



I-95

1. CHART TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS

The Coordinated Highway Action Response Team (CHART) started in the mid-1980s' as the "Reach The Beach" initiative to improve traffic operations for motorists travelling to and from Ocean City and other Eastern Shore points. The success of the program led to the formation of CHART which evolved into a statewide program anchored by the Statewide Operations Center (SOC) in Hanover. CHART's mission is to improve mobility and safety using intelligent transportation systems (ITS) devices and interagency teamwork to address non-recurring congestion. Non-recurring congestion includes crashes, vehicle breakdowns, work zones, special events, and weather events. Non-recurring congestion is estimated to account for about 50 percent of all delays on Maryland roadways. The importance of avoiding secondary crashes and providing emergency response in a timely manner is critical both for safety and mobility. From a safety standpoint, minimizing incident clearance times reduces the potential for secondary incidents. Proper incident management benefits the environment by reducing the amount of emissions, including greenhouse gases. CHART, a joint effort between the Maryland Department of Transportation (MDOT) and Maryland State Highway Administration (SHA), in partnership with the Maryland State Police (MSP), and the Maryland Transportation Authority (MDTA), improves real-time operations for Maryland's highway system through communication, system integration, incident response and management, service patrols, and advanced traffic management systems. CHART is involved in:

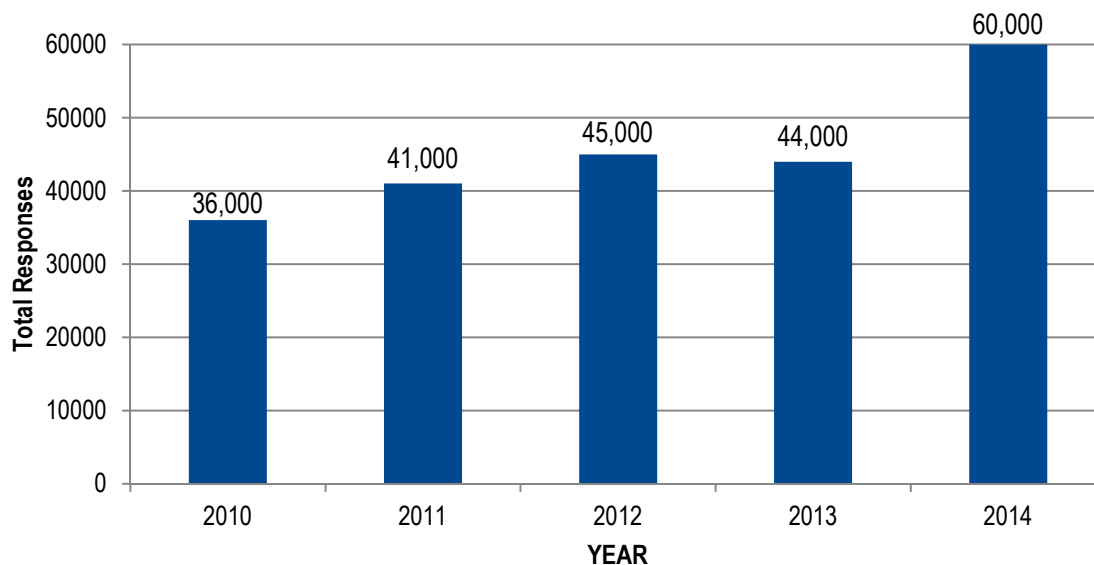
- Emergency and Weather Operations
- Emergency Preparedness
- Incident Management
- Traffic and Roadway Monitoring
- Traffic Management
- Traveler Information

a. CHART Incident Management

A major emphasis for CHART is incident management. One of the goals of CHART is to improve response times to crashes and clear incidents quickly. This is accomplished by providing emergency traffic patrols (ETP) along major roadways to assist drivers when their vehicles become disabled or when involved in a crash. SHA also recently partnered with State Farm Insurance to expand CHART's emergency traffic patrol coverage. These daily patrols supplement CHART's current coverage and optimize incident response in identified high-volume/high-incident locations. As of July 2014, CHART doubled the size of its service patrol fleet and expanded its patrol operations to a 24 hour a day/seven days a week schedule. There are currently 48 full-time ETP's in the Baltimore, Washington, Frederick and Annapolis regions that offer various types of motorist assistance on the freeways. In addition, from May through September, extra patrols are assigned in response to the increased traffic volume traveling to and from Maryland's Eastern Shore. At the SOC near BWI Airport in Hanover and regional operations centers located in College Park, Baltimore and Annapolis, traffic is monitored through 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. With the use of various ITS technologies, travel time information is available to motorists along the major roadways. As a result of all of the incident management and traveler information system initiatives, CHART saves billions of dollars for roadway users in terms of lost time, wasted fuel, and emissions.

The CHART Program responded to and cleared more than 23,000 incidents and assisted almost 37,000 stranded motorists in 2014. CHART increased coverage to 24/7 operations resulted in significant motorist assistance compared to previous years. This meant an approximate 35% increase both in responding to incidents and stranded motorists. The total number of CHART responses on a yearly basis is illustrated in the following graph.

CHART SERVICE PATROL RESPONSES





I-695 South of I-795

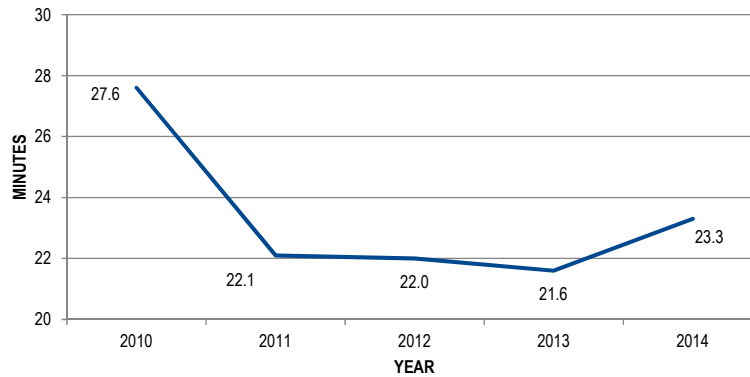
A key goal of CHART is to reduce the potential of secondary incidents by providing a timely response and efficient management once an incident has been identified. The quicker an incident is cleared from the roadway the greater the benefits in reducing delay, improving mobility, and providing safer conditions. Once the traffic and roadway monitoring system has identified an incident, an immediate response is initiated to clear the problem and re-open lanes as quickly as possible. This is accomplished 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 with the cooperation of SHA, MSP, MDTA and other agencies.

