

A major effort in calendar year 2015 related to beginning the implementation of Centrac and adaptive signal system operations that allows for timings to be adjusted to conditions. The first corridor selected was along US 1 in Howard County which was implemented in October. The next corridor for implementation will be at 13 intersections on MD 24 in Harford County in 2016.

Another program is a joint state/county effort to implement transit signal priority. The first project is in Montgomery County on MD 355. A joint state/county policy and criteria for location identification has been developed, and corridors have been screened to determine the most beneficial locations for potential implementation. Future deployment remains unfunded at this time. Initial deployment will be focused on MD 355 between Lakeforest Mall and the Medical Center Metro Station as part of a new limited stop “Ride On Plus” transit service to be launched in Fall of 2017.

### 3. MULTI-MODAL

#### a. Park and Ride

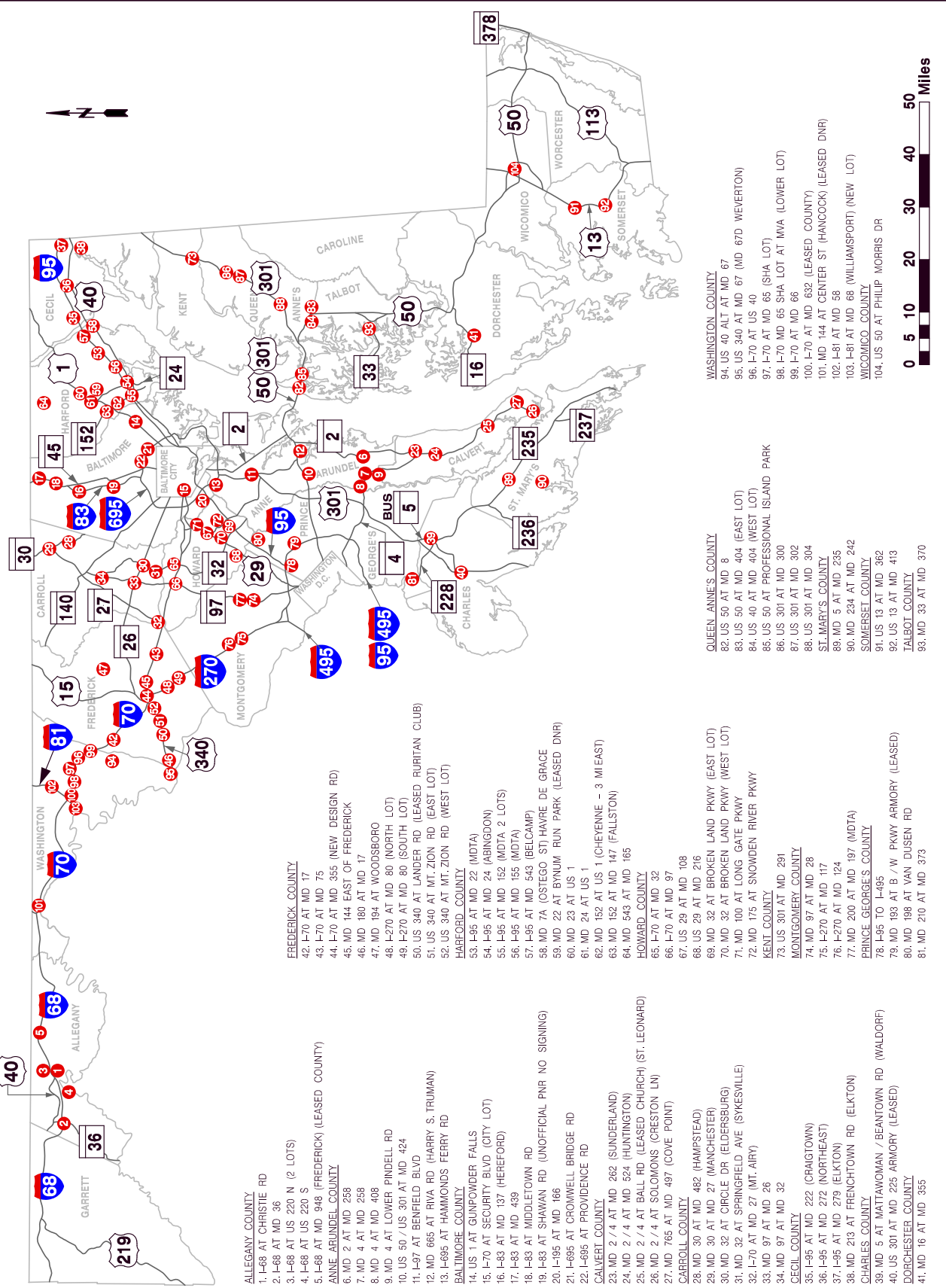
The MDOT has created and maintains a system of park and ride lots throughout the State. These lots reduce single occupant vehicles and encourage transit use and ride-sharing. SHA partners with the Maryland Transit Administration and local transit agencies to encourage transit connections to the lots. The mutually beneficial relationship increases transit trips and reduces congestion. The lots operated by SHA and MDTA include 104 locations in 20 counties providing a total of 13,342 spaces. The number of spaces at the park and ride lots range from less than 15 spaces to more than 800 spaces. The two largest lots are MD 5 in the Waldorf area of Charles County and MD 665 at Riva Road in the Annapolis area of Anne Arundel County. The success of the program has justified funds to be allocated to expand



the opportunities to utilize the lots. In 2015, 213 new spaces were constructed at the US 50/301 at MD 424 lot in Anne Arundel County and the number of spaces doubled at the I-70/MD 75 lot from 50 to 100. Also, a new lot opened last year at I-81/MD 68 in Williamsport of Washington County with nearly 50 spaces. It is estimated SHA and MDTA park and ride lot facilities result in a 107 million VMT reduction annually, a savings of approximately \$58 million in annual user costs. Other minor adjustments occurred in the number of spaces in the network.

