MARYLAND

2015

STRATEGIC GOODS MOVEMENT PLAN

Maryland Department of Transportation

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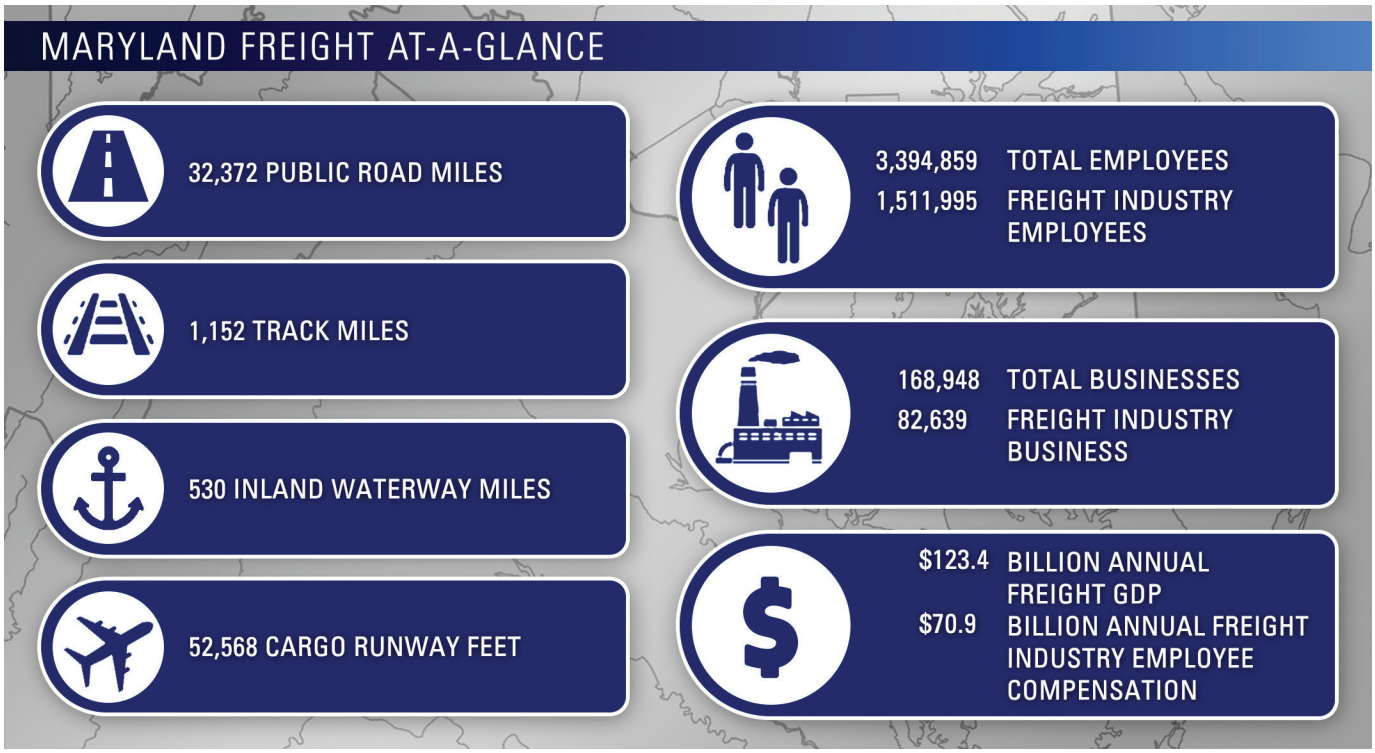
1.0 INTRODUCTION

Maryland business travels on a high-quality multimodal freight transportation network. The freight network is the foundation of a supply chain that supports diverse companies and institutions. Reliable access to the air and water ports, highways, and rail networks enable businesses to meet their customers' needs in the State and beyond. A free flowing freight system leads to lower costs of goods that consumers and companies need for good quality of life and successful enterprise. Ensuring that the network of highways, railways, waterways, and airports are ready to handle the current level and anticipated growth of goods movement is a priority of the Maryland Department of Transportation (MDOT). The Department's overarching goal is to help improve Maryland's economy by making the goods movement system more efficient, reliable, and safe.



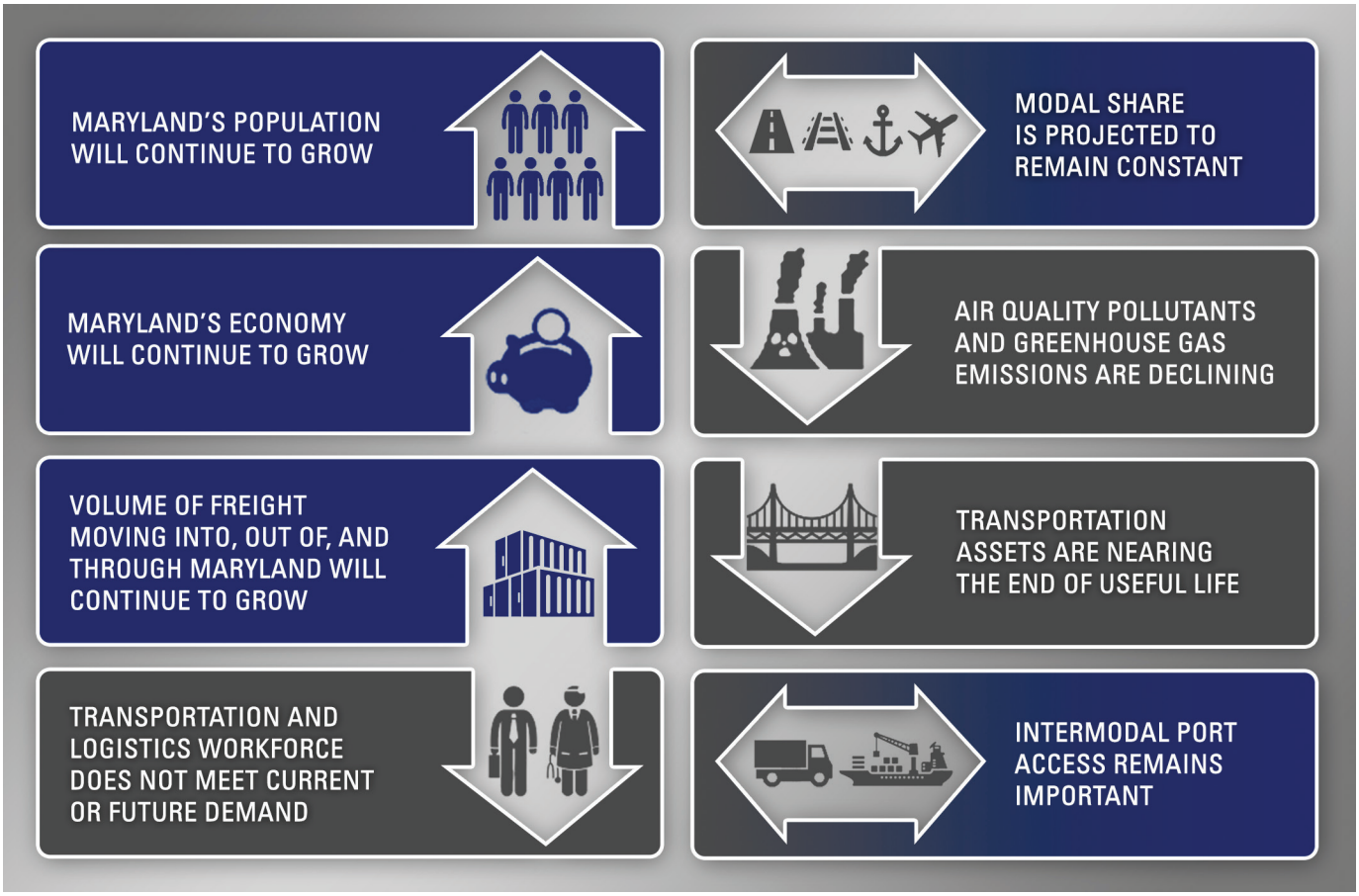
WHAT IS "GOODS MOVEMENT?"

The term "goods movement" in the context of the Plan describes the conveyance of raw materials and finished goods from supplier to end user. Raw materials are heavy cargo such as energy products, construction materials, and agricultural products. These types of cargoes move through industrial, manufacturing, and agriculture supply chains. Finished goods are business materials and consumer items that are moved via a range of transportation services through wholesale, retail, and service support supply chains. Use of the term "goods movement" in the Plan is an attempt to capture the broad variety of items that rely on a strong transportation system to fuel Maryland's economy and support Marylanders' quality of life.

1.1 PLAN PURPOSE

Maryland's multimodal transportation system for goods movement provides a critical support structure for the economic vitality of the State and surrounding region. The volume of goods moving into, out of, and through Maryland continues to grow. The logistics chains of Maryland industries continue to evolve. It is critically important that Maryland's transportation agencies are well-equipped to understand current goods movement patterns, monitor trends and projections, be flexible to respond swiftly, and anticipate future needs. This Strategic Goods Movement Plan examines existing conditions and long-range projections, and recommends policy positions and strategies for MDOT and freight stakeholders to advance over the next five years.

The Strategic Goods Movement Plan acknowledges several key trends that are drivers for goods movement demand and performance of the goods movement transportation system, including:



MDOT and freight stakeholders have implemented many of the policies and guidance recommended in the 2009 Plan, such as establishing freight performance measures, and have planned, designed, and constructed several significant projects. This Strategic Goods Movement Plan continues the focus on multimodal freight policy and provides guidance without being prescriptive in terms of program and project selection.

Each of MDOT's modal administrations[1] will develop freight projects and programs in their own freight-related planning documents that advance the strategic direction specified in this document. These modal plans will be incorporated as modules to this document, thereby creating a complete MDOT freight plan package. The modular format is comparable to other transportation planning efforts within MDOT, such as the 2035 Maryland Transportation Plan, which provides overarching policy direction, goals and objectives that are then delivered through the modal administrations' functional plans and business plans.

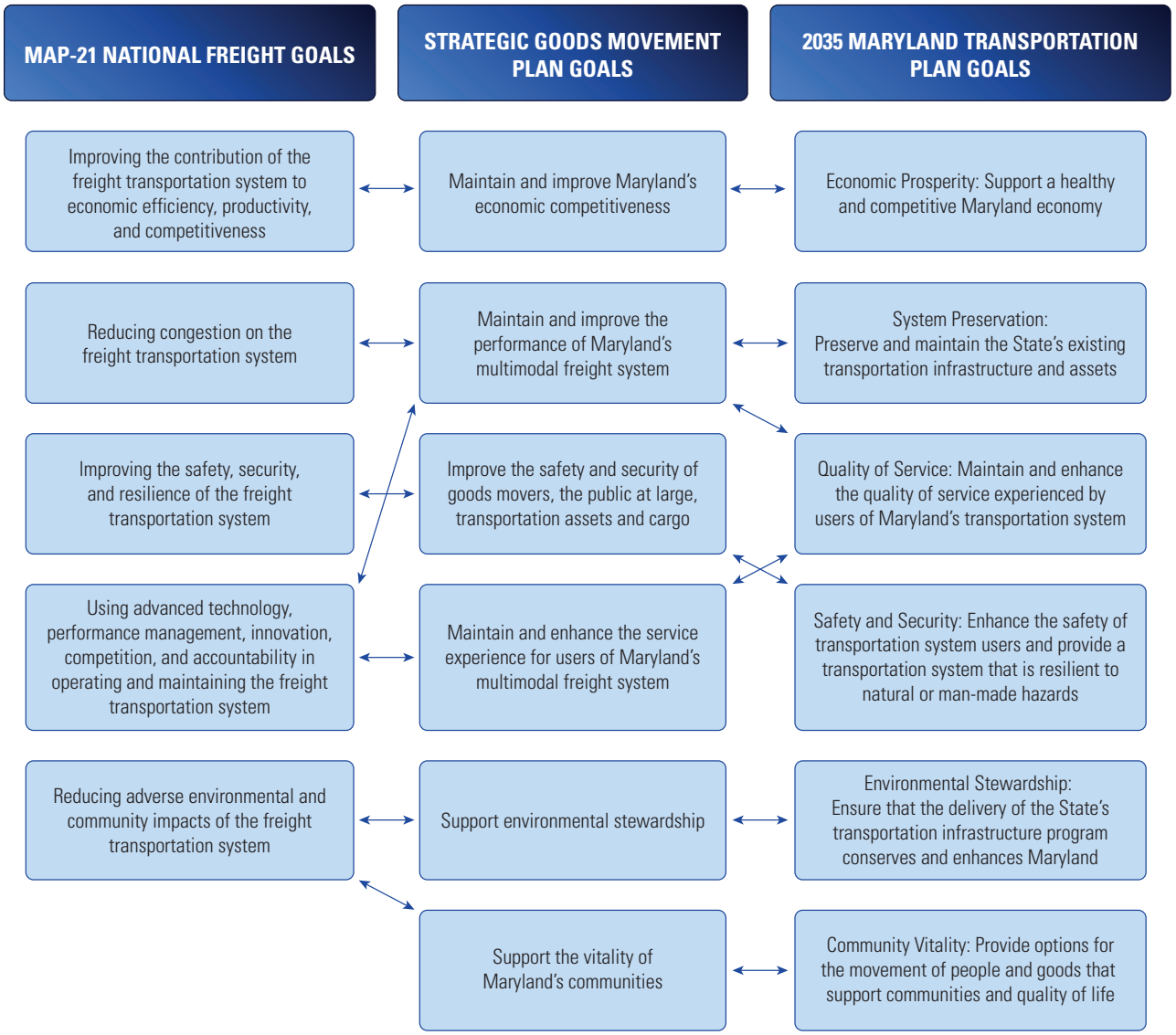
The modular freight plan package, containing both the strategic plan document and modal freight planning documents, could be presented as a cohesive package when necessary, such as for a State freight plan approval by the United States Department of Transportation (USDOT).

The Plan recognizes that goods movement relies on private infrastructure in addition to public infrastructure. The strategies in this document will help Maryland reach its goals only with the engagement and participation of the private sector. Private sector freight providers and system owners should use the Plan to understand MDOT's intended strategic direction for goods movement as they develop programs and projects.