The equipment and policies used for incident management include:

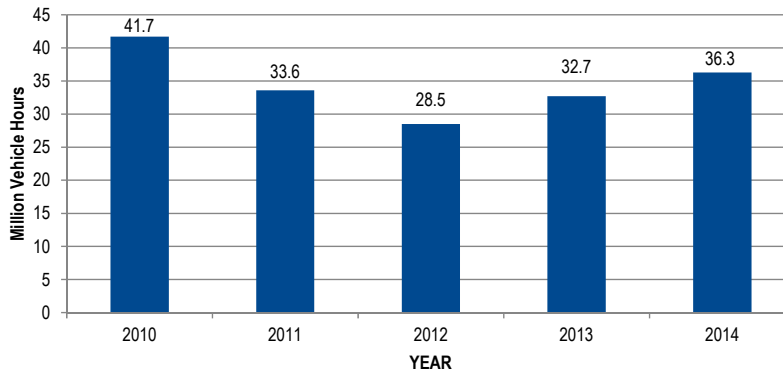
- Emergency Traffic Patrols (ETP's), which are used to provide emergency motorist assistance and to clear disabled vehicles from the travel lanes.
- Emergency Response Units (ERU's), which establish overall traffic control at crash locations.
- Freeway Incident Traffic Management (FITM) trailers, which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

A reduction in the time required to clear an incident translates into a reduction in delay and a cost savings to motorists. In 2014, CHART's average response time was 11 minutes, and the average incident took 23 minutes to clear. This saved almost 36.3 million vehicle hours in delay to motorists. The following graphs depict the trends of average incident duration and reduction in delay for the last five years.

AVERAGE INCIDENT DURATION

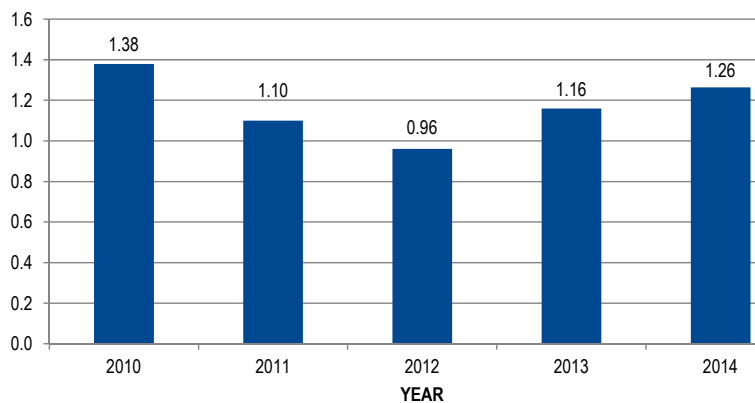


REDUCTION IN DELAY



A quick response time helps reduce delays which results in a savings in annual user costs. The following graph depicts the savings to motorists due to the CHART system in 2014, nearly \$1.26 billion.

ANNUAL USER COST SAVINGS





I-95 South of MD 32

b. ITS/511

ITS devices deployed throughout the state assist motorists of traffic operations and incidents. These ITS devices include:

- 700+ CCTV Cameras which include video feeds from other agencies.
- 200+ Speed Detectors.
- 85+ Dynamic Message Signs (DMS).
- 50+ Roadway Weather Information Systems.
- 35+ Traveler Advisory Radios.

CHART is involved in:

- Emergency Preparedness - Redundant Power and Communication, Decentralized Communications and Department of Transportation Emergency Operations (DOTOPs).
- Emergency Weather Operations - Automatic Vehicle Location Fleet Management System and Resource Tracking System.
- Incident Management - Emergency Traffic Patrols, CHART Operations Center, and Emergency Response Units.
- Traffic Management - Special Event and Work Zone Management.

- Traffic and Roadway Monitoring - Cell phone #77, CCTV, and Public/Private Partnerships.
- Traveler Information - Maryland 511 Traveler Information System - High-quality, Timely, and Comprehensive Travel Information to Motorists, CCTV Camera Video Sharing with First Responders, and Internet (www.traffic.md.gov).

The success of the systems CHART has implemented means further areas are evaluated to expand the network. Each year improvements to the CHART system are analyzed and implemented as funding is available. The expansion of the CHART system will further assist travelers by providing better traffic operations statewide. Travel time information is made available based on the analysis of INRIX probe data on more than 100 DMS signs owned by SHA and MDTA. The Maryland 511 Travel Information System continues to provide useful, high-quality, timely, and comprehensive travel information. In 2014, an enhancement customized information to support the commercial vehicle industry was implemented in the Maryland 511 system.