The following map shows the location of all the Park and Ride lots operated by SHA and MDTA in Maryland.

PARK AND RIDE LOCATIONS





A survey is performed twice a year (spring and fall) at each park and ride to determine usage. Over 7,000 spaces were utilized on a given day accounting for about 55% of the total spaces. The reduction in the price of fuel may have contributed to a reduction in the utilization of the lots as shown in the following figure.

**SHA/MDTA PARK AND RIDE LOT SPACES AND USERS**



Several lots saw increases in the number of persons utilizing those facilities. The largest increase in usage were at:

- I-270 at MD 124
- I-70 at Security Blvd
- MD 200 at MD 97

Each of these lots had a greater than 10 vehicle increase in usage with the largest being more than 50 additional vehicles parking at the I-270 and MD 124 lot in Montgomery County. The estimated annual user savings over the past four years is shown below.

Several lots experienced capacity constrained conditions with motorists parking on the grass, in unmarked spaces. The following locations exceeded capacity during the survey:

- MD 2/4 @ MD 262 (Calvert County)
- MD 2/4 @ Ball Road (Calvert County)
- US 340 @ Mt Zion Road (East and West Lot) (Frederick County)

**b. HOV Lane Operation (HOV)**

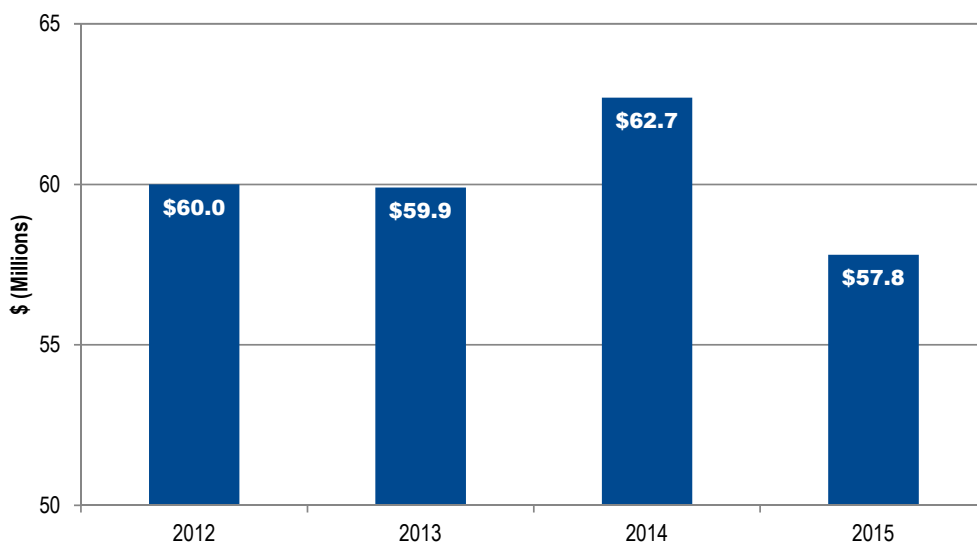
High occupancy vehicle (HOV) lane operations provide an effective travel demand management strategy to move people and goods. These lanes maximize person throughput by offering a travel time savings for multiple occupant vehicles over single occupant vehicles. In Maryland, vehicles in HOV lanes must have two or more occupants; transit vehicles, motorcycles or plug-in electric vehicles (permits required) are exempt. This mobility measure allows the HOV lanes to operate near free flow speeds when the general purpose lanes

generally experience congestion and lower travel speeds. HOV lanes are located on I-270 in Montgomery County and US 50 in Prince Georges County. The I-270 and US 50 HOV lanes are mostly separated by pavement markings from the general purpose lanes although, a few sections along I-270 have a physical separation between the lanes.

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 function the entire day. HOV lanes, in combination with park and ride lots, increase person throughput and provide a viable alternative transportation mode for commuters in Maryland. This provides an effective Active Travel Demand Management (ATDM) strategy.