1.2 ADVANCEMENT OF STATE AND NATIONAL GOALS

The Strategic Goods Movement Plan follows the overarching Strategic 2035 Maryland Transportation Plan vision and goals, as well as goals and objectives of each mode. Additionally, the Plan aims to advance national freight goals specified in federal surface transportation authorization Moving Ahead for Progress in the 21st Century Act (MAP-21). The goals set forth in the three documents complement one another, and coalesce around several key themes, including:

- Economic competitiveness;
- Quality of service;
- Transportation system performance;
- Safety and security;
- Environmental stewardship; and
- Community vitality.

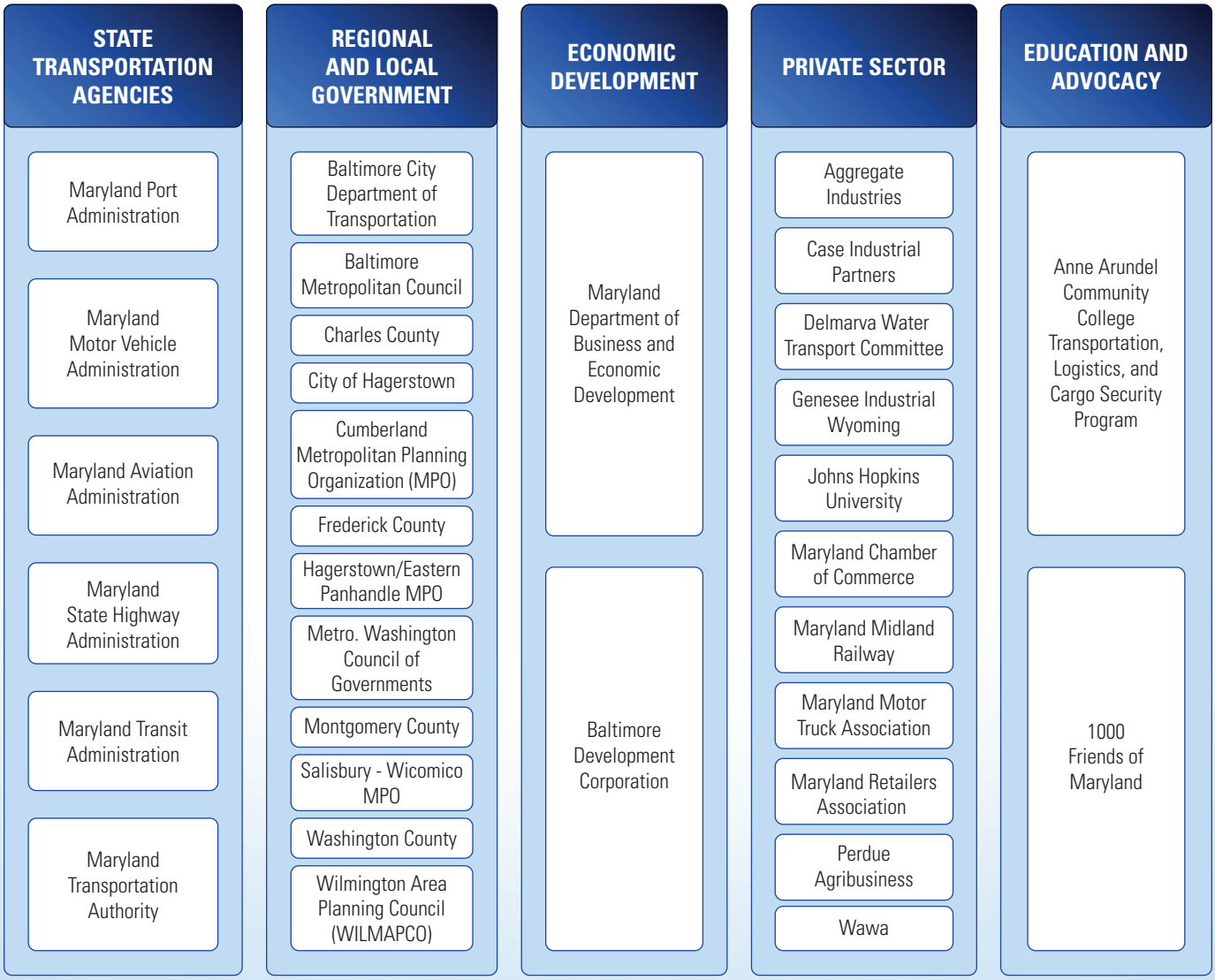


1.3 POLICY DEVELOPMENT THROUGH COLLABORATION

The development of the policies identified in the Strategic Goods Movement Plan was a collaborative effort led by the Secretary's Office with contributions from the modal administrations. The Plan also benefits from input from external stakeholders, such as private sector freight providers and system users, and representatives from other State, regional, and local agencies. Opinions on the direction and needs for freight transportation in Maryland were captured through extensive stakeholder engagement. The input, along with data and information analysis, helped to affirm and refine the goals and strategies that are reflected in this Plan.

1.4 STAKEHOLDERS AND PARTNERSHIPS

Goods movement relies on an intrinsic partnership between the freight transportation system owners and the users. The freight network consists of publicly and privately owned and maintained infrastructure. Efficient and safe transport of goods requires that MDOT and public and private sector partners work together to assess issues and towards mutually beneficial solutions. MDOT encourages all freight stakeholders to take an active interest and demonstrate a dynamic effort to meet goals and implement the strategies identified in this Plan. The public sector agencies, private sector companies, and other stakeholders shown in the figure below contributed to the development of this Plan.



2.0 MULTIMODAL GOODS MOVEMENT NETWORK

Businesses in Maryland generate products that are shipped throughout the world while simultaneously demanding goods that are produced across the globe and shipped to Maryland. Domestic and international goods move through the Port of Baltimore or other seaports in the US, BWI/Marshall Airport or other airports in the US, and by truck or rail. Maryland's goods movement transportation network is composed of the State's highway network, freight rail network, air cargo airports, waterways, seaports, and intelligent transportation systems.

Logistics networks often span thousands of miles over land, sea, and air, and require critical multimodal connections. At a state level, Maryland's logistics network includes freight shippers and receivers, freight handling facilities, waterborne freight terminals, and air cargo facilities. The highway and rail networks provide vital connections between generating, receiving, and handling facilities.

Maryland's goods movement transportation network is comprised of 32,372 public road miles, 758 rail miles, 530 inland waterway miles, and over 50,000 feet of air cargo runways. Together, these modes moved nearly 631 million tons of freight worth $835 billion, in 2012, the most recent year of available data. By 2040, more than 1 billion tons of freight worth close to $1.6 trillion, is expected to move within and through Maryland. This section describes the components of each of these networks, including the locations of key links and nodes along with an overview of performance indicators.

Table 1: Percent of Shipments by Domestic Mode, 2012 Weight and Value

Mode	Total	Within Maryland	From Maryland	To Maryland	Through Maryland
Truck Tonnage	83.9%	96.4%	92.0%	56.7%	84.6%
Truck Value	97.7%	97.9%	93.7%	94.4%	99.3%
Rail Tonnage	12.8%	0.5%	5.1%	42.2%	11.1%
Rail Value	0.9%	<0.5%	0.7%	3.2%	0.5%
Domestic Water Tonnage*	<0.5%	<0.5%	<0.5%	<0.5%	0.0%
*Domestic Water Value**	<0.5%	<0.5%	<0.5%	<0.5%	0.0%
Domestic Air Tonnage**	<0.5%	<0.5%	<0.5%	<0.5%	0.0%
*Domestic Air Value***	0.5%	<0.5%	2.0%	1.5%	0.0%

*Domestic water Includes shallow draft, deep draft, Great Lakes, and intra-port shipments, but does not include international waterborne trade through the Port of Baltimore. The domestic (landside) moves of Port of Baltimore trade are accounted for in other modes.

**Domestic air includes air cargo between U.S. and domestic origin-destination pairs. The domestic portions of international air cargo movements are accounted for in the appropriate domestic modes.

2.1 HIGHWAY INFRASTRUCTURE

Table 2: Percent of Shipments by Truck, 2012 Weight and Value

Mode	Total	Within Maryland	From Maryland	To Maryland	Through Maryland
Truck Tonnage	83.9%	96.4%	92.0%	56.7%	84.6%
Truck Value	97.7%	97.9%	93.7%	94.4%	99.3%

Maryland's roadway system consists of 32,372 centerline miles including: 785 miles of Interstates and freeways; 1,534 miles of principal arterials; 7,342 miles of minor arterials and collectors; and 22,713 miles of local roads. There are also more than

[2] Based on Freight Analysis Framework figures.

[3] 2035 Maryland Transportation Plan

[4] Ibid.

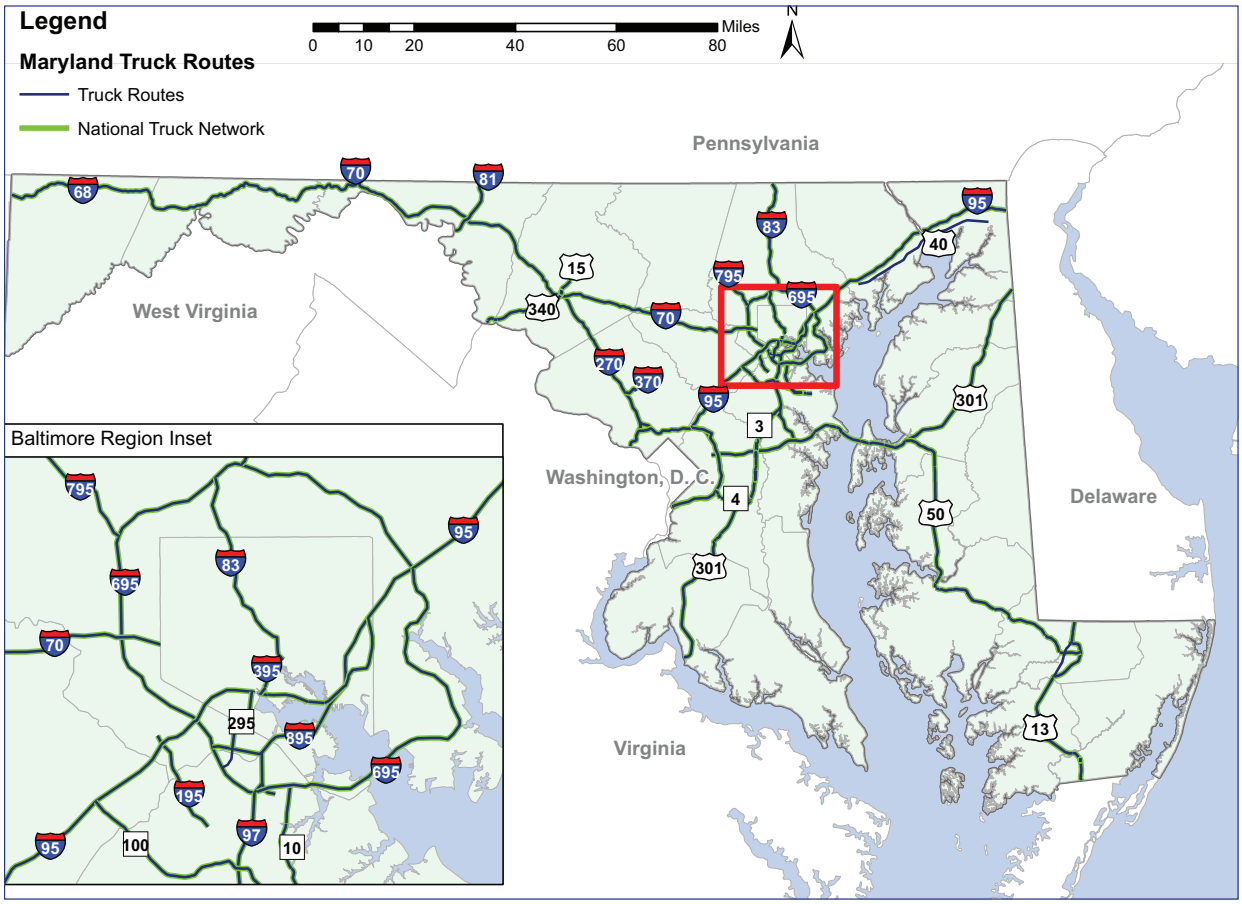
5,000 bridges across the State, including 2,712 on the State Highway system. Maryland roadways handled 529 million tons and $816 billion worth of freight in 2012.[2] By 2040, more than 850 million tons of freight worth $1.5 trillion is expected to travel on Maryland roads and highways. While goods move along the entire roadway network, the majority of freight by both weight and value utilizes the Maryland Truck Route System (Figure 1).[3] The Maryland Truck Route System is approximately 900 miles long and includes all Interstate segments in Maryland (481 miles), six segments of the US highway system (320 miles), and eight segments of the Maryland State highway network (99 miles).[4]

Highway Congestion

Evening rush hour in Maryland is the peak period of traffic congestion. Between 5:00 p.m. to 6:00 p.m., 12 percent of Maryland's freeway and expressway network was congested in 2013, and approximately 22 percent of vehicle-miles traveled (VMT) during this period were traveling in congested conditions (Figure 2). During the morning peak hour, 8:00 a.m. to 9:00 a.m., 8 percent of Maryland's freeway and expressway network was congested, and approximately 16 percent of the VMT during this period were traveling in congested conditions (Figure 3).