MD 187 South of I-270

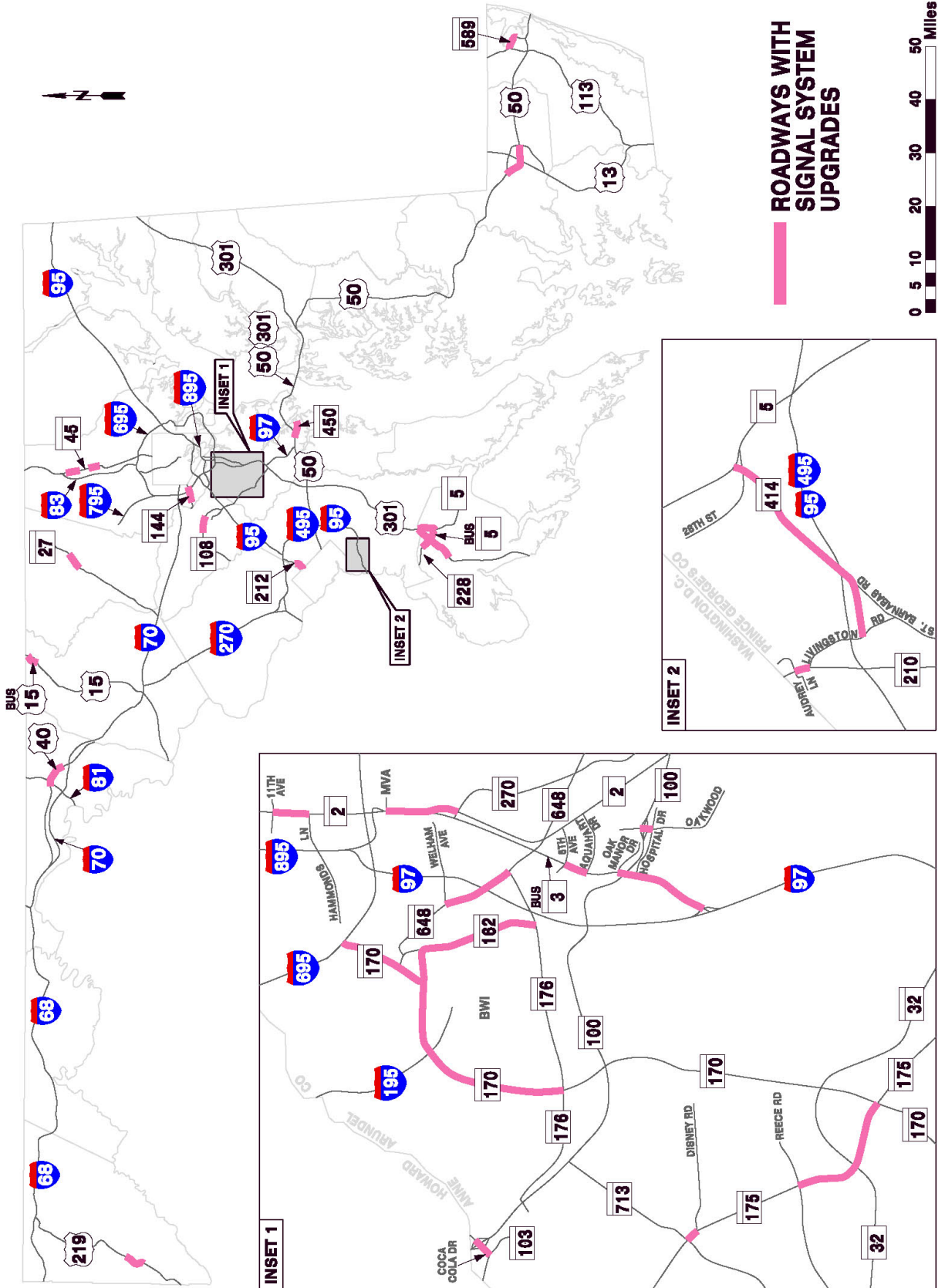
c. Signal Operations

One of the most cost effective ways to improve mobility on arterial highways is to improve signal system performance. Traffic signal optimization projects provide improved safety and increased person throughput on arterial corridors. This is accomplished by the retiming of signals to be more responsive to traffic flows, thereby reducing delay to motorists and decreasing automobile emissions. In addition, re-timings not only improve traffic progression but also provide a more walkable environment. In studies from around the country, the benefit cost ratio of improving signal timings range up to 40:1 by providing reduction in travel time delays, number of stops and fuel consumed.

The SHA operates and maintains 1,541 signals in 252 systems. The process of upgrading signal timing includes gathering new traffic volume data, performing traffic modeling, developing adjustments to the timing patterns and conducting travel time analysis to evaluate the before and after results. The major emphasis of the signal system optimization program projects in the last few years is to increase the rate of traffic signal timing modifications that were installed in the controllers at the intersections after the analysis was completed. In 2014, new signal timings were implemented into 65% of the controllers with many of the remaining intersections expected to be installed in early 2015.

In calendar year 2014, a total of 409 signals were reviewed and 221 signals were proposed to be retimed, including 29 signal systems. The signal systems that were retimed and new signal timings were implemented are included on the following map:

SIGNAL SYSTEM UPGRADES





MD 166 Park and Ride

The MD 175 project in Odenton provided the highest benefits associated with any of the 29 signal system upgrades. The network delay reduction associated with this project amounted to an estimated 102,000 vehicle hours annually. Overall, the signal retiming and optimization modifications provided an estimated reduction of 866,000 hours of delay for motorists and saving almost 300,000 gallons of gasoline. The fuel, delay and emissions savings resulted in approximately \$29.6 million total annual user cost savings.

2. MULTI-MODAL

a. Park and Ride

Park and ride lots reduce single occupant vehicles on the roadway network and encourage transit use and ride-sharing. The SHA and MDTA have established a park and ride lot network in Maryland. 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. Together SHA and MDTA operate 104 park and ride lots in 20 counties providing a total of 13,062 spaces, ranging in size from less than 15 spaces to more than 800 spaces (MD 5 in the Waldorf area of Charles County and MD 665 at Riva Road in the Annapolis area of Anne Arundel County are the largest). A new 98 space park and ride lot was constructed in 2014 in Washington County at I-81 and MD 68. Other expansions include 75 new spaces at MD 4 at MD 408 in Anne Arundel County, 50 additional spaces at the I-83 at MD 439 lot in northern Baltimore County and 99 new spaces at I-70 at MD 17 in Frederick County. The lot in Charles County at MD 231 and the County Fairgrounds was eliminated resulting in a loss of 20 spaces. Other minor adjustments occurred in the number of spaces in the network.