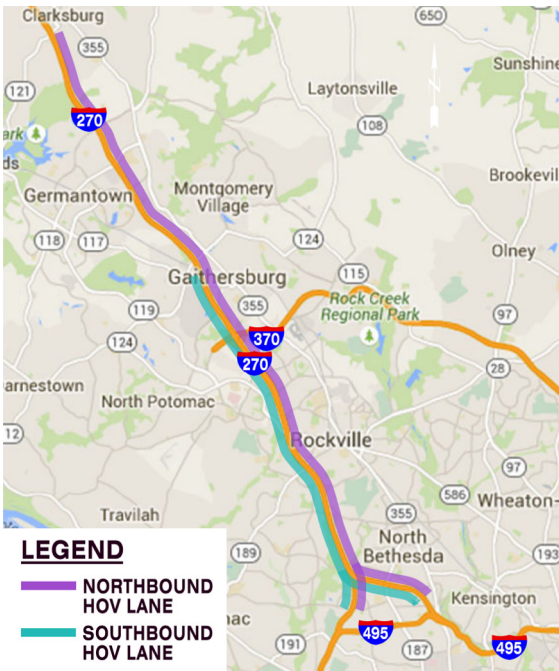
A study was conducted to analyze the performance of the HOV lanes relative to the general purpose lanes. This was accomplished using travel time data from permanent Bluetooth sensors analyzing person throughput, and determining travel time savings. Person throughput evaluates the total number of people moved in each lane versus the total number of vehicles. On I-270 the HOV lanes transported approximately 400 to 1,800 additional people compared to an average general purpose lane.

**SHA/MDTA PARK AND RIDE SAVINGS TO MOTORISTS (MILLIONS)**



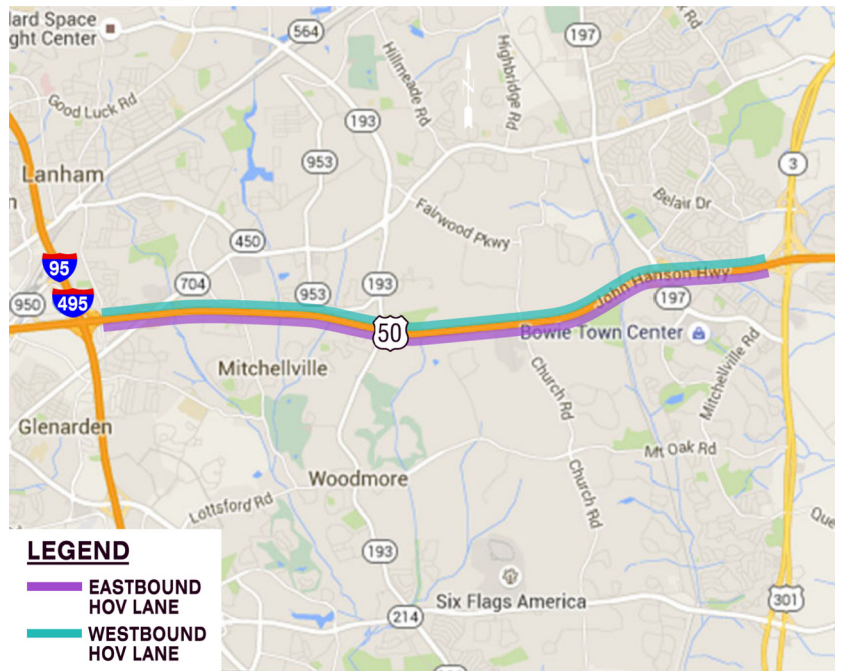


## HOV LOCATIONS



I-270 Northbound I-495 to MD 121 - 16 miles

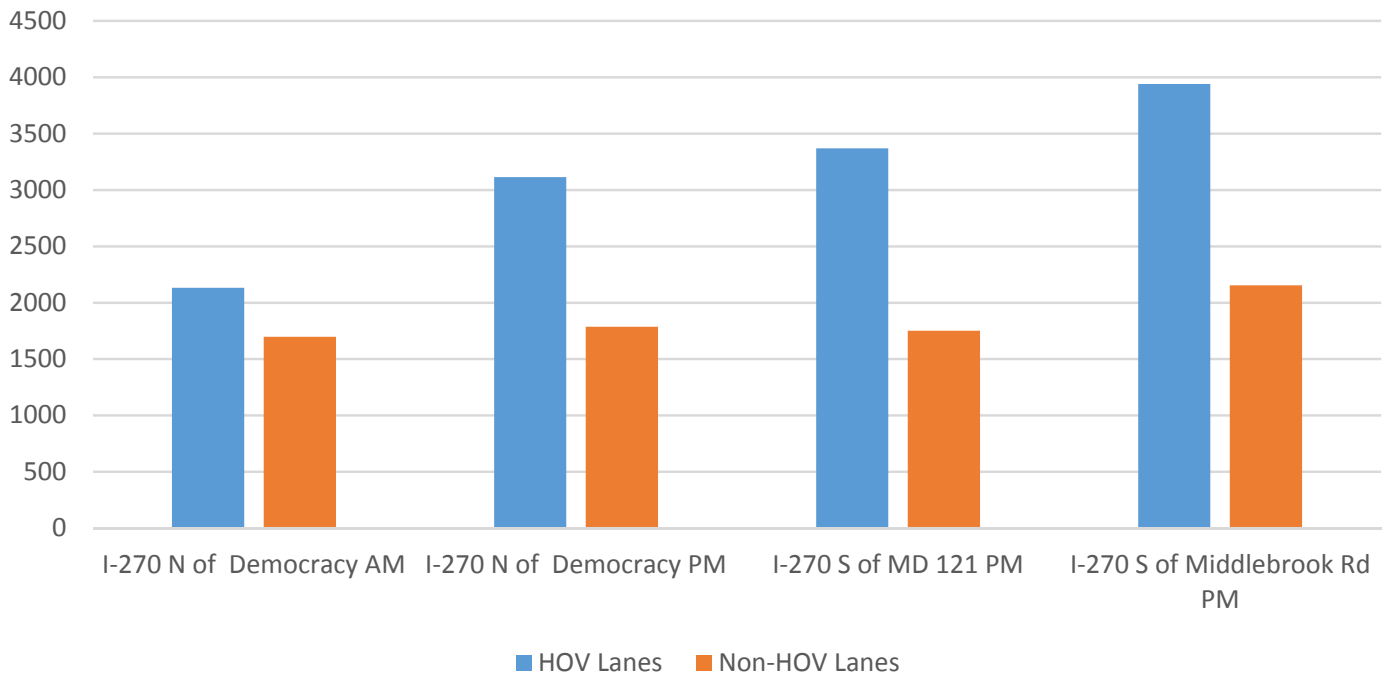
I-270 Southbound MD 117 to I-495 - 9 miles