I-270, I-495, I-695, and I-95 between I-495 and MD 100 had the greatest number of route miles experiencing congested conditions during the morning and evening peak hours in 2013. In most urban areas nationally, peak periods for truck travel tend to occur just before the commuter peak period in the morning and well before the commuter peak period in the evening. Although trucks account for about 7 percent of miles traveled in urban areas nationwide, almost 23 percent of the cost of operating in congested conditions is borne by trucks. This estimate accounts only for the costs of operating a vehicle in congested conditions, and does not include the costs to shippers and receivers of goods that are delayed due to congestion.[5]

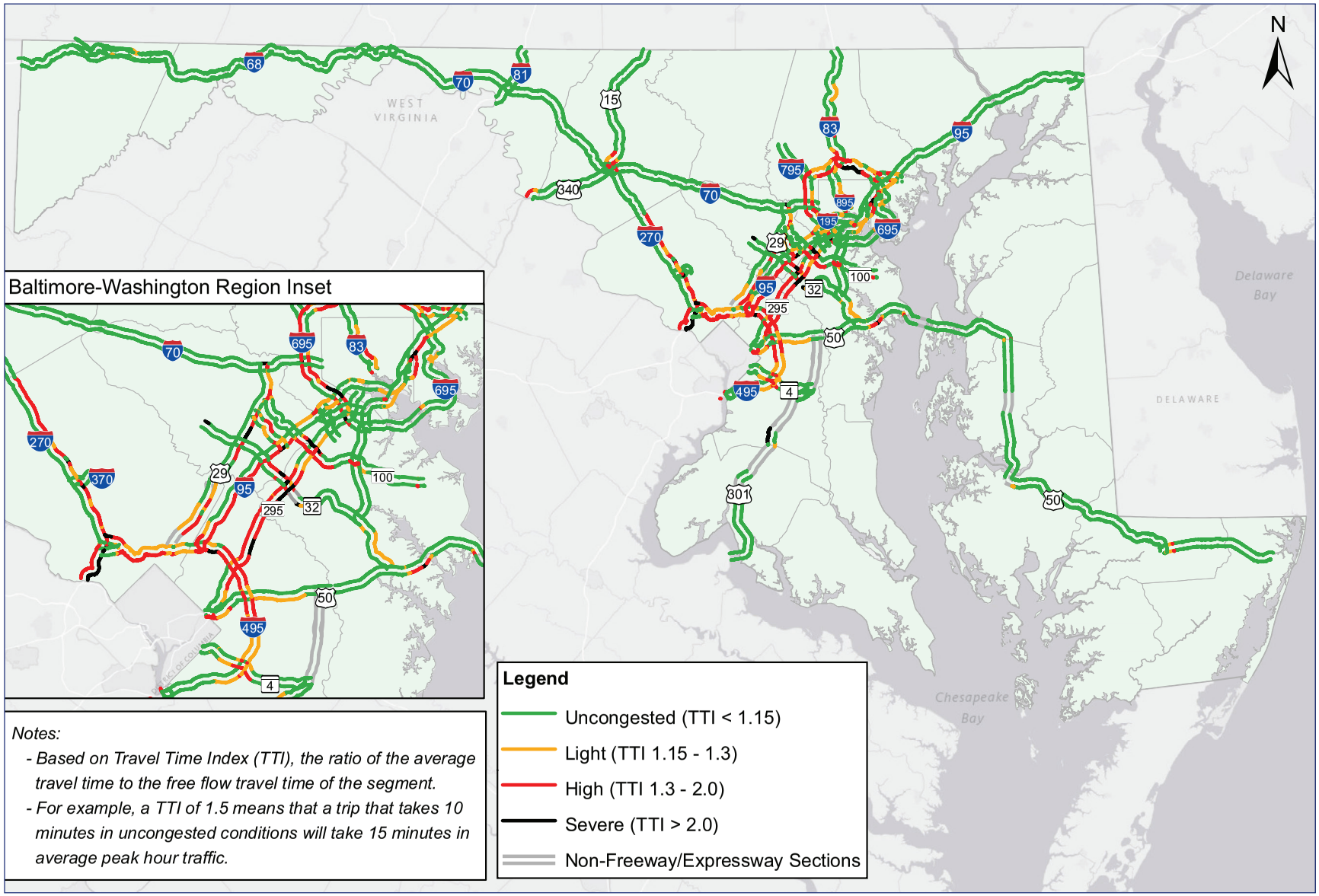
Figure 1: Maryland Truck Routes[6]



[5] "2012 Urban Mobility Report," Texas Transportation Institute

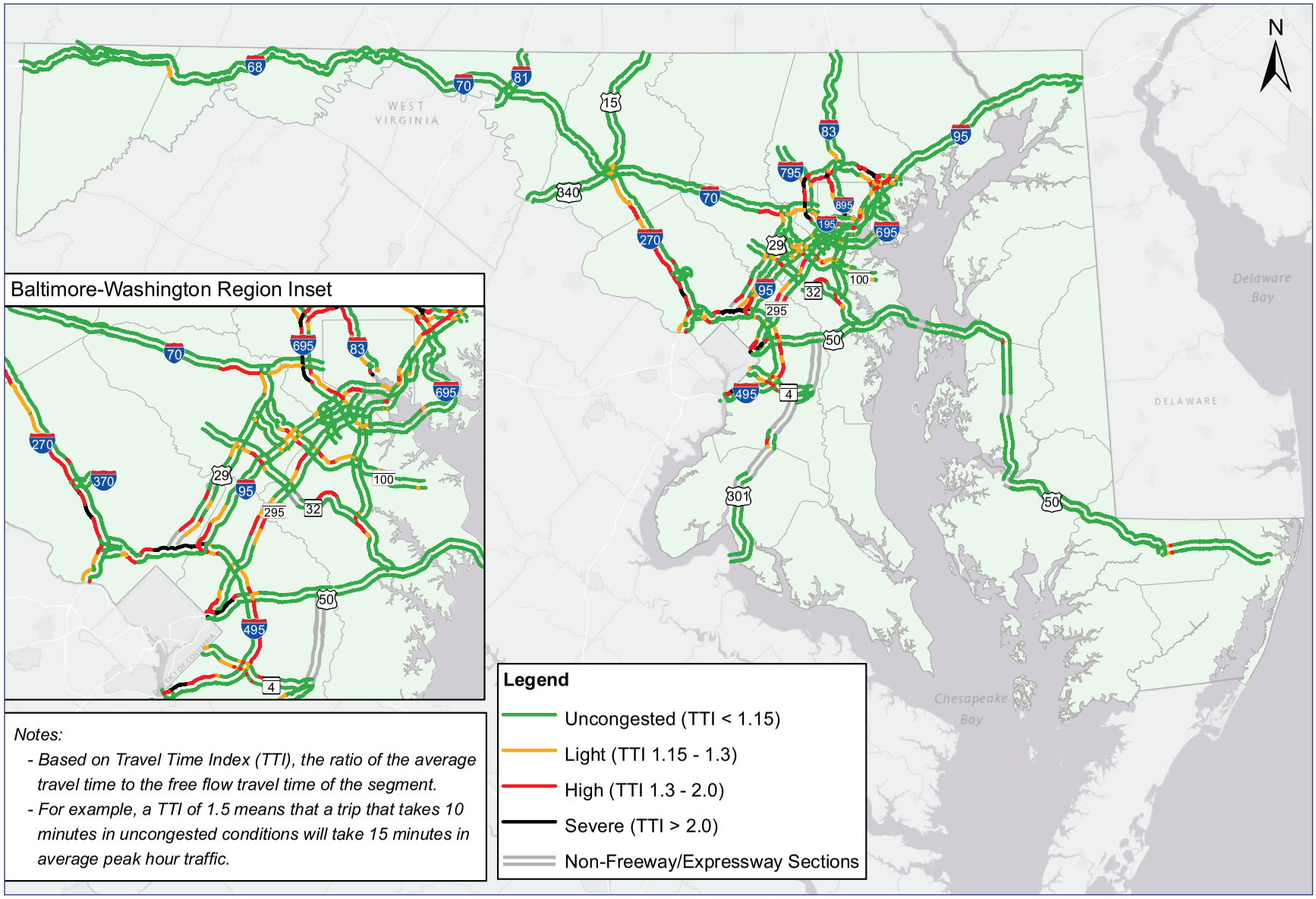
[6] The routes shown in this figure are those designated as part of the National Truck Network, authorized under the Surface Transportation Assistance Act (STAA) of 1982. Trucks may travel on any road in Maryland, except where expressly prohibited, for local deliveries and pick-up.

Figure 2: PM Peak Hour (5:00 p.m.-6:00 p.m.) Congestion on Maryland Freeway/Expressway Network, 2013[7]



[7] Source: Maryland State Highway Administration

Figure 3: AM Peak Hour (8:00 a.m. - 9:00 a.m.) Congestion on Maryland Freeway/Expressway Network, 2013



[8] Source: Maryland State Highway Administration

2.2 RAILROAD INFRASTRUCTURE

Table 3: Percent of Shipments by Rail, 2012 Weight and Value

Mode	Total	Within Maryland	From Maryland	To Maryland	Through Maryland
Rail Tonnage	12.8%	0.5%	5.1%	42.2%	11.1%
Rail Value	0.9%	<0.5%	0.7%	3.2%	0.5%

Maryland's rail network consists of approximately 1,152 miles of track and is comprised of two Class I freight railroads, four Class III short line freight carriers, one switching/terminal railroad, and one passenger railroad.[9] Four of these railroads, CSX, Norfolk Southern (NS), Maryland and Delaware Railroad (MDDE), and Amtrak own 76 percent of the entire network. The other 24 percent of the rail network consists of short lines, rail operating within ports, and track banked by MDOT for future use. Other freight and passenger rail carriers, such as MARC, operate via trackage rights and do not contribute to track system mileage.

Maryland railroads carried nearly 90 million tons and $5.4 billion dollars of freight in Maryland in 2012. By 2040, nearly 141 million tons of freight worth $10 billion is expected to move by rail in Maryland.[10]

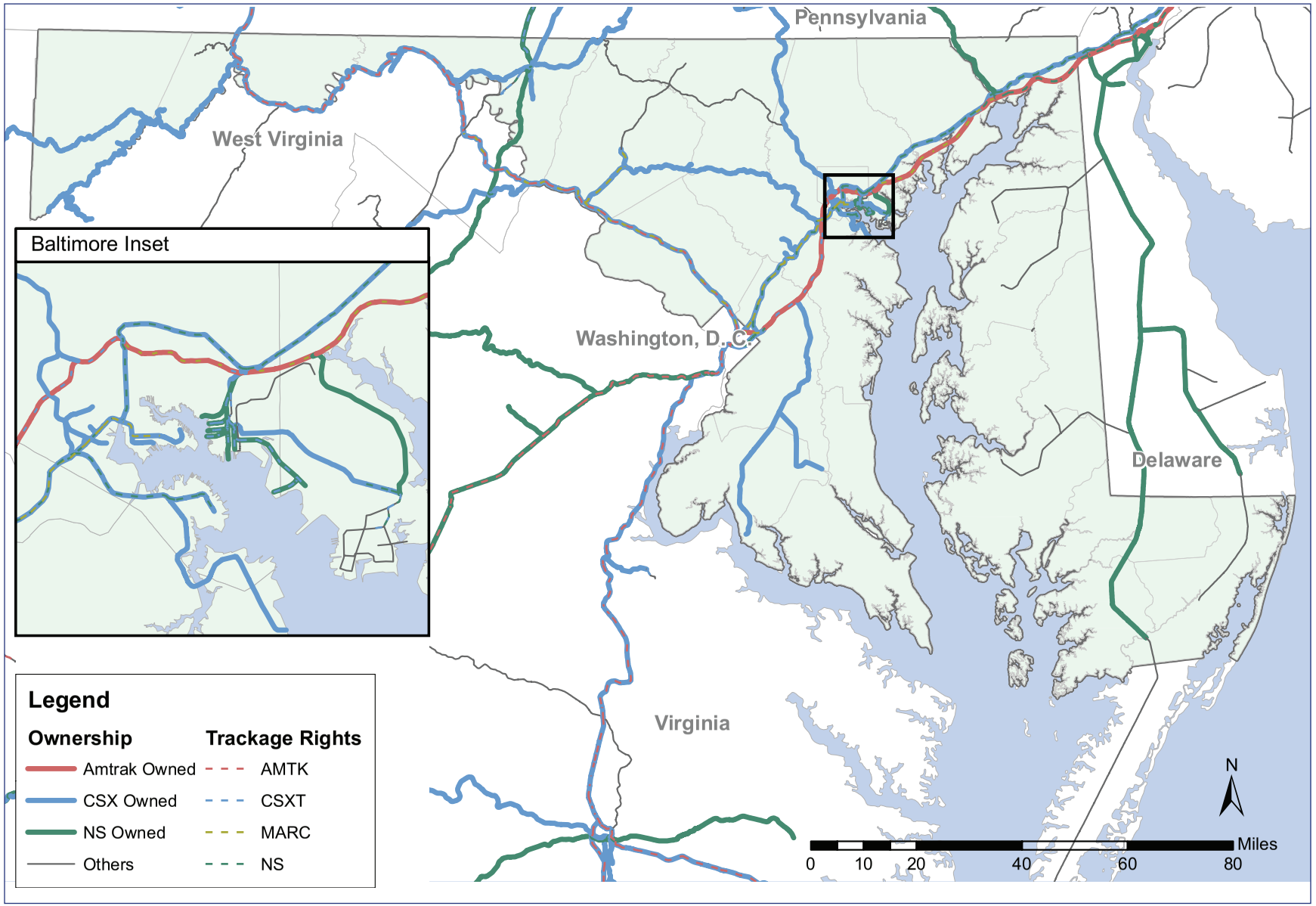
Rail Network and Density

The rail lines in Maryland with the highest freight density are the CSX Capital subdivision between Washington, D.C. and Baltimore, and the CSX Metropolitan, Cumberland, and Keystone subdivisions between Washington, D.C. and the Pennsylvania border just north of Cumberland. The latter of these two segments carries large volumes of coal and other mined materials. Both CSX and NS are investing in their rail lines in Maryland. CSX is developing the National Gateway to link Mid-Atlantic ports with the Midwest, focusing on double-stack clearance between Chambersburg, PA and ports in Virginia. NS's Crescent Corridor will connect New York and New Jersey with the Southeast and includes a major intermodal terminal in Greencastle, PA, just north of Hagerstown.

[9] Railroad classifications are based on annual operating revenue. After adjusting for inflation, annual operating revenues must exceed $250 million to be classified as Class I, be less than $250 million but in excess of $20 million for Class II, and $20 million or less for Class III.