The 104 lots were surveyed during the spring and fall of 2014 to determine the number of occupied spaces. Over 7,500 spaces were utilized on a given day accounting for about 60% of the total spaces. The park and ride lots which saw the largest increase in the number of motorists parking were:

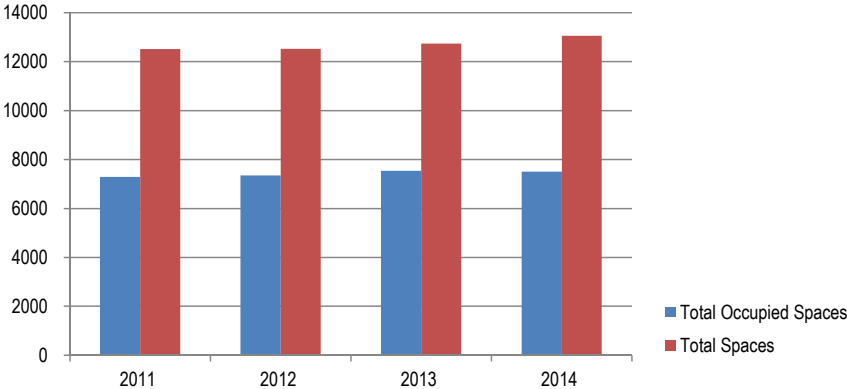
- MD 210 @ MD 373
- I-95 @ I-495
- I-70 @ MD 65
- MD 32 @ Broken Land Parkway
- I-195 @ MD 166
- I-95 @ MD 152



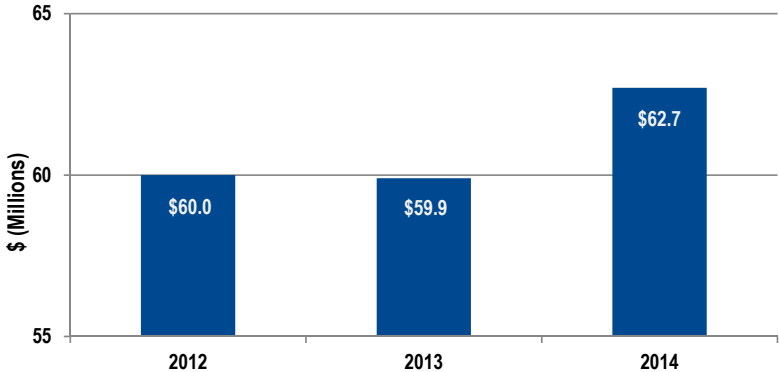
MD 187 South of I-270

The surveys at these six lots indicate a minimum of a 25 vehicle increase in usage and up to 115 vehicles at the MD 210 and MD 373 lot in southern Prince George’s County. It is estimated SHA and MDTA park and ride lot facilities result in a 112 million reduction in VMT on roadways. This mileage reduction amounts to a savings of approximately \$63 million in annual user costs. The total occupied spaces and total number of spaces are illustrated in the following graph along with the annual user savings over the past three years.

SHA/MDTA PARK AND RIDE LOT SPACES AND USERS



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





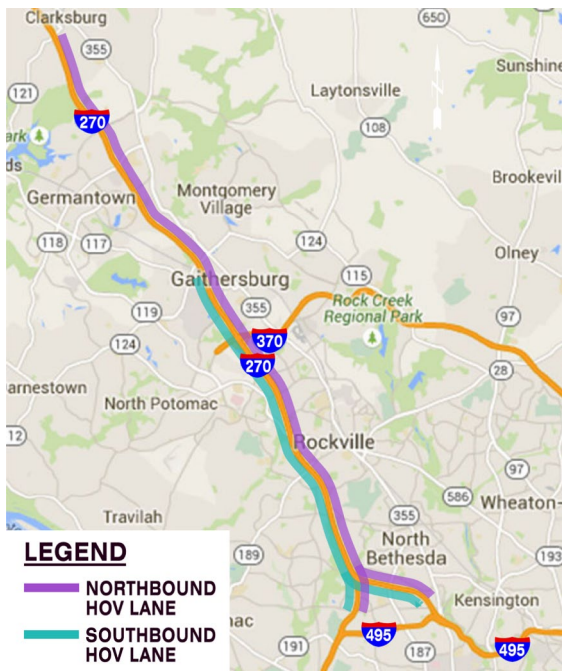
I-270 North of Rockledge Drive

b. HOV Lane Operation

High occupancy vehicle lanes (HOV) are in use in two locations in Maryland. These lanes maximize person throughput by offering a travel time savings for multiple occupant vehicles over single occupant vehicles. In Maryland, HOV lanes restrict access to vehicles with two or more occupants, transit vehicles, motorcycles or plug-in electric vehicles (permits required). The goal of this mobility measure is to allow the HOV lanes to operate near free flow speeds when the general purpose lanes experience congestion and lower travel speeds. The 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.

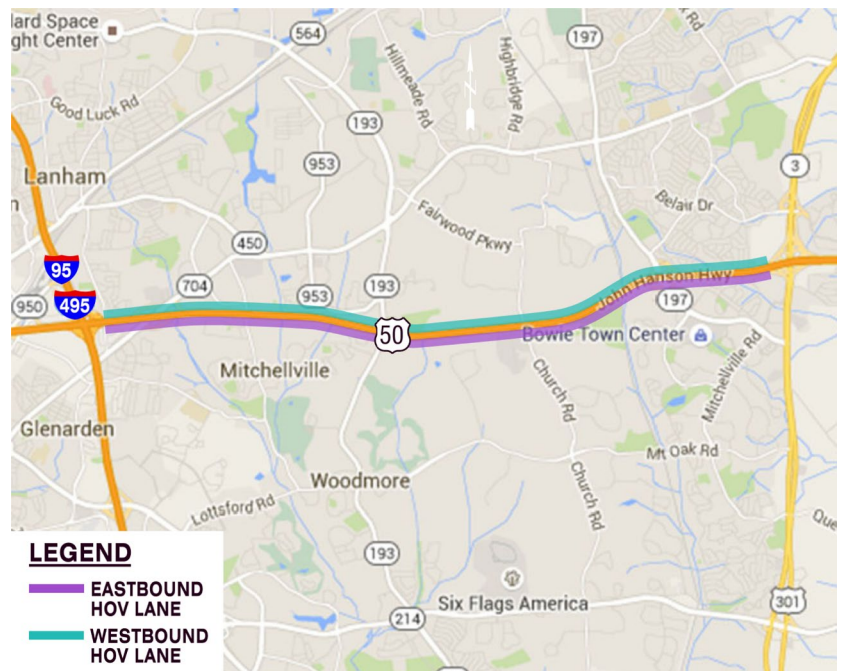
The I-270 HOV lanes operate southbound from 6:00 to 9:00 AM and northbound from 3:30 to 6:30 PM while the US 50 HOV lanes function the entire day. HOV lanes, in combination with park and ride lots, increase person throughput and provide a viable alternative transportation mode for commuters in Maryland. This provides an effective Active Travel Demand Management (ATDM) strategy.