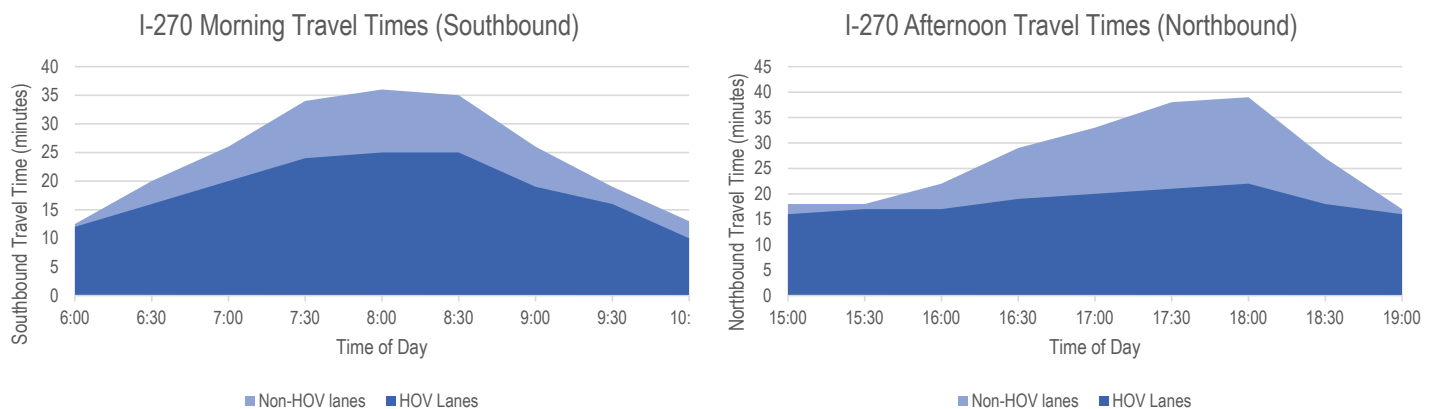
US 50 - US 301 to I-95 - 7.5 miles

The HOV lane carries as many as 3,900 persons per lane per hour as shown in the following chart:

### I-270 PERSON THROUGHPUT PER LANE PER HOUR



A major advantage that HOV lanes provide is in travel time savings to users of those lanes. Of the two locations with HOV lanes, the I-270 facility experienced a more significant savings in travel time. In the morning peak period, the travel time savings was as much as 11 minutes with an average of six (6) minutes. The afternoon peak period provided even greater travel time savings with a maximum of 17 minutes and an average of eight (8) minutes. In 2015, HOV lane operations on I-270 resulted in 153,000 hours of travel time savings and 186,000 gallons of fuel savings. This amounts to \$5.3 million in annual user savings. The average travel time savings on the HOV lanes versus the general purpose lanes during the AM and PM peak period of operation are depicted in the following figure.



The travel time savings on US 50 for the HOV lanes versus the non-HOV lanes is relatively nominal. It is estimated that the HOV lanes on US 50 provide \$0.4 million in annual benefits. The total savings for both facilities is estimated to be \$5.7 million.

### c. Reversible Lane Operation

Reversible lanes is another strategy utilized in selected corridors to improve mobility. The use of reversible lanes allows for increased person throughput and reduced congestion without significant capital investment. This reduces the impact to surrounding residents, businesses and environmental resources. Reversible lanes are limited to corridors with high directional traffic volumes in the peak periods and operate through the use of overhead lane control signals designating the middle lane(s) to alternate with the peak flow of traffic. Reversible lanes are usually limited to certain hours of the day.