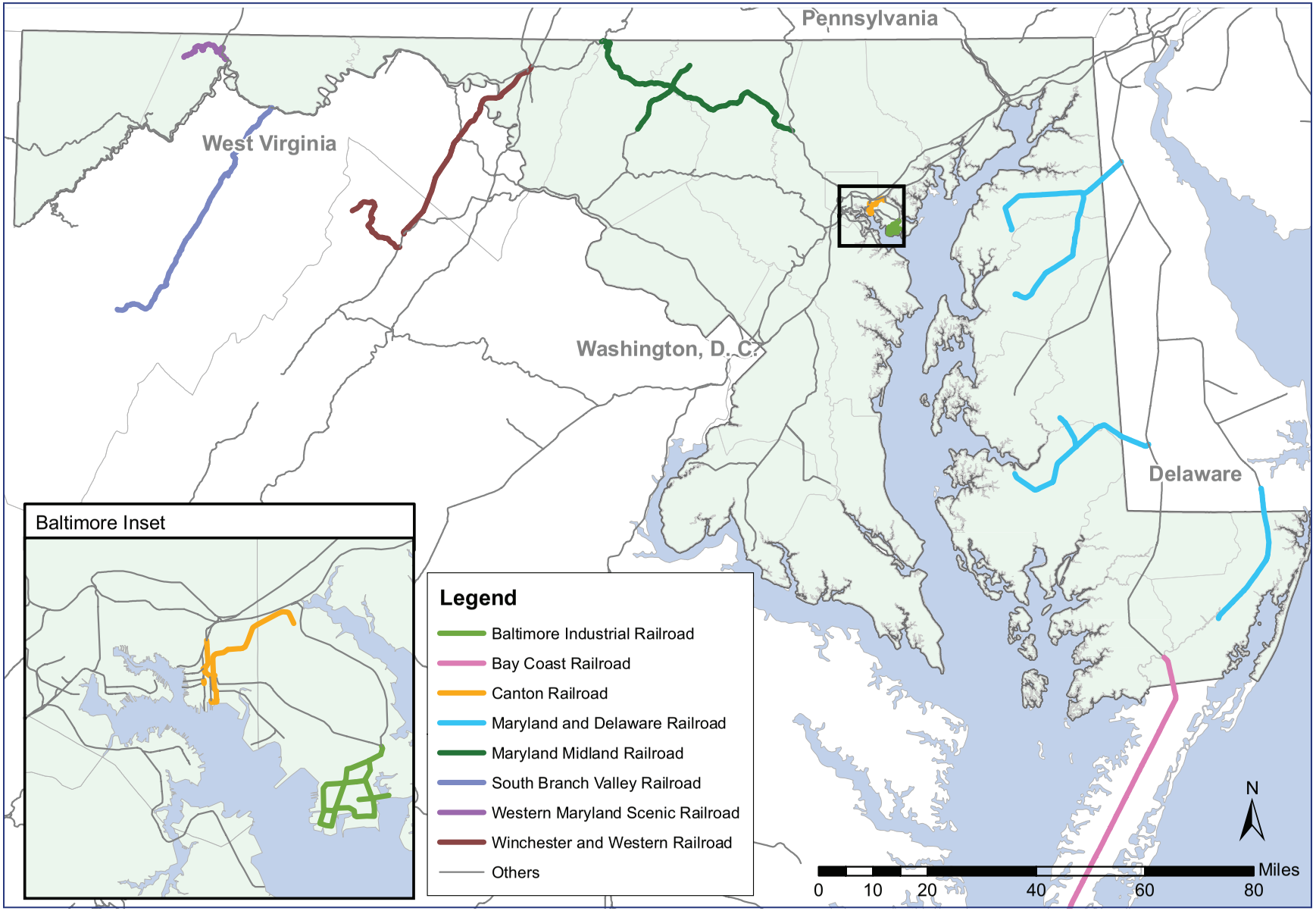
[10] Based on Freight Analysis Framework figures.

Figure 4: Maryland's Class I Freight and Passenger Railroads[11]



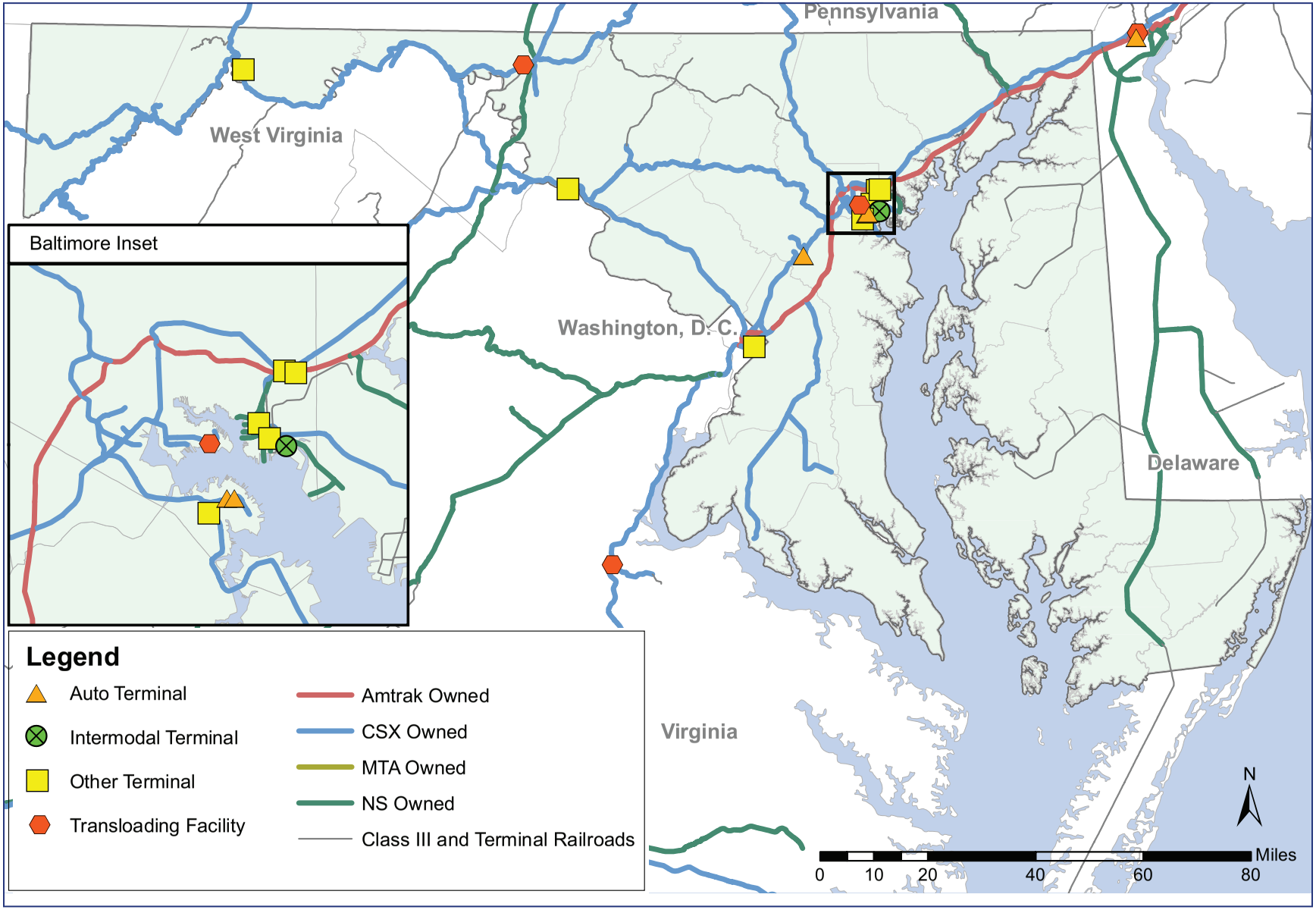
[11] Source: Maryland Statewide Rail Plan, 2014

Figure 5: Maryland's Class III and Terminal Railroad Operators[12]



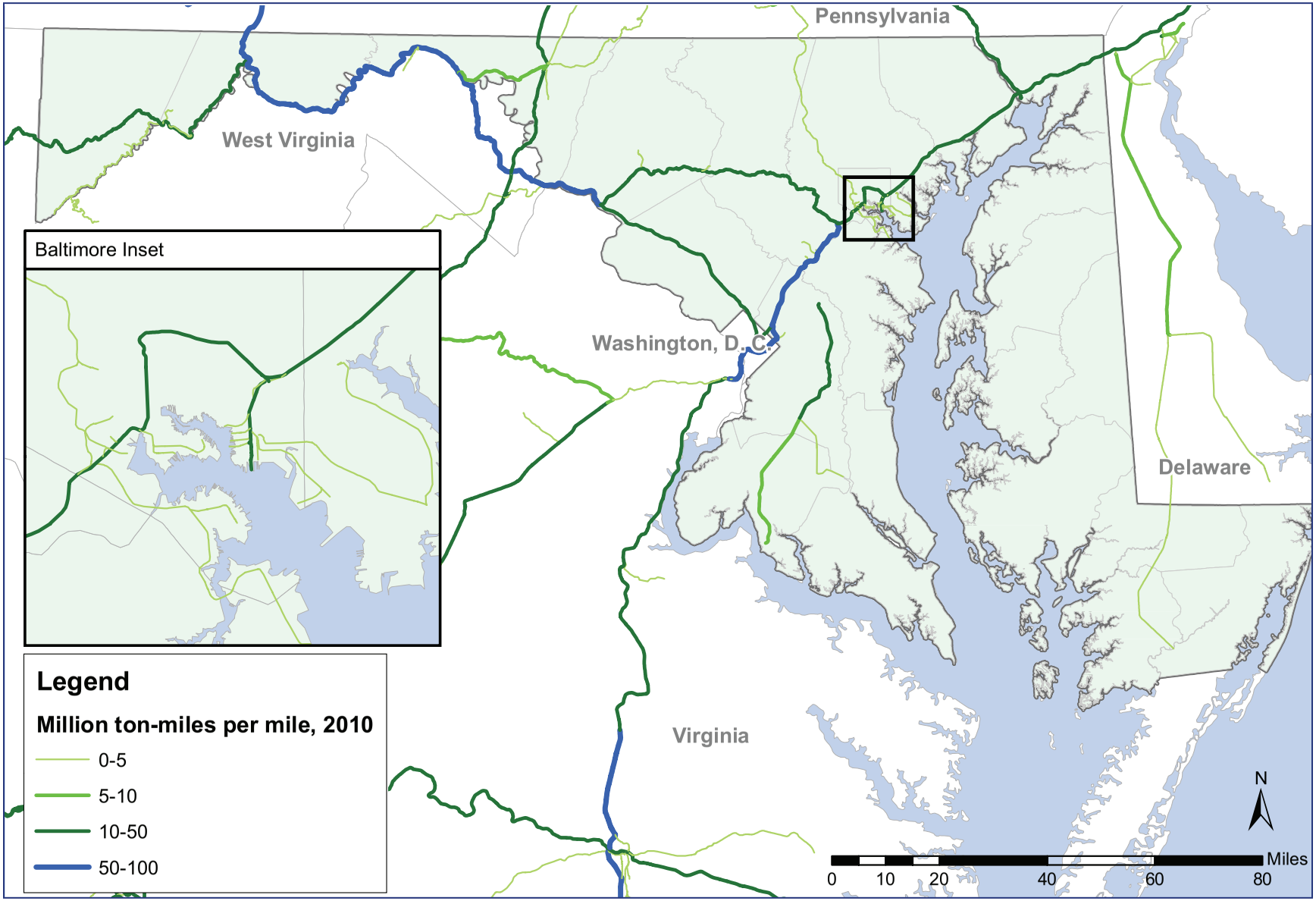
[12] Source: Maryland Statewide Rail Plan, 2014

Figure 6: Rail Terminals Within and Around Maryland[13]



[13] Source: Maryland Statewide Rail Plan, 2014

Figure 7: Class I Railroad Freight Density, 2010[14]



[14] Source: Maryland Statewide Rail Plan, 2014

2.3 PORT AND WATERWAY INFRASTRUCTURE

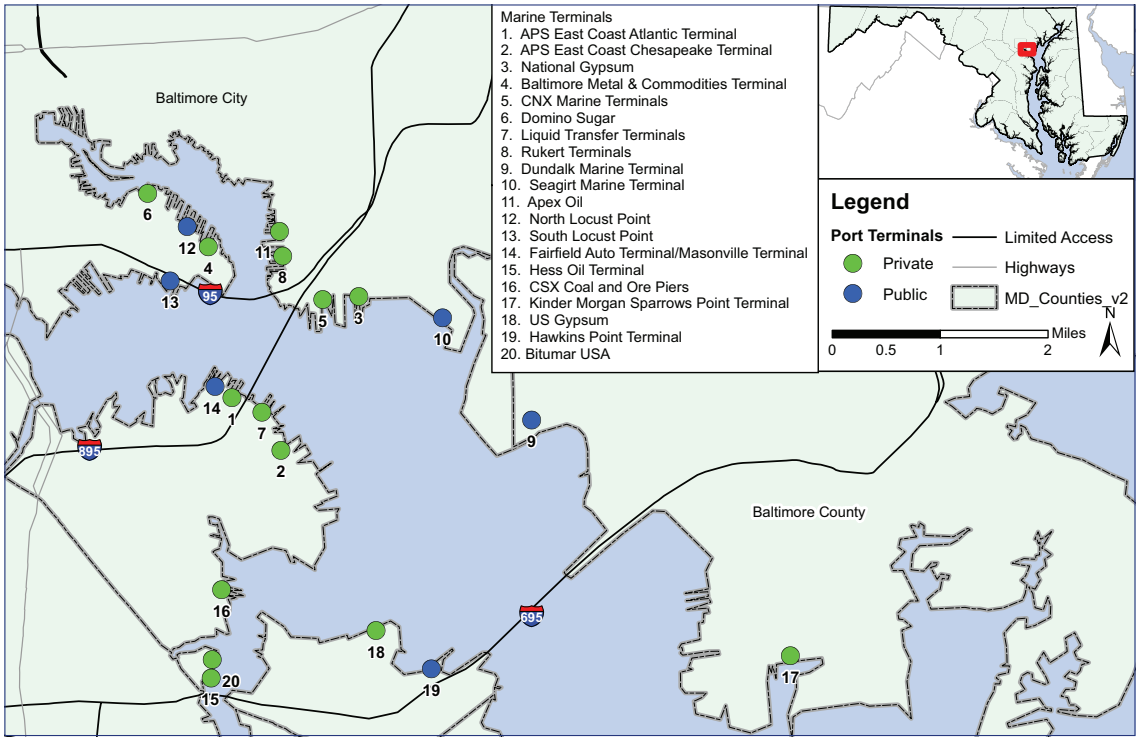
Table 4: Percent of Shipments by Domestic Water, 2012 Weight and Value, and Port of Baltimore Foreign Trade Statistics, 2014

Mode	Total	Within Maryland	From Maryland	To Maryland	Through Maryland
Domestic Water Tonnage*	<0.5%	<0.5%	<0.5%	<0.5%	0.0%
*Domestic Water Value**	<0.5%	<0.5%	<0.5%	<0.5%	0.0%
Port of Baltimore Foreign Trade Statistics, 2014			Export	Import	Total
Port of Baltimore Foreign Trade by Tons (millions)			16.8	12.8	29.5
Port of Baltimore Foreign Trade by Value (billions of dollars)			18.6	33.9	52.5
			Foreign	Domestic	Total
Port of Baltimore Container Trade by Trade Type			90.9%	9.1%	100.0%

Cargo is the lifeblood of the Port of Baltimore. As one of the nation's top ports for total cargo tonnage and overall dollar value of cargo, the Port of Baltimore is also one of the most diverse ports in the United States. The key commodities handled at the Port's public marine terminals include autos, roll on/roll off, containers, forest products, and project cargo. The Port of Baltimore has an outstanding operations system that includes quality control programs, connectivity to land-side transportation, and a productive labor force.