HOV LOCATIONS



I-270 Northbound I-495 to MD 121

I-270 Southbound MD 117 to I-495

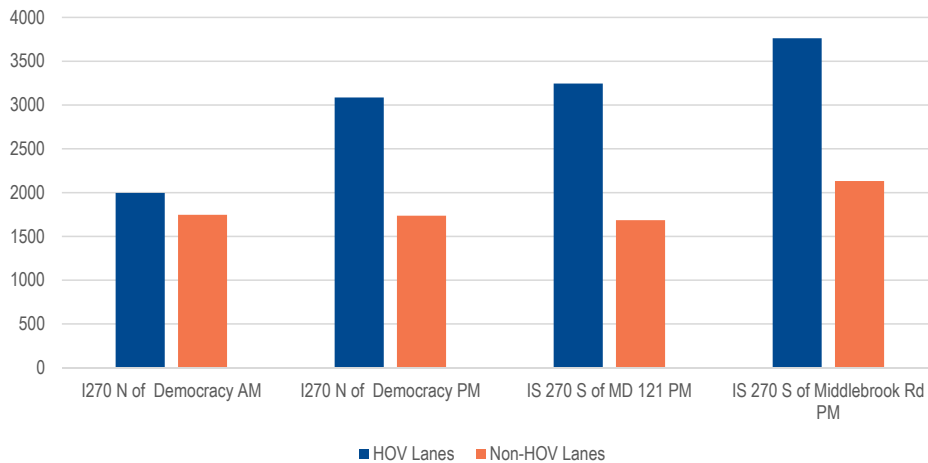


US 50 - US 301 to I-95

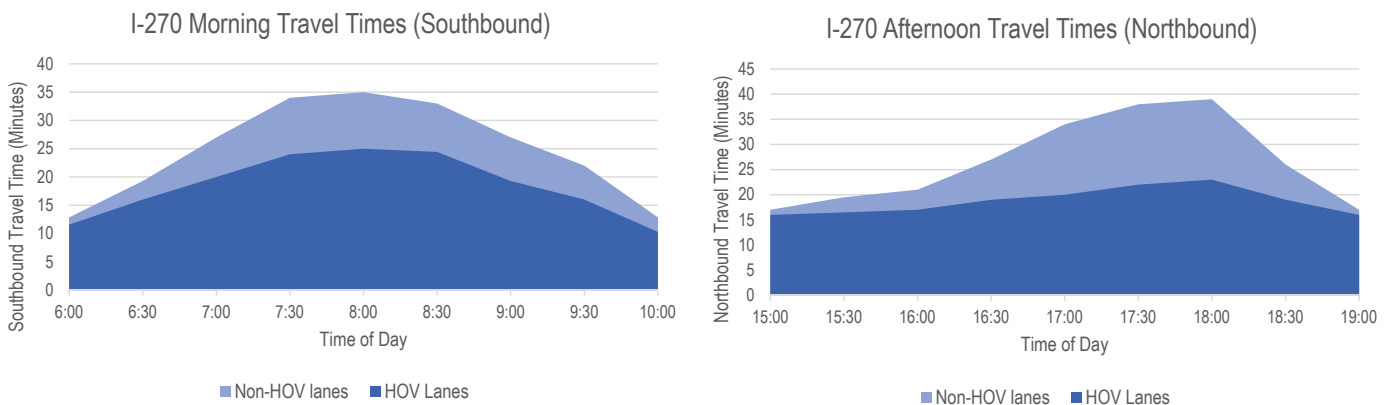
Surveys were performed along I-270 to evaluate the effectiveness of the HOV lanes, including analyzing person throughput and travel time savings. Person throughput evaluates the total number of people moved in each lane. On I-270 the HOV lanes transported approximately 200 to 1,500 additional people compared to an average general purpose lane.

The HOV lane carries as much as 3,500 persons per lane per hour as shown in the following chart:

I-270 PERSON THROUGHPUT PER LANE PER HOUR



Motorists utilizing the I-270 HOV lanes experienced a significant savings in travel time. In the morning peak period, this amounted to up to 10 minutes with an average of 6 minutes. The afternoon peak period provided even greater travel time savings with a maximum of approximately 16 minutes and an average of 8 minutes. This resulted in a 131,000 person-hour time savings amounting to \$4.75 million dollars. These savings were calculated using travel time data collected from permanent Bluetooth sensors on I-270. It is estimated that 182,000 gallons of gasoline were saved by the HOV lanes. The following figures show the average travel time savings on the HOV lanes during the AM and PM peak period of operation.



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 \$380,000 in annual benefits. This means a total of over \$5.13 million in savings for both HOV facilities in Maryland.



MD 177

c. Reversible Lane Operation

There are selected corridors in Maryland with high directional traffic volumes in the peak periods. In order to maximize vehicle throughput, reversible lanes are utilized. Reversible lanes operate through the use of overhead lane control signals designating the middle lane(s) to alternate with the peak flow of traffic. This improves capacity in the section where the reversible lanes are utilized, decreases congestion and can assist in reducing congestion related crashes. The 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 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

