134	106	**285694**	17	**-7**
11	I-95 N @ MD-43/Whitemarsh Blvd/Exit 67 [1]**	I-95	Northbound	48	64	68	62	129	**273513**	31	**-20**
12	I-270 S @ I-495/MD-355	I-270	Southbound	144	142	164	159	89	**268278**	11	**+1**
13	I-270 N @ I-70/US-40	I-270	Northbound	117	105	95	122	76	**248223**	39	**-26**
14	I-95 S @ MD-24/Exit 77 [1]***	I-95	Southbound	18	47	61	67	117	**242333**	42	**-28**
15	I-695 CCW @ MD-144/Frederick Rd/Exit 13**	I-695	Outer Loop	24	98	36	135	96	**217831**	132	**-117**
16	I-270 S @ MD-109/Exit 22	I-270	Southbound	145	159	144	103	81	**216811**	96	**-80**
17	MD-295 S @ MD-193[2]	MD-295	Southbound	82	95	102	134	84	**212795**	37	**-20**
18	I-495 CW @ MD-450/Annapolis Rd/Exit 20	I-495	Inner Loop	85	102	79	90	92	**212177**	24	**-6**
19	US-50 W @ MD-295/Baltimore Washington Pkwy	US-50	Westbound	108	107	118	85	100	**208398**	52	**-33**
20	I-495 CW @ MD-4/Pennsylvania Ave/Exit 11	I-495	Inner Loop	45	38	110	65	99	**205394**	41	**-21**
21	I-495 CCW @ MD-185/Connecticut Ave/Exit 33	I-495	Outer Loop	66	79	86	62	120	**200199**	18	**+3**
22	I-270 N @ MD-109/Exit 22	I-270	Northbound	68	82	73	60	82	**188339**	68	**-46**
23	I-495 CW @ I-95/Exit 27	I-495	Inner Loop	95	126	91	63	108	**187425**	19	**+4**
24	MD-295 S @ Powder Mill Rd[2]	MD-295	Southbound	115	143	139	118	81	**171661**	29	**-5**
25	I-495 CCW @ MD-97/Exit 31	I-495	Outer Loop	95	137	117	209	93	**167879**	35	**-10**
26	I-270 N @ MD-85/Exit 31	I-270	Northbound	30	25	41	33	108	**165839**	109	**-83**
27	I-695 CW @ MD-41/Perring Pkwy/Exit 30	I-695	Inner Loop	84	102	80	58	84	**163878**	14	**+13**
28	I-695 CCW @ US-1/Southwestern Blvd/Exit 12	I-695	Outer Loop	110	3	79	85	53	**156555**	8	**+20**
29	MD-295 N @ I-695	MD-295	Northbound	97	125	105	88	91	**148687**	30	**-1**
30	I-495 CW @ MD-202/Landover Rd/Exit 17	I-495	Inner Loop	36	51	56	59	94	**146199**	28	**+2**

Q1: Jan - Mar, Q2: Apr- Jun, Q3: Jul- Sep, Q4: Oct-Dec

Occurrence: # of times speed dropped below 60% of free flow speeds

Impact Factor = Sum of # Occurrences per quarter x Avg. Duration per quarter x Queue Length per quarter

[1] – Owned and operated by the Maryland Transportation Authority
*[2] – NPS - Owned by the National Parks Service; *Under Review; ** Under Construction;*
**** Under Construction and further review of this location is occurring; CW: Clockwise; CCW: Counter Clockwise*


Maryland Top 30 Bottlenecks

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