The Port of Baltimore includes seven State-owned public terminals that are managed by the Maryland Port Administration (MPA) plus many privately owned terminals. It is a vital link for raw materials and manufactured goods moving into and out of Maryland. The Port of Baltimore ranks at or near the top of all US ports in a number of categories including handling farm and construction machinery, automobiles, imported forest products, imported sugar, imported gypsum, and exported coal. Total general cargo at MPA's public terminals reached 9.6 million tons in FY 2014.[15]

Figure 8: Port of Baltimore Marine Terminals[16]



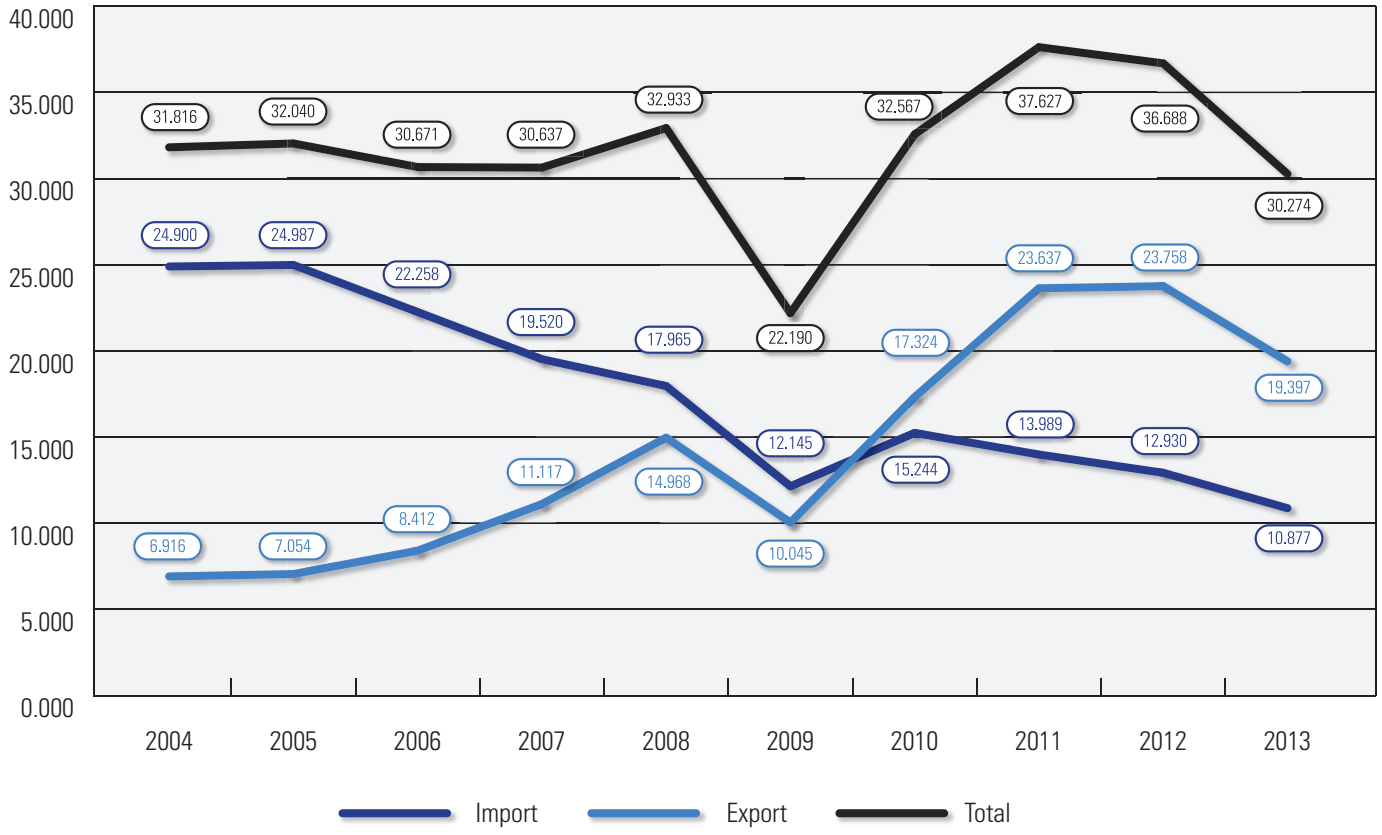
[15] Source: 2035 Maryland Transportation Plan

[16] Source: Maryland Port Administration

Marine Terminal Throughput

If you bought a foreign built car in the Mid-Atlantic region, chances are that automobile came in through the Port of Baltimore. The Port of Baltimore is the top-ranked port in the US by volume of automobiles and roll-on/roll-off heavy equipment, such as farm, construction, and transportation equipment. The Port imports foreign automobiles and equipment for consumption in the US and exports American-made automobiles and equipment to consumers throughout the world. Once the third set of locks on the Panama Canal is complete, it will allow larger vessels a quicker transit from Asia. On the East Coast, the Port of Baltimore is one of a few ports that will be able to handle these larger vessels.

Figure 9: Import/Export Balance for Foreign Waterborne Trade, Port of Baltimore (Millions of Tons), 2004-2013[17]

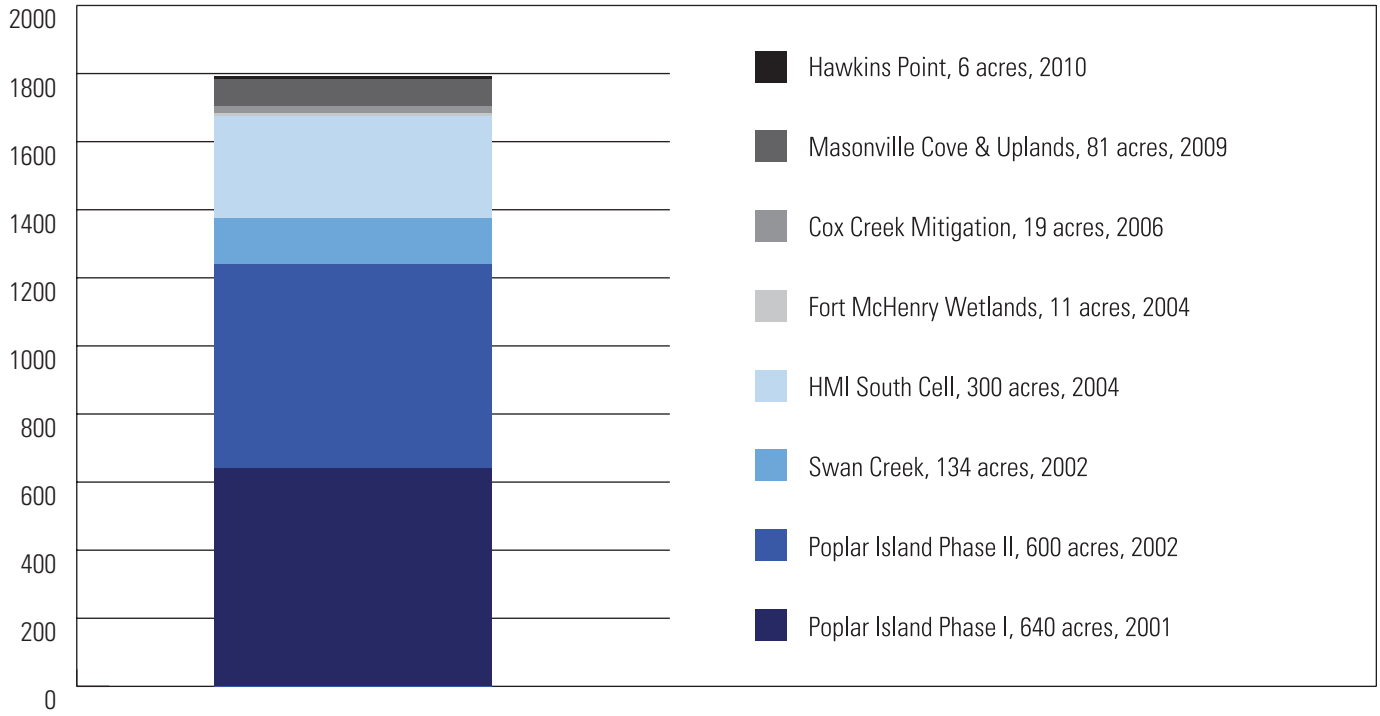


Dredging for Safe Passage

To maintain 50-foot-deep shipping channels that are necessary for large Post-Panamax vessels, approximately 1.5 million cubic yards of material must be dredged from the Baltimore Harbor annually. Maryland's Dredged Material Management Program strives to provide adequate dredged material placement capacity for harbor and bay dredging through preferred management options. "Beneficial use" means using dredged material for environmental benefits, such as creating wildlife habitat and restoring eroded islands. Beneficial use projects exist at Poplar Island, Hart-Miller Island, and Cox Creek. "Innovative reuse" transforms dredged material into usable products for construction and agriculture. Port demonstration projects are underway to test the feasibility of using Harbor material to produce a lightweight aggregate, construction fill, and soil amendments.

[17] Source: Maryland Port Administration

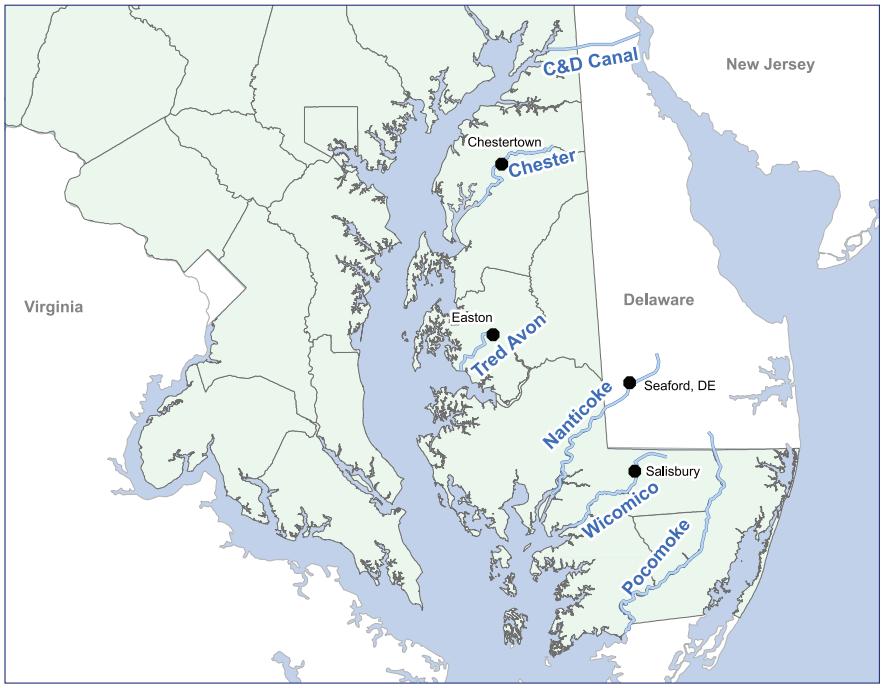
Figure 10: Acres of Wetlands or Wildlife Habitat Created, Restored, or Improved since 2000[18]



Eastern Shore Rivers

On Maryland's Eastern Shore, the Chester, Pocomoke, Tred Avon, Wicomico, Choptank, and Nanticoke rivers are vital goods movement corridors. On these waterways, approximately 2.5 million tons of petroleum, grain, and aggregates are moved annually.[19] About 43 percent of these goods move on the Wicomico River, including via the Port of Salisbury, Maryland's second-largest port. Key issues confronting waterborne commerce on Maryland's Eastern Shore include dredging to maintain adequate channel depths, securing appropriate dredge materials disposal sites, need for truck and rail access improvements, and encroachment of residential development near waterborne industrial facilities.