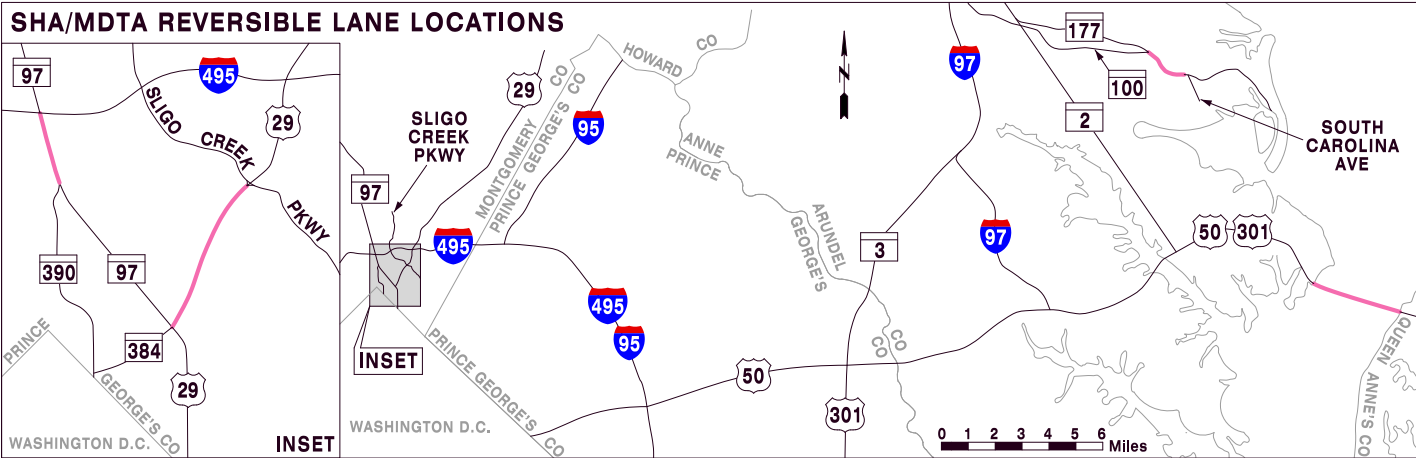
The most recognizable reversible lane operation is on the US 50/US 301 Bay Bridge. Traffic on the two lane eastbound span and the three lane westbound span alternates through the use of overhead lane signing. This allows for three eastbound lanes and two westbound lanes. The changeover occurs as needed during the PM peak period and on Saturdays mornings during the summer. The US 29 and MD 97 reversible lane operations improve traffic flow from residential areas into the downtown Silver Spring employment center and the WMATA METRO Red Line. The lanes operate southbound in the morning and returning northbound in the PM peak period. MD 177 is the main roadway leading to Lake Shore and Gibson Island. Traffic volumes are directional leading off the island in the morning and returning home in the evening. This three lane roadway is converted from two lanes westbound in the AM peak period to two lanes eastbound in the PM peak period.

B. PROGRAMS AND POLICIES

The following are the number of motorists in the peak hour that utilize the reversible lane or lanes:

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	1,550 (1,350)	1,050 (1,350)
US 50/301	N/A (3,000)	N/A (1,550)
MD 97	2,700 (3,100)	650 (800)
MD 177	1,075 (1,375)	375 (325)

The use of reversible lanes allows for increased person throughput and reduced congestion without significant capital investment. This reduces the need to widen the roadway and impact surrounding residents, businesses and environmental resources. It should be noted that Maryland 2 (Hanover Street) bridge over the Patapsco River in Baltimore City operates with reversible lanes but is maintained by the Baltimore City Department of Transportation. The reversible lane locations for SHA/MDTA facilities are shown on the following map.





MD 144 West of I-695

d. Bicycles and Pedestrians

Safe and efficient bicycle and pedestrian accommodations are crucial to creating a transportation network that accommodates all users of the road. Bicycle and pedestrian facilities are increasingly important in urban areas and near transit stations where there are significant numbers of pedestrians and cyclists. MDOT completed the “Maryland Twenty Year Bicycle and Pedestrian Master Plan” in January 2014. The master plan provides the vision and direction for bicycle and pedestrian improvements in Maryland.

The Maryland SHA incorporates a Complete Streets policy to create a transportation system that balances all users of the roadway, including pedestrians, transit, bicyclists, and motorists. By incorporating a Complete Streets policy, this impacts all areas in SHA. The construction of bicycle and pedestrian facilities is implemented through the planning, design, and construction phases from project development to design to construction.

Maryland SHA has developed various programs to implement the planning, design, and construction of bicycle and pedestrian facilities throughout the state, including:

Sidewalk Retrofit

The sidewalk retrofit program improves mobility for the general population and persons with disabilities by removing barriers that impede movement of citizens and lower potential safety risks. This program advances MDOT’s vision of multi-modal transportation by providing pedestrian facilities and enhancing access along state routes in existing communities as viable and safe modes of transportation. The major emphasis is to provide new sidewalks as part of a request from a local government, or due to a high rate of pedestrian crashes at a location.

Bicycle Retrofit

The Bicycle Retrofit program ensures bicycling remains a viable mode of transportation. The program identifies projects along state roadways that enhance bicycle mobility and safety while minimizing the impacts to environmental features or requiring private property (right-of-way). The range of improvements could include minor enhancements to safety such as signing and marking corridors for bicycle access, remarking wide curb lanes or shoulders as bike lanes, changing the typical section of the roadway to accommodate bicyclists or creating new off-road bike trails parallel to a roadway within the context of performing practical design.

Bicycle and Pedestrian Priority Areas (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. MDOT completed the “Maryland Twenty Year Bicycle and Pedestrian Master Plan” in January 2014. The master plan provides the direction for bicycle and pedestrian improvements for the State of Maryland including the Bicycle and Pedestrian Priority Areas (BPPA's). The designation allows the state and the local counties to emphasize bicycle and pedestrian improvements and requires a plan be developed in cooperation between the counties and MDOT. MDOT will release further guidance and criteria for designation by the end of 2015.

Transportation Alternatives Program

This program involves various projects including the construction of bicycle/pedestrian facilities, construction of safe routes for non-drivers, converting abandoned rail lines to bicycle/pedestrian trails and the planning/design of pedestrian/bicycle facilities. The projects associated with this program provides for the enhancement of cultural, aesthetic, historic and environmental aspects of the intermodal transportation system.

Recreational Trails Program

The construction of new trails or the maintenance/rehabilitation of existing trails is the primary purpose of the Recreational Trails Program. The program is federally funded and can be utilized for trails that support hiking, biking, water sports, snow sports, in-line skating and equestrian usage. It is part of the Transportation Alternatives Program but has its own dedicated funding source at SHA.

Safe Routes to School Program

The promotion and safety for children in kindergarten to eighth grade to walk to school is the goal of the Safe Routes To School Program. Elements of this program include education, enforcement near schools and public awareness campaigns. Construction projects could include sidewalk improvements, traffic calming, bike/pedestrian crossing improvements, on and off street paths and traffic diversion. This program is included as part of the Transportation Alternatives Program.