Reversible lane operations are in use along:

- US 29 from Sligo Creek Parkway to MD 97 (Georgia Ave) (Montgomery County) - 1.0 miles
- US 50/US 301 Chesapeake Bay Bridge (Anne Arundel/Queen Anne's County) - 4.5 miles
- MD 97 from I-495 to MD 390 (16th Street) (Montgomery County) - 0.5 miles
- MD 177 from MD 100 to West of South Carolina Avenue (Anne Arundel County) - 1.6 miles



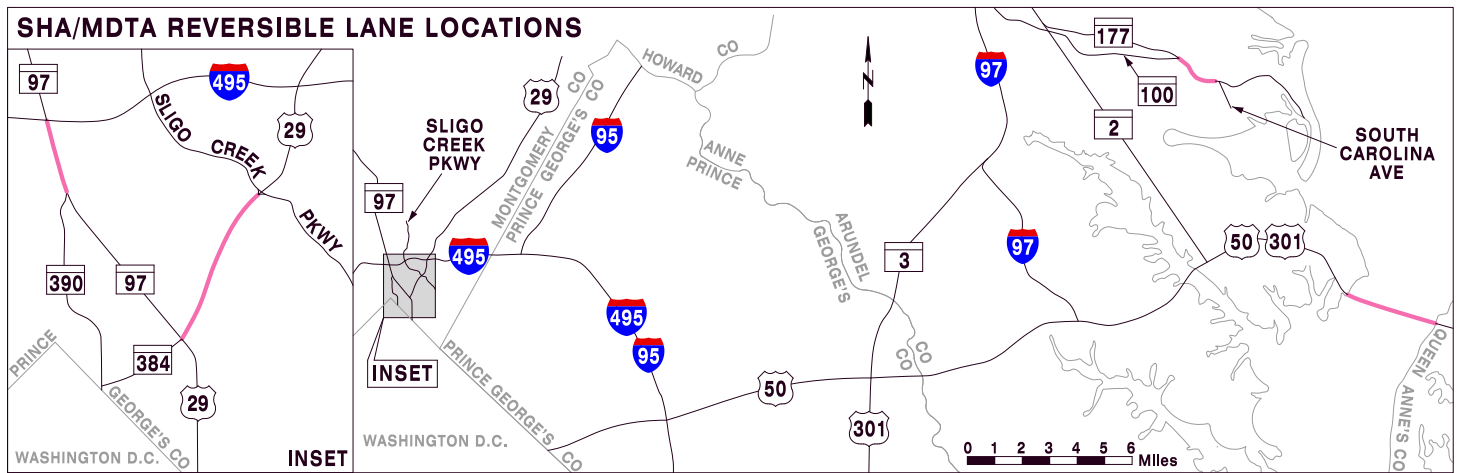
Motorists statewide are most familiar with the reversible lanes on the US 50/US 301 Bay Bridge. Travellers heading to or from the Eastern Shore and points such as Ocean City normally have two lane eastbound lanes and three westbound lanes across the Bridge. Through the use of overhead lane signing, this alternates to allow for three eastbound lanes and two westbound lanes. The changeover occurs as needed during the PM peak period and on Saturday mornings in the peak travel periods. Outside of Washington DC, US 29 and MD 97 reversible lane operations improve traffic flow into the

downtown Silver Spring employment center and access to the WMATA METRO Red Line. The lanes operate southbound in the AM peak period and northbound in the PM peak period. MD 177 (Mountain Rd.) is a three lane roadway in Anne Arundel County that is converted from two lanes westbound in the AM peak period to two lanes eastbound in the PM peak period to respond to the directionality of the traffic between Lake Shore and Gibson Island to Pasadena.

The number of drivers in the peak hour peak direction that utilize the reversible lane or lanes and the other lanes on those particular facilities are as follows:

Location	AM (PM) Volume Traveling in General Lanes (Vehicles Per Hour)	AM (PM) Volume Traveling in Reversible Lane(s) in Peak Direction (Vehicles Per Hour)
US 29	1,575 (1,050)	1,250 (1,325)
US 50/301	N/A (3,000)	N/A (1,600)
MD 97	2,200 (1,650)	600 (650)
MD 177	1,100 (1,275)	375 (450)

There are other reversible lane operations in Maryland not operated by MDOT, along Brightseat Road and Arena Drive near FedEx Field in Prince George’s County, along Clara Barton Parkway in Montgomery County and along MD 2 (Hanover Street) over the Patapsco River in Baltimore City. The reversible lane locations for SHA/MDTA facilities are shown on the following map.



**d. Bicycles and Pedestrians**

The MDOT integrates bicycle and pedestrian facilities into every aspect of our multi-modal transportation network. Pedestrian and bicycle facilities provide numerous benefits including reducing auto emissions, improving public health and enhancing community vitality to encourage more sustainable and livable places. Methods used by the State to achieve these goals are outlined in the Bicycle and Pedestrian Master Plan. One of the initiatives is Cycle Maryland which provides a one-step portal on cycling activities in Maryland.

The planning/design/construction of MDOT projects incorporates a Complete Streets policy to create a transportation system that balances all users of the roadway, including pedestrians, transit, bicyclists, and motorists. This could involve providing new sidewalks, reconstructing existing sidewalks, providing ADA facilities such as ramps and audible pedestrian signals, bike lanes, and upgrades to signing/pavement markings to alert motorists to all users of the facility.