Figure 11: Eastern Shore Rivers



[18] Source: Maryland Port Administration

[19] Source: Delmarva Freight Plan, Chapter 4

2.4 AIR CARGO INFRASTRUCTURE

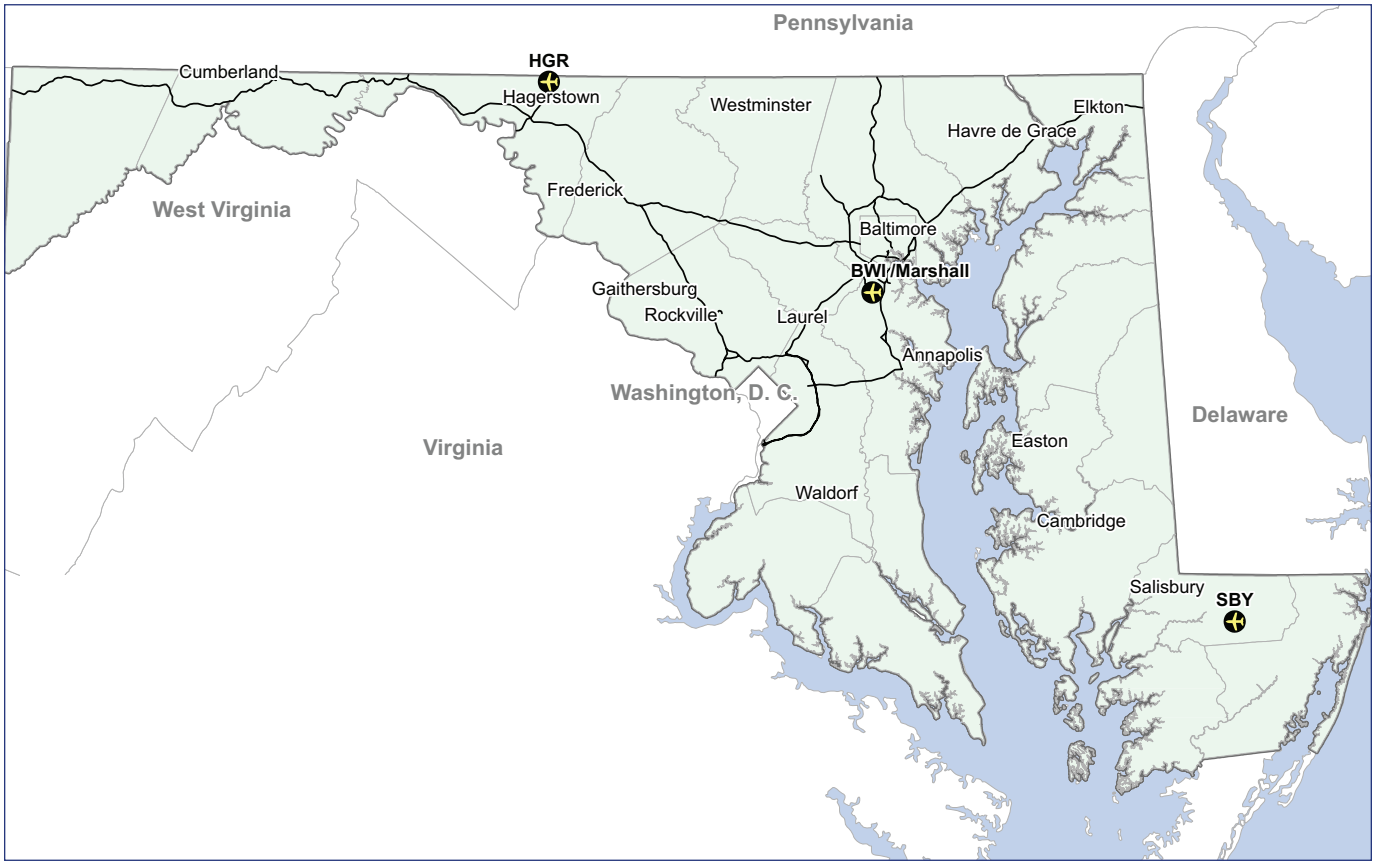
Table 5: Percent of Shipments by Domestic Air, 2012 Weight and Value

Mode	Total	Within Maryland	From Maryland	To Maryland	Through Maryland
Domestic Air Tonnage*	<0.5%	<0.5%	<0.5%	<0.5%	0.0%
*Domestic Air Value**	0.5%	<0.5%	2.0%	1.5%	0.0%

*Domestic air includes air cargo between U.S. and domestic origin-destination pairs. The domestic portions of international air cargo movements are accounted for in the appropriate domestic modes.

Maryland Aviation Administration is responsible for airport regulation in the State. There are 18 publicly owned general aviation airports and 18 private airports open for public use in Maryland. Three of these airports are capable of cargo shipments: Hagerstown (HGR), Salisbury (SBY), and Baltimore/Washington International Thurgood Marshall Airport (BWI/Marshall), the largest cargo airport in Maryland. In total, there are approximately 415,000 square feet of air cargo warehouse space in ten buildings at BWI/Marshall.[20]

Figure 12: Maryland Air Cargo Airports



[20] Source: http://www.bwiairport.com/en/about/cargo/factsheet.

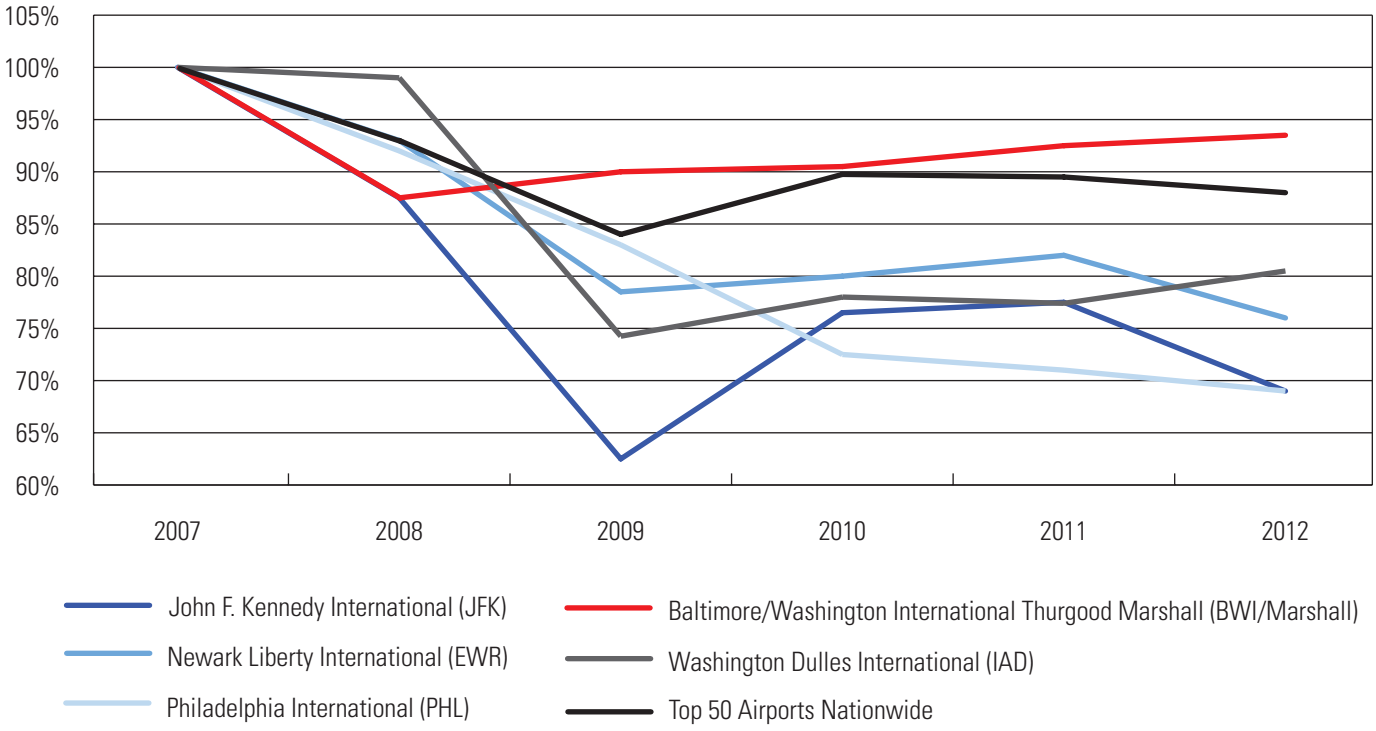
Air Cargo Performance

Air cargo is important in moving high value, time-sensitive shipments. Pharmaceuticals, certain manufacturing or health care equipment, electronics, and packages and parcels move by air. In 2012, approximately 57,000 tons of air freight and mail enplaned on all-cargo flights at Maryland airports (Table 6). BWI/Marshall leads all Maryland airports with approximately 61,500 tons of cargo and mail landed (1st in Maryland, 33rd in the nation). BWI/Marshall has also outpaced all major Mid-Atlantic Air Cargo Airports since 2009.

Table 6: Scheduled and Non Scheduled Air Freight and Mail Enplaned in Maryland, in Short Tons, 2004-2012[21]

Year	Scheduled Freight	Nonscheduled Freight	Scheduled Mail	Nonscheduled Mail	Total
2004	53,377	5,867	7,230	1	66,475
2006	49,095	4,746	5,924	0	59,765
2008	46,407	2,265	4,881	0	53,553
2010	47,093	707	3,245	0	51,045
2012	51,603	1,966	3,096	65	56,730

Figure 13: Annual Landed Air Cargo Volume Percent-Change, 2007-2012[22]



[21] Source: US Department of Transportation, Bureau of Transportation Statistics, TranStats Database, T-100 Market (All Carriers)

[22] Note: Annual Landed Air Cargo Volume (Short Tons) as a Percent of 2007 Landed Air Cargo Volume at Major Mid-Atlantic Air Cargo Airports, 2007-2012. Cambridge Systematics, using US Department of Transportation, Bureau of Transportation Statistics, TranStats Database, T-100 Market (All Carriers)

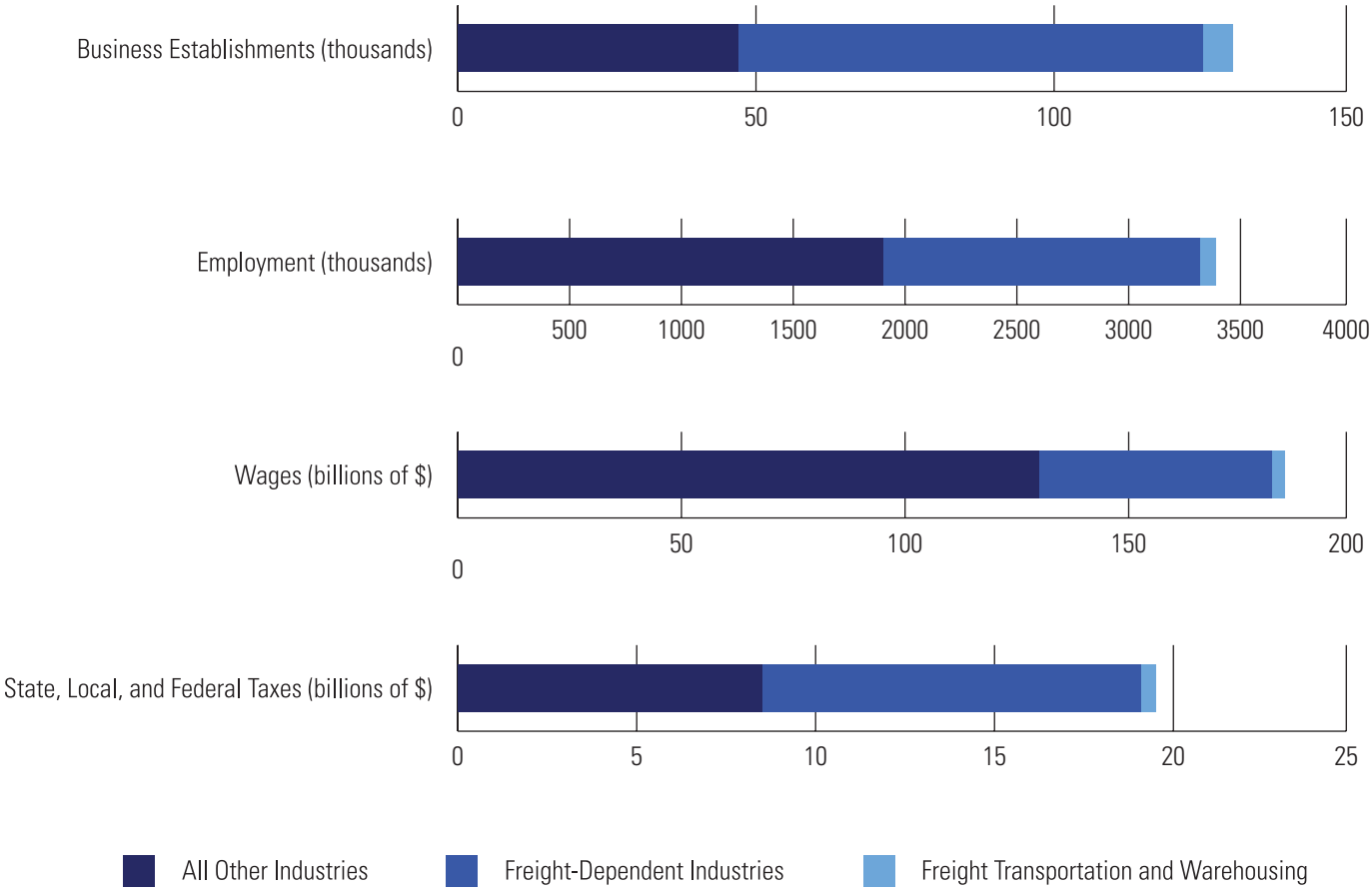
3.0 GOODS MOVEMENT AND THE ECONOMY

Measures of the economic benefit of goods movement to the State of Maryland consist of the economic output of industries that move goods or are dependent upon goods movement, as well as the tax revenue generated from business income tax, sales and use tax receipts from freight-generating businesses, and revenues generated from commercial vehicle operations, including International Registration Plan (IRP) registration fees and International Fuel Tax Agreement (IFTA) apportionments.

Goods movement is essential to the economy. Simply put, the freight transportation network keeps commerce flowing. The measures of economic benefit of goods movement to the State of Maryland consist of the economic output of industries that move goods or are dependent upon goods movement, as well as the tax revenue generated from business income tax, sales and use tax receipts from freight-generating businesses, and revenues generated from commercial vehicle operations.

A healthy economy is directly connected to its relationship to transportation system performance. The need for the supply chain to have the capacity to provide reliable and cost-effective transportation is an integral component of this relationship.

Figure 14: Role of Freight Transportation and Warehousing and Freight-Dependent Industries on Maryland's Economy, 2012[23]



[23] Source: IMPLAN; US Census, Bureau of Labor Statistics, analyzed by Maryland Department of Business and Economic Development and Cambridge Systematics, Inc.

Goods movement contributes to the State government coffers, paying an estimated $4 billion in annual taxes and fees, as Table 7 shows.