ADA Retrofit Program

This fund was established to upgrade existing sidewalks, curb ramps, intersections and driveway entrances along state roadways for compliance with the Americans With Disabilities Act (ADA). The location of these projects are not limited to priority funding areas.

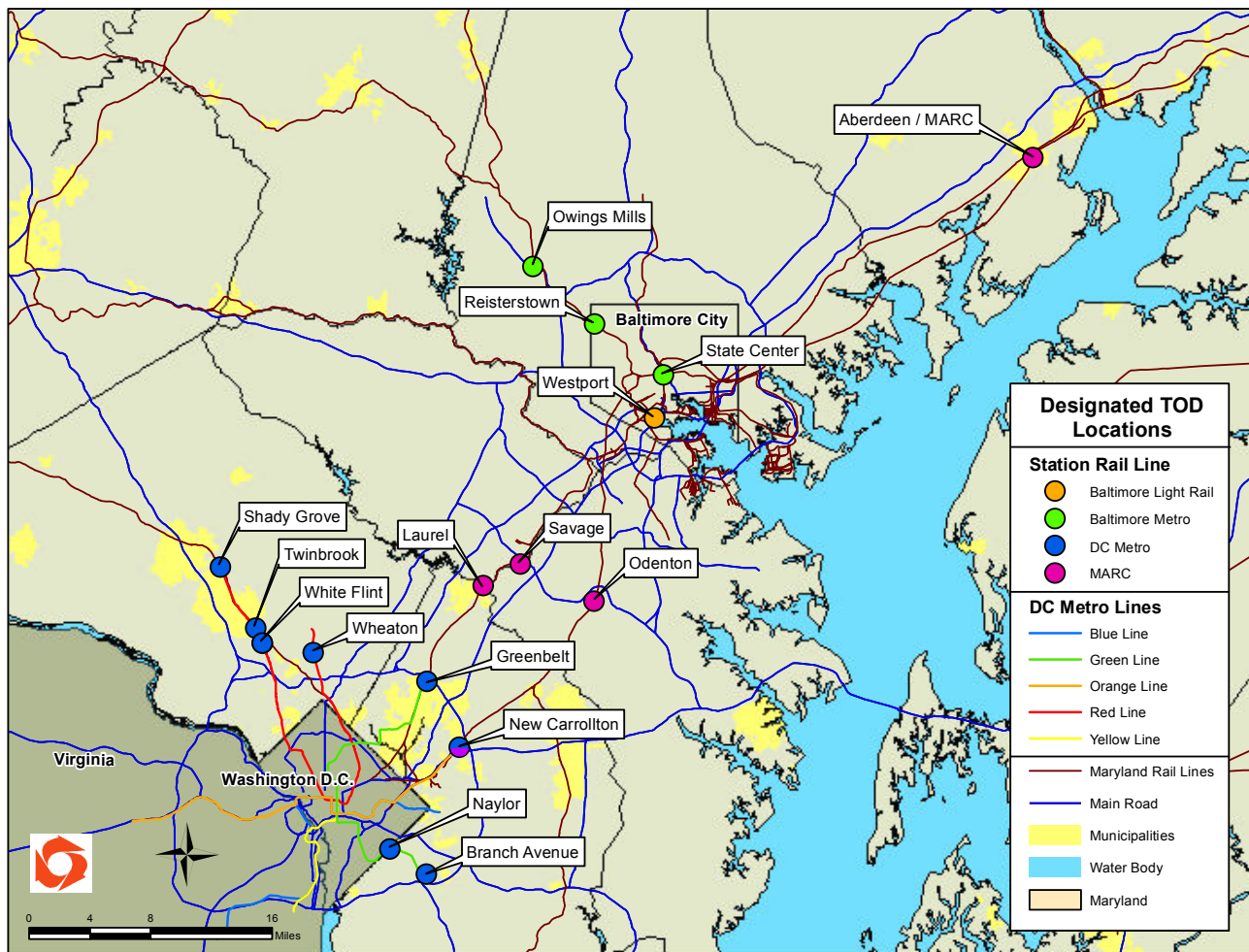
Urban Reconstruction Program

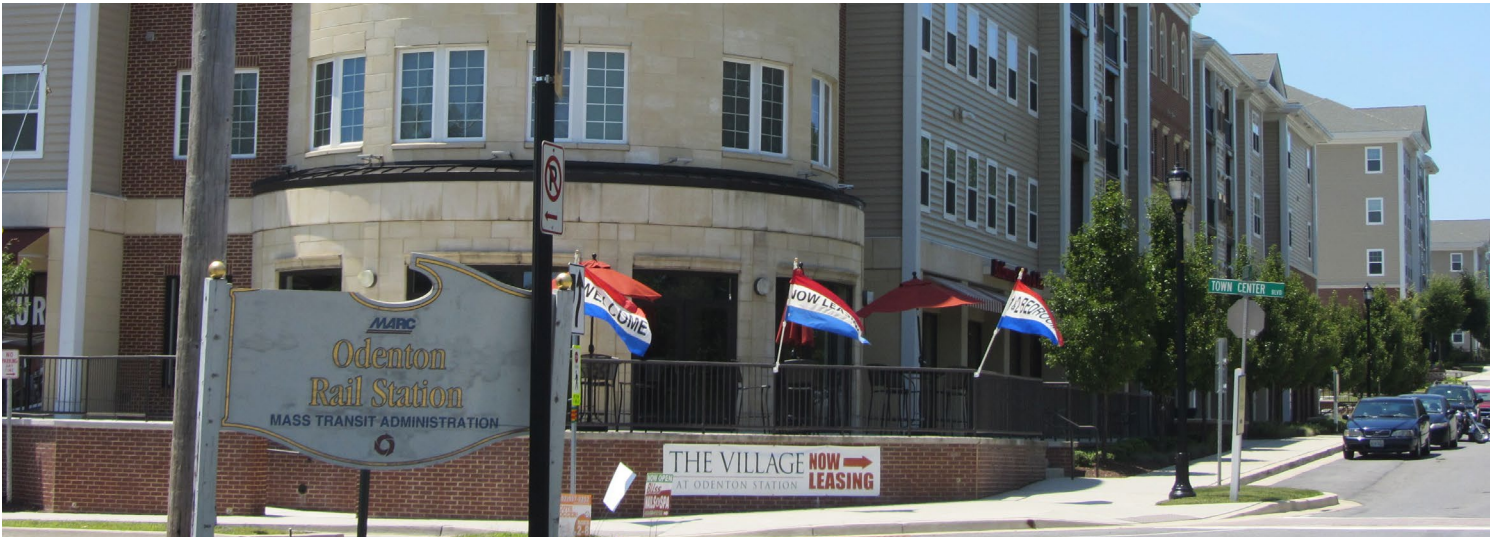
Urban Reconstruction Program projects are located in priority funding areas. These projects promote safety and economic development in communities. The local entity must support the project through maintenance of the sidewalks after completion of the construction.