MDOT has developed several programs to implement the planning, design, and construction of bicycle and pedestrian facilities throughout the state, including:

- Sidewalk Retrofit - Sidewalk program to fill in gaps or construct key pieces of the pedestrian network.
- Bicycle Retrofit - Bicycle improvements including signing and marking upgrades, modifying typical sections and creating off road trails to facilitate bicycle mobility.
- Bicycle and Pedestrian Priority Areas (BPPA) - Collaborative approach that designates areas to improve multi-modal options by better aligning state and local bicycle and pedestrian facilities in areas with high potential for bicycling and walking.
- Transportation Alternatives Program (TAP) - Pedestrian and bicycle improvement program for transportation related community projects to strengthen the intermodal transportation system.
- Recreational Trails Program - Construction of new trails or maintenance/rehabilitation of existing trails.
- Safe Routes to School Program - Program for bicycle and pedestrian routes to school for children in grades K-8.





MD 144

- Americans with Disabilities Act (ADA) Retrofit Program - Upgrades of sidewalks, curb ramps, intersections and driveway entrances to comply with ADA.
- Urban Reconstruction Program - Projects to promote safety and economic developments such as including sidewalks in priority funding areas.

**e. Transit Oriented Development**

Developments at locations that can be integrated with transit facilities provide a comprehensive multi-modal

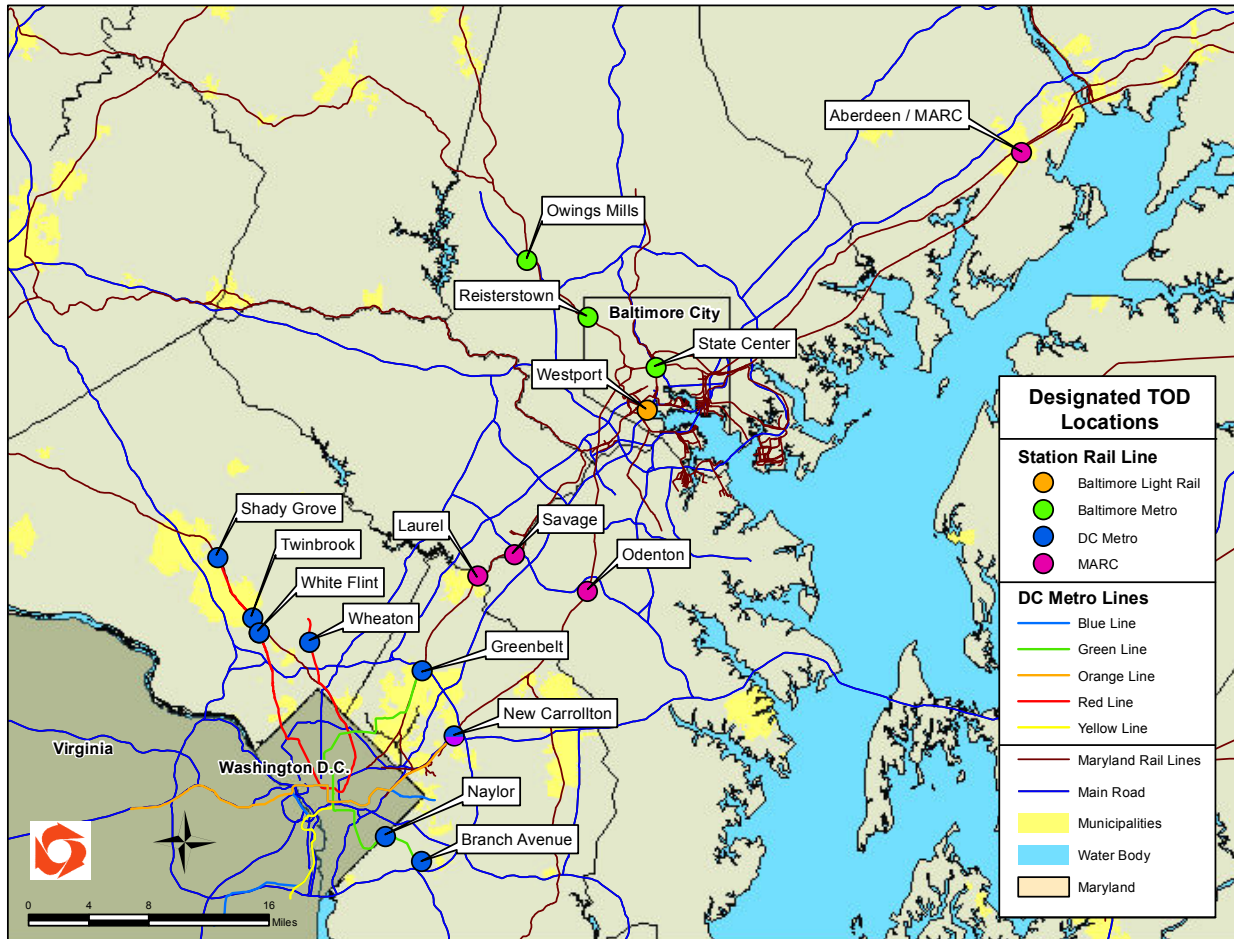
method to reduce auto dependency, increase pedestrian and bicycle trips, foster safer station areas, offer attractive public spaces, enhance public transportation ridership, and encourage new development or revitalization around the station. MDOT has established 16 such sites throughout the state referred to as Transit Oriented Developments (TODs). TODs increase the mobility of citizens by providing more convenient access to mass transit while reducing fuel consumption, air pollution, greenhouse gas emissions, and local infrastructure costs. State designated TOD projects allows for funds and resources, financing assistance, tax credits, prioritization for the location of State offices, and support from MDOT on access improvements. The sites are located in six (6) counties (Harford, Baltimore, Anne Arundel, Howard, Montgomery, and Prince George’s) and Baltimore City as shown by the figure on the following page.