Table 7: Annual State Revenues from the Maryland Freight Industry, Fiscal Year 2013

Revenue Source	Amount
Motor Carrier IFTA Temporary Permit Fees	$134,000
Motor Carrier Fuel Tax Gross Revenue	$4,526,000
Toll Revenue[1]	$150,258,000
Sales and Use Tax[2]	$3,501,139,000
Income Taxes[3]	$405,410,000
Total Freight Industry-Generated State Revenues	$4,061,467,000

Notes:

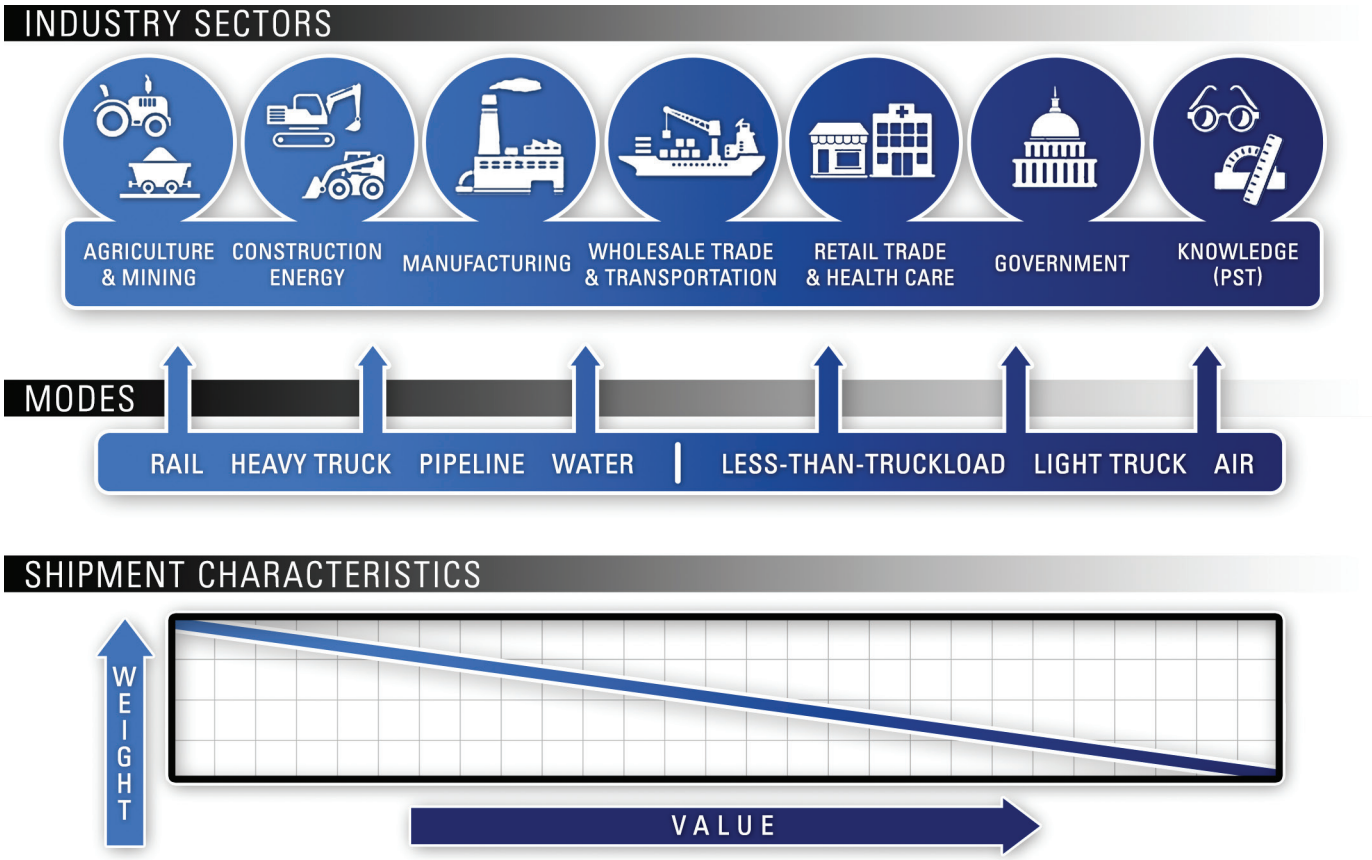
[1] Toll Revenue for vehicles with three or more axles.

[2] Includes sales and use tax on freight transportation and freight-generating industries, including food and beverage, apparel, general merchandise, automotive, furniture and appliances, building and contractors, utilities and transportation, and hardware machinery & equipment.

[3] Tax Year 2011, includes tax liability on agriculture, mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, health care, and food services.

Sources:
Comptroller of Maryland, Motor Fuel Tax Annual Report 2013; Maryland Transportation Authority as reported on http://www.mdta.maryland.gov/about/finances/traffic_and_toll_revenue.html; Comptroller of Maryland, Consolidated Revenue Report Fiscal Year 2013; Comptroller of Maryland, Corporate Income Tax Statistics of Income Tax Year 2011; Partners for Economic Solutions, 2014.

Safe and efficient goods movement benefits the economy beyond the impact on the freight industry. Maryland's economy spans an array of industry sectors and each has a unique supply chain that depends on a reliable freight transportation system. The graphic below illustrates broadly the spectrum of industries and how they use the goods movement transportation system.



- Raw material-intensive industries such as agriculture and mining, construction, energy, and manufacturing require the movement of heavy commodities that are relatively low in value on a per-ton basis. These heavy commodities tend to move in bulk by water, rail, pipeline, or in permitted oversize/overweight trucks.
- Wholesale trade and transportation industries, shown in the center of the graphic, are engaged in the movement of both heavy and light commodities. These industries' supply chains are balanced in terms of inbound and outbound movements and weight-to-value ratios. These goods move by all modes, including combinations of movements by various modes.
- Service industries such as retail trade, health care, government, and public administration, as well as knowledge industries such as professional, scientific, and technical services (PST), require frequent supply of food, office supplies, instruments and equipment, and parcels. These lighter-weight, higher-value goods often move by truck as less-than-truckload (LTL) or parcel shipments, or by air.

Through rigorous data analysis and input from stakeholders, the Strategic Goods Movement Plan aims to better understand and address the needs of Maryland's industry sectors that engage in different types of economic activities. The specific transportation challenges and needs of the industry sectors are different from one another. The key issues that affect the performance of the transportation network these industry sectors rely upon are accounted for in the Plan's recommendations.

The following profiles illustrate the supply chains of the industry sectors noted above. The profiles are intended to illustrate through broad strokes how industries throughout the State receive and send raw materials and products, the demands on Maryland's multimodal freight transportation system, and the industry-specific challenges and needs that are incorporated in the policies and strategies set forth in this Plan. The profiles do not explain the whole of all economic activity, and every individual business has a unique approach to their logistics needs.

3.1 AGRICULTURE AND MINING

Agriculture in Maryland accounts for just below 16,000 jobs and approximately $927 million in Gross State Product (GSP). While total agricultural employment and GSP are less than one percent of the state total, the agriculture sector is vitally important to the State. Perdue Farms, the State's largest agriculture employer, employs more than 1,600 Marylanders.

Just under 5,000 mining and extraction jobs in Maryland contribute close to $12 billion in GSP, accounting for less than 1 percent of the State's employment and 3.7 percent of the State's GSP. Two of the largest mining companies in the State, Vindex Energy and Tri-Star Mining, employ 175 people combined.

Agriculture and Mining Modes:

Class I rail
Short line rail
Barge
Container vessels
Trucks

Agriculture Inbound and Outbound Needs:

- **Animal feed** – Approximately half of the 1,000,000 tons of feed needed by Maryland farms is grown on the Delmarva Peninsula and shipped via truck. The other half are imported from Pennsylvania and the Midwest on Class I railroads, short line railroads, and trucks. These inbound flows are expected to grow by nearly 70 percent by 2040.
- **Fertilizer** – More than 70 percent of the fertilizer shipments terminating in Maryland originate in-state. The top out-of-state origins include Pennsylvania, the South Atlantic states, and the Midwest. About 1 million tons of fertilizer were consumed in Maryland in 2012. A 2 percent reduction in fertilizers consumed in Maryland is expected by 2040.
- **Farm machinery** – Tractors, combines, and other agriculture equipment arrive from domestic and international manufacturers through the Port of Baltimore, via Class I rail, and by truck.
- **Food products** – Chickens are transported to production facilities throughout Maryland and from there to consolidation facilities via truck. Some of the chicken products are transported via truck for international export through the Port of Baltimore, the Port of Virginia (Norfolk), and the Port of New York and New Jersey to the growing middle-class consumers in East Asia, South Asia, and other parts of the world. Fruits, vegetables, dairy, and artisanal items are delivered to supermarket distribution centers and ethnic food wholesalers in the major consumer markets in the Baltimore-Washington metropolitan region, New York, New Jersey, Pennsylvania, and New England. The "to market" shipments are via truck. About 17 million tons of food products worth about $11 billion were exported from Maryland in 2012. By 2040 the aggregate weight of food product shipments is expected to grow by 30 percent and the value by 39 percent.
- **Ag Tourism** – The agriculture industry promotes "ag" tourism which brings people to farms instead of farm products to people. Wine and ice cream trails on farms and vineyards exist across the State. While this might reduce the number of freight trips leaving agricultural businesses, it increases the number of total vehicle trips to the area. This means that both the freight transportation and non-freight transportation networks are vital for sustaining agriculture businesses.

Mining Outbound Needs:

- **Stone, Sand, Metallic Ores, and Salt** – Raw materials extracted from the earth include stone, sand, metallic ores, and salt, used for construction, industrial processes, or as ingredients to manufacture finished goods. More than 50 million tons of these materials, worth about $1 billion, were shipped from or within Maryland in 2012. By 2040, the volume of material is

projected to decline 7 percent by weight yet increase more than 60 percent by value.

- **Coal** – Coal mined in Western Maryland is transported to destinations throughout the world via truck, rail, and by water via the Port of Baltimore. Approximately 1.9 million tons of outbound coal shipments worth $78 million originated in Maryland in 2012. This does not include coal that was mined in other states, but passes through Maryland on its way to other destinations. These shipments are expected to decline 7 percent by weight and by value through 2040.

Agriculture and Mining Challenges:

- The demand for locally sourced fresh food means that freight transportation networks need to operate smoothly to allow for timely arrival to market.
- To ensure that traditional domestic markets and the emerging overseas markets can be served, the highway and rail systems that carry inbound feed, fertilizer, and outbound product must be maintained for efficient and reliable travel times.
- Federal highways are at a weight limit that may differ for Maryland and other State roadways, which complicates interstate movement.
- The transportation networks that serve farmland along the shores of the Chesapeake Bay and river system may be vulnerable to sea level rise.
- The Food Safety Modernization Act (FSMA) of 2010 introduced more stringent controls on the movement of food products. The lack of qualified truck operators is impacting all segments of the truck transport nationwide, and the increased food safety regulations may make it particularly difficult to find food processing drivers.
- Increasing competition from other fossil fuel sources, such as Marcellus shale, and renewable energy sources could decrease the use of coal, thus limiting the need for rail shipments of coal.
- Most quarries and mines in Maryland extract materials that serve the State's construction industry, and therefore, the mining industry is sensitive to growth and decline in construction.
- Infrastructure maintenance, especially bridges, is a priority due to the heavy weight of mined materials.
- Goods moving on rail sometimes share the lines with passenger service, limiting freight to late night travel and slower speeds. Increasing need of passenger service may curtail freight operations.

3.2 CONSTRUCTION AND ENERGY

Construction activity provides almost 205,000 jobs in Maryland (6 percent) and is responsible for 14.9 billion in GSP, or approximately 4.6 percent of the total state GSP. The top three employers in Maryland's construction sector are Facchina Construction, NVR, and American Infrastructure, which employ 550, 450, and 445 people, respectively.

The energy sector in Maryland includes power generation from any source, sewage treatment, and distribution networks for natural gas, oil, water, and electricity. This sector produces over $7 billion in GSP and employs 10,393 persons. The largest single sub-sector is "Electric power generation, transmissions, and distribution," which accounts for 94 percent of the energy workforce and 94.5 percent of GSP generated by the energy sector. Exelon is Maryland's largest firm in the energy sector, employing approximately 4,100 people.

Construction and Energy Modes:

Pipeline
Class I rail
Short line rail
Tanker vessels
Trucks
Barge

Construction Inbound and Outbound Needs:

- **Building materials and machinery** – Inbound materials include nonmetallic minerals, gravel, sand, building stone, and lumber. Many of these goods arrive on truck, although some are shipped in bulk on rail. Heavy machinery comes through the Port of Baltimore via rail. Shipments from outside of Maryland are projected to grow slightly by 2040, rising 19 percent by weight and 10 percent by value.

  Construction goods from within Maryland utilize a similar network as noted above. Final delivery to sites for both intra- and interstate shipments occurs on local truck routes and roads throughout the region. Shipments from within Maryland are projected to hold steady at around 500,000 tons and $35 million.

- **Construction waste and scrap metal** – The major outbound commodities from the construction industry are waste and scrap metals. These materials travel by truck and rail. By volume, these shipments are projected to grow by 19 percent by 2040.

Energy Inbound and Outbound Needs:

- **Coal, coal ash, and oil** – The major inbound commodities for the energy sector are coal, coal ash, and oil for energy production facilities. These shipments arrive via Class I rail, short line rail, barge, and pipeline, with a small amount of coal shipped via truck. Tonnage and value of commodities from other states are projected to decrease by 2040.

  Small amounts of coal ash transport via pipeline within Maryland. Shipments within Maryland, including coal, coal ash, and petroleum products are expected to double by weight and triple by value by 2040.

- **Liquefied Natural Gas (LNG)** – LNG is imported from overseas markets via ship then piped to facilities onshore where it is stored before being distributed by pipeline. Approximately 3.9 million tons of LNG are consumed in Maryland annually.[24] At the time of this report, one energy supplier was converting from importing to exporting LNG.