e. Transit Oriented Development

The creation of Smart Growth policies led to the implementation of Transit Oriented Developments (TOD). These incorporate a mix of land-uses that is physically and functionally integrated with transit, reduce auto dependency, increase pedestrian and bicycle trips, foster safer station areas, offer attractive public spaces, enhance public transportation ridership and encourage revitalization. TODs offer many positive elements including reducing traffic congestion, fuel consumption, air pollution, greenhouse gas emissions, sprawl, and local infrastructure costs, while increasing the mobility of citizens by providing more convenient access to mass transit.

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 program started in 2008. There are now 16 sites which have been designated as TOD's with the latest being the Greenbelt Metro Station in 2013.





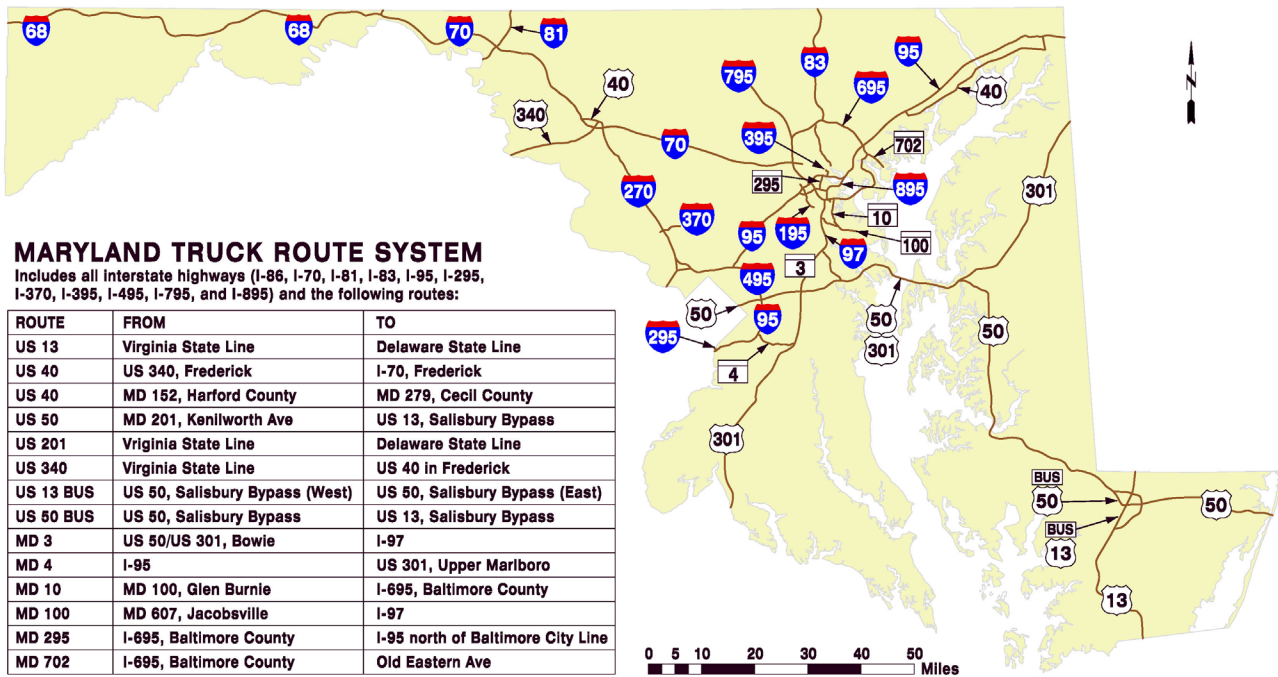
Odenton TOD

A joint effort has been established by MDOT and the Washington Metropolitan Area Transit Authority (WMATA) to develop and refine processes and policies to support TOD development. These documents detail the State's role in promoting TOD's and provide guidance to developers, county and local jurisdictions, and citizens on the TOD process in Maryland. This was developed not only for official designated sites but also for TOD at non-designated transit stations.

Various TODs are at different stages of occupancy and construction. The Owings Mills Metro Station is one of the most active TOD's. The Baltimore County Library and the Baltimore Community College have branches at this TOD. The first phase of the METRO Crossing Apartments are being rented. A new parking garage was constructed in 2014. Another on going TOD project is at Odenton/Annapolis Junction. Construction is taking place on a mixture of housing and retail, set to open in 2015. The remainder of the development will proceed as the market dictates.

3. FREIGHT

The movement of freight is critical to distributing goods and services throughout Maryland and the East Coast. Although this is vital to the economy, residents often prefer to prohibit trucks near their homes. Maryland established the Maryland Truck Route System which consists of approximately 900 miles of roadways throughout the State. This 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. Maryland SHA is in the process of updating its truck route system to further address intermodal movements, truck network gaps, improve connections and identify other routes experiencing a high-severity index related to truck crashes. Other programs and policies include improving at-grade railroad crossings through the Highway-Rail Crossing Program, programs to construct virtual weigh stations and CVISN facilities and the on-going development of the Maryland One Hauling Permit System.



Freight is integrated into highway project planning as a result of the SHA/MDTA Freight Implementation Plan. This document provides direction for future transportation investments to enhance the safe and efficient movement of commercial vehicle freight.