The development of TODs includes partnerships between MDOT and the Washington Metropolitan Area Transit Authority (WMATA). The two agencies are working together at locations such as New Carrollton, White Flint, and Branch Metro stations to develop joint projects.

The 16 current TODs are at different stages of development ranging from the commencing of agreements to occupancy and final construction. Locations including Twinbrook, where 214 apartments and 18,000 sf of retail opened in September 2015 are in the planning stages for additional development. Among the most active presently are shown in the following table.

ACTIVE DEVELOPMENT AT TODs		
TOD Location	MULTI-MODAL CONNECTION	ON-GOING DEVELOPMENT
Owings Mills	MTA-METRO	200,000 sf office
Annapolis Junction/ Savage	MARC	100,000 SF office 14,000 SF retail 416 residential units

### DESIGNATED TOD LOCATIONS



#### 4. FREIGHT

A balance exists between the movement of freight and the impact to residents that may prefer to prohibit trucks near their homes. In order to direct truckers to the most appropriate routes the Maryland Truck Route System was established consisting of approximately 900 miles of roadways throughout the State. It includes all interstate routes (481 miles), seven segments of U.S. Routes (320 miles) including US 13, US 40, US 50, US 301, US 340, US 13 Business and US 50 Business and seven segments of Maryland state routes (99 miles). The state routes include sections of MD 3, MD 4, MD 10, MD 100, MD 201, MD 295 and MD 702. MDOT is in the process of updating its truck route system in accordance with the FAST ACT, commencing in the fall of 2016. It will evaluate Freight Elements for Critical Rural and

Urban Corridors including intermodal movements, truck network gaps, improve connections and identify other routes experiencing a high-severity index related to truck crashes.

Several programs and policies have been developed to improve safety and mobility. These include upgrades to at-grade railroad crossings through the Highway-Rail Crossing Program, programs to construct virtual weigh stations and Commercial Vehicle Information Systems and Networks (CVISN) facilities to the implementation of the Maryland One Hauling Permit System and the continual monitoring of truck parking as part of Jason’s Law. Jason’s Law provides federal funding toward the construction of safe roadside parking



lots for truck drivers. This includes assessing truck volumes, developing metrics to measure truck parking, and evaluating the capacity to provide adequate truck parking.

MDOT-SHA has several on-going initiatives related to Jason’s Law including identifying welcome centers/rest areas that could be expanded. This includes:

- I-68 Youghiogheny Overlook (Garrett County)
- I-70 Eastbound and Westbound Welcome Areas (Frederick County)
- I-95 Northbound Welcome Center (Howard County)
- I-70 Eastbound Truck Rest Area (Frederick County)

Other methods to increase truck parking being explored include:

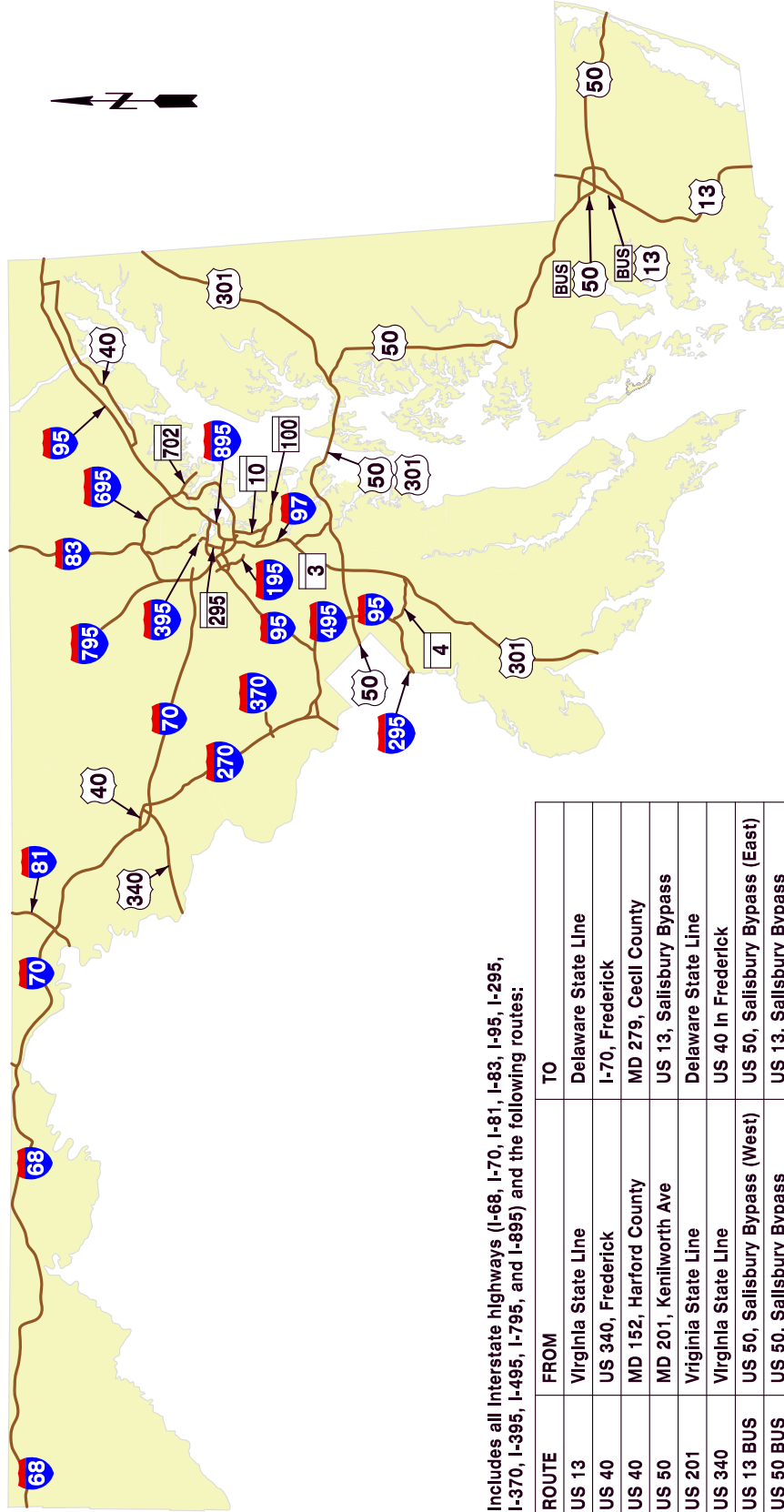
- Identifying areas along freight corridors that have sizable right-of-way that can serve as a possible truck holding area.
- Investigating P3 truck parking opportunities with developers.
- Researching the use of Truck Weigh and Inspection Stations for overnight truck parking when the station is closed.
- Reviewing possible expansion of park and ride facilities to include truck parking.

In addition, future studies will delve into a better understanding of the analytics of why truck drivers park at certain locations and then to address them through research and development. Efforts such as the I-95 Corridor Coalitions Truck n’ Park pilot project introduce intelligent transportation systems to address these challenges.

An additional element is the incorporation of freight into the highway project planning process. The SHA/MDTA Freight Implementation Plan provides direction for future transportation investments to enhance the safe and efficient movement of commercial vehicle freight.



# MARYLAND TRUCK ROUTE SYSTEM



Includes all Interstate highways (I-68, I-70, I-81, I-83, I-95, I-295, I-370, I-395, I-495, I-795, and I-895) and the following routes:

ROUTE	FROM	TO
US 13	Virginia State Line	Delaware State Line
US 40	US 340, Frederick	I-70, Frederick
US 40	MD 152, Harford County	MD 279, Cecil County
US 50	MD 201, Kenilworth Ave	US 13, Salisbury Bypass
US 201	Virginia State Line	Delaware State Line
US 340	Virginia State Line	US 40 In Frederick
US 13 BUS	US 50, Salisbury Bypass (West)	US 50, Salisbury Bypass (East)
US 50 BUS	US 50, Salisbury Bypass	US 13, Salisbury Bypass
MD 3	US 50/US 301, Bowie	I-97
MD 4	I-95	US 301, Upper Marlboro
MD 10	MD 100, Glen Burnie	I-695, Baltimore County
MD 100	MD 607, Jacobsville	I-97
MD 295	I-695, Baltimore County	I-95 north of Baltimore City Line
MD 702	I-695, Baltimore County	Old Eastern Ave



**5. MARYLAND TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSM&O) PLAN**

Transportation Systems Management and Operations (TSM&O) has emerged in recent years as a formal discipline for state departments of transportation (DOTs) to better assist in operating existing network facilities to their fullest service potential. In 2016, MDOT SHA released the Maryland TSM&O Strategic Implementation Plan that included four key goals, associated objectives, performance metrics, and strategies. This is one of the first TSM&O Plans in the nation that was advanced through FHWA Strategic Highway Research Program (SHRP 2) implementation assistance.

This TSM&O Plan is a strategic effort to institutionalize planning for operations and expand SHA’s existing programs to promote:

- More efficient, useful, and personalized traveler information
- Increased safety along freeways, in work zones, and at highway/rail crossings

- Increased mobility at inter-modal transfer points
- More secure and redundant transportation management services
- Safer and quicker management of roadway incidents at multi-jurisdictional locations
- Increased mobility on arterials/surface streets, tolled roadways, and event/work zone locations
- Increased real-time traffic management and traveler information services through use of the latest technology tools
- Increased safety, mobility, and reliability due to coordinated management of commercial vehicles and hazardous material shipped along roadways.

SHA has started implementing key aspects of this TSM&O Plan and expects this program to shape performance based planning and operations at the agency.



Goal 1. Develop and implement a sustainable TSM&O Program at SHA.



Goal 3. Improve travel time reliability for both people and freight on both freeways and arterials.



Goal 3. Develop data-and performance-driven approaches to support TSM&O planning, programming, implementation and evaluation decisions.



Goal 4. Improve the travelling public’s experience on Maryland highways by enabling customers with information and choices.