- **Gypsum** – Gypsum is a by-product of burning coal that is used in producing wallboard. The Morgantown Generating Station, as an example, produces 210,000 tons of gypsum "on-specification," that is shipped to New York for use in wallboard manufacturing. An additional 5,000 tons of "off-specification" gypsum is sent to a landfill in Virginia.[25] These shipments move by truck and by barge.[26]

Construction and Energy Challenges:

- New construction is needed to keep up with growing residential and commercial demand, thus there will be more freight needs for this sector.
- The main issues facing transportation in the construction sector are infrastructure maintenance, especially bridges, and road congestion.
- Goods moving on rail sometimes share the lines with passenger service, limiting freight to late night travel and slower speeds. Increasing need of passenger service may curtail freight operations.
- The increasing demand for energy consumption leads to the need for more production facilities, which generates more construction.

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[24] Source: US Energy Information Administration, "Maryland State Energy Profile," available from: http://www.eia.gov/state/print.cfm?sid=MD.

[25] Source: http://www.flyash.info/2013/111-Sebastian-2013.pdf p.13

[26] Source: http://dlslibrary.state.md.us/publications/Exec/DNR/PPRP/ERMCBGLP_2010.pdf p.9

- Growing demand for renewable energy resources may create an increase in shipments of solar cells and wind turbines. Some of these energy generation components require permitted heavy hauling, which can complicate the logistics chain.
- Increased reliance on renewable sources could decrease the use of fossil fuels, thus limiting the need for rail shipments of coal and oil.
- The transportation networks that serve energy production facilities along the shores of the Chesapeake Bay and river system may be vulnerable to sea level rise.

3.3 MANUFACTURING

Manufacturing is a large and important sector in Maryland's economy, despite the decline in jobs throughout the nation over the last two decades. This sector includes traditional manufacturing such as plastics, paper mills, or engine construction, and technology manufacturing such as search, detection, and navigation instruments. It also includes food processing such as ice cream and dessert manufacturing, and bakeries. For the entire State, manufacturing generates $19.7 billion in GSP and provides nearly 116,000 jobs, representing 6.1 percent of the GSP and 2.7 percent of Maryland's workforce. Northrop Grumman, which employs nearly 9,900 people in Maryland, is the largest manufacturing company in the State.

Manufacturing Modes:

Air	Container vessels
Class I rail	Roll-on/roll-off vessels
Short line rail	Trucks

Manufacturing Inbound and Outbound Needs:

- **Glass, base metals, chemicals, and lumber** – Inbound commodities for the manufacturing industry mostly consist of raw materials needed for manufacturing processes. These goods arrive on trucks, Class I rail, and short line rail. A 19 percent increase in shipments by weight and 36 percent increase in value are expected for interstate shipments.
- **Equipment, tools, machinery, and precision instruments** – Items that are needed for the manufacturing process arrive on truck, Class I rail, and short line rail. About 4 million tons of these goods moved into or within Maryland in 2012. By 2040, more than 10 million tons are expected. A near three-fold growth in value of these goods, from $30 billion to nearly $90 billion, is projected between 2012 and 2040.
- **Finished goods** – The outputs of manufacturing are a variety of goods that are used by other manufacturing facilities, business, and consumers. Finished goods are transported by truck, Class I rail, short line rail directly to the end user or to distribution centers. Some finished goods, such as precision instruments, are shipped to international markets via air. Larger finished goods, such as machinery, are shipped to locations in the United States and abroad on rail and roll-on/roll-off vessels. Outbound shipment by the manufacturing industry is projected to grow slightly by tonnage but decrease 27 percent by value by 2040.

Manufacturing Challenges:

- The major issues facing manufacturing revolve around truck movements. Congestion and significant weather events can close or severely hamper movement, jeopardizing just-in-time deliveries.
- Bridge infrastructure conditions are also a concern. Several manufacturing processes use hazardous material, and these goods are moved near or through communities causing safety and security concerns.

- A lack of qualified drivers is a nationwide issue that is felt by the manufacturing industry. Without enough drivers to move commodities and goods through the supply chain, business deadlines can be at risk.
- In addition to a shortage of truck drivers, manufacturers are in need of qualified freight and logistics support staff.

3.4 WHOLESALE TRADE AND TRANSPORTATION

The Wholesale Trade sector statewide generates 93,361 jobs and $14 billion in GSP, representing 2.8 percent of the state's workforce and 4.3 percent of GSP. Wholesale Trade is often associated with warehousing. Goods are typically stored by wholesalers, either before their intended use or after their production. Goods may include agriculture and mining outputs, material needed for manufacturing processes, as well as manufactured products of any type. Maryland's top employers in the wholesale trade sector include Sysco Foods, C&S Wholesale Grocers/Collington Services, and Penguin-Random House, which employ approximately 1,400, 900, and 750 people, respectively.

The Transportation and Warehousing sector contributes nearly 98,000 jobs and $7.2 billion in GSP to Maryland's economy, representing 2.9 percent of the state's jobs and 2.2 percent of the GSP. Excluding passenger, transit, and scenic transportation services, the sector contributes approximately 75,000 jobs and $6.5 billion, representing 2.2 percent of the Maryland's workforce and 2.0 percent of the Maryland's GSP. The top employers in the transportation and warehousing sector include United Parcel Service (UPS), which employs more than 6,000 people, Southwest Airlines, which employs 3,200 people, and CSX Transportation, which employs 900.

Wholesale Trade and Transportation Modes:

Air	Container vessels
Class I rail	Roll-on/roll-off vessels
Short line rail	Trucks

Wholesale Trade and Transportation Inbound and Outbound Needs:

- **Imported goods** – A major source of imports to the region is from countries in the Pacific Rim. These goods move by ship to the Port of Baltimore, a major intermodal hub that imported nearly 11 million tons of goods in 2013. Other shipments arrive via Class I railroads or long distance trucking from the West Coast ports to cross the US, or by regional trucking from the Midwest, South, and Northeast. Nearly all of these shipments travel to distribution centers.
- **Exported goods** – Wholesale trade produces a significant amount of outbound goods, which are projected to reach over 14 million metric tons by 2040. This includes both export goods and shipments destined for retailers. Goods bound for retailers and other outbound commodities such as machinery, transportation equipment, and durable goods move by truck, Class I rail, and short line rail to final domestic destination or to the Port of Baltimore for overseas shipment.
- **High end goods** – High end goods, such as fashion and perishable items, are a small segment of wholesale trade. These goods move by truck to final domestic destination or to airports for overseas shipment. In 2012, approximately 6 million tons of high end goods moved to or from Maryland, and the volume of these goods is expected to exceed 11 million tons by 2040. The value of high end goods, worth $51 billion in 2012, is projected to increase to $88 billion by 2040.

Wholesale Trade and Transportation Challenges:

- This industry utilizes a complex logistics network composed of multiple transportation modes. Interconnectedness and reliability of all segments of the freight transportation system is imperative.
- The expansion of the Panama Canal may fuel future growth, as the Port is one of two ports on the US East Coast that can currently accommodate Post-Panamax vessels. Congestion on the road network slows the flow of goods. For an industry segment that supports the retail market—a market heavily reliant on just-in-time supply chains—delays on the road can be a major inhibitor of growth. Further, congestion limits the number of trips that trucks can make within the region, hurting drayage operators that bring goods from the Port of Baltimore to warehouses for sorting prior to final delivery.
- Double stack capability on rail from and to the Port of Baltimore is a critical issue. The Class I railroads serving the Port currently lack direct double stack connection to the national rail network, as the rail tunnels through the City of Baltimore are not high enough to accommodate two stacked containers.
- A lack of qualified drivers is a nationwide issue that particularly impacts the wholesale trade industry. Without enough drivers to move goods just-in-time, business deadlines can be at risk.
- In addition to a shortage of truck drivers, businesses are in need of qualified freight and logistics support staff.
- Goods moving on rail sometimes share the lines with passenger service, limiting freight to late night travel and slower speeds. Increasing need of passenger service may curtail freight operations.

3.5 RETAIL TRADE AND HEALTH CARE

The retail trade sector is vitally important to Maryland's economy. Goods must reach shelves in urban neighborhoods, small towns, and large malls, and the continued growth in e-commerce necessitates deliveries directly to consumers. The vitality of the State's commercial and residential centers relies on people being able to access goods. Retail is responsible statewide for employing nearly 342,000 persons and producing $16.4 billion in GSP. This represents 10.1 percent of the State's workforce and 5.1 percent of GSP. Walmart/Sam's Club is Maryland's largest retail trade employer, with more than 17,000 employees statewide. Giant Food, which employs 12,000, is the second-largest retail trade employer.

The health care sector includes a wide range of facilities including hospitals, clinics, doctor's offices, psychiatric facilities, community care, child and youth services, child care, and home health care providers. These facilities are found throughout the State of Maryland, with major clusters in the Washington, D.C. suburbs and the Baltimore Region. The health care industry is a major contributor to Maryland's economy, employing just over 413,100 persons and producing over $25.1 billion in GSP. Those numbers represent 12.2 percent of Maryland's workforce and approximately 7.8 percent of the GSP. It is a growing consumer and generator of economic activity and goods movement throughout the State. University of Maryland Medical Systems and Johns Hopkins Hospital and Health System, each of which employs 23,000 people, are the largest employers in the health care sector.

[27] Source: Maryland Department of the Environment, "Maryland Solid Waste Management and Diversion Report, 2013," available from: http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/CountyCoordinatorResources/Documents/%2713%20MSWMR.pdf.

Retail Trade and Health Care Modes:

Air
Class I rail
Trucks

Retail Trade Inbound and Outbound Needs:

- **Consumer goods** – The retail and wholesale sectors are closely linked with one another, as most goods bound for retail establishments utilize the wholesale industry supply chain for the first part of the journey. Consumer goods are the dominant inbound delivery to retail establishments. These arrive from distribution centers via truck and Class I railroads. Approximately 11 million tons of consumer goods worth $55 billion flowed into or within Maryland in 2012. The volume of consumer goods is projected to be 86 percent greater by weight and 72 percent greater by value in 2040.
- **Fulfillment centers** – Fulfillment centers are part of a growing logistics chain that moves consumer goods directly to consumers that have been reached through omni-channel retailing. Omni-channel retailing is an approach that allows consumers to interact with a retailer seamlessly across multiple "channels," including in-store, online, mobile devices, television, catalogs, etc. These shipments are typically smaller and lower weight products that travel by truck to the final destination or to BWI/Marshall Airport for overseas shipment.
- **Reverse logistics** – Reverse logistics describes the process of moving product returns from the consumer back to a wholesale fulfillment center or warehouse. Trucks move product returns along local streets and highways.
- **Material waste** – Discarded packaging accounts for most of the material waste produced by retail establishments. Trucks move material waste along local truck routes to reach consolidation centers. Bulk material waste is transported to recycling facilities or landfills via truck and Class I railroads. Retail establishments, along with other businesses and residences, contributed to the 12.3 million tons of solid waste generated in Maryland in 2012.[27]

Health Care Inbound and Outbound Needs:

- **Operational supplies** – These facilities require an enormous amount of goods in order to operate. Goods that must reach these facilities on a regular basis include linens, sheets, gowns, towels; medical supplies including gauze, bandages, wrappings, instruments; food; office supplies and documents; and pharmaceuticals and other specialty items (blood, plasma, etc.). Many of the bulk items needed to likely arrive to distribution centers via import through the Port of Baltimore or via truck. Delivery to each health care location is by truck. In 2012, about 400,000 tons of medical supplies worth $37 billion, moved into or within Maryland. The volume of medical supplies is expected to increase more than two-fold by 2040.
- **Outbound parcels and packages** – Outgoing freight needs include parcels and packages, medical samples, or pharmaceuticals, including many of the commodities described above. These shipments are typically smaller and lower weight products that travel by truck to the final destination or to BWI/Marshall Airport for overseas shipment.
- **Material and Bio-hazard Waste** – Waste shipments travel almost entirely by truck, first to local consolidation centers, and then to in-state or out-of-state recycling facilities and landfill sites, as appropriate. Pennsylvania and Virginia are the primary out-of-state destinations for exported medical waste. Bio-hazardous material moving out of health care facilities requires special routing. Health care establishments, along with other businesses and residences, contributed to the 12.3 million tons of solid waste generated in Maryland in 2012.[28]

[28] Source: Maryland Department of the Environment, "Maryland Solid Waste Management and Diversion Report, 2013," available from: http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/CountyCoordinatorResources/Documents/%2713%20MSWMR.pdf.

Retail Trade and Health Care Challenges:

- As the share of sales made online and via mobile devices expands, some retailers are devoting some of the distribution center space, previously used to supply retail stores, for order fulfillment and preparing shipments for delivery to customers. Delivery from fulfillment centers to customer occurs on all segments of the highway network. This is increasingly a concern for retailers along roadways that have traffic calming measures, as these streets may not be able to accommodate large trucks.
- Congestion is the dominant goods movement transportation issue, particularly because shipments are extremely time sensitive. Delays create additional costs for shippers, transporters, and customers.
- As portions of the State continue to urbanize, increasing numbers of truck deliveries to retail establishments will be made in close proximity to vulnerable road users. Promoting vibrant, pedestrian friendly development in these areas while also enabling efficient goods movement will be of increasing concern for business owners and residents and should be considered in the urban planning and development process. Connected with this issue is the need for truck parking/staging facilities to accommodate drivers who are waiting for retailers' delivery acceptance times.

3.6 GOVERNMENT AND KNOWLEDGE

Discussion of the Government sector and the Knowledge industry (Professional, Scientific, and Technical Services) industry sectors has been combined in this section, because both sectors have similar goods movement needs and supply and logistics chains supporting them. Combined, the two sectors account for 25.6 percent of Maryland's workforce and approximately 24.1 percent of its GSP.

Government is a major component of Maryland's economy. At the local, state, and federal level, government, including the US Postal Service, employs just over 518,000 persons in the State and produces $62.2 billion in GSP. This represents 15.3 percent of the State's workforce and 19.3 percent of its GSP. The National Institute of Health employs more than 17,000 people in Maryland, the US Social Security Administration employs 14,500, and the US Food and Drug Administration employs nearly 13,000.

The Professional, Scientific, and Technical (PST) industry, which includes jobs in the legal services, architecture and engineering, computer systems work, advertising, and marketing fields, among others is another major contributor to Maryland's economy. With approximately 351,500 jobs and $31.5 billion in GSP output statewide, 10.4 percent of jobs and 9.8 percent of GSP in Maryland is within this sector. Maryland's largest employers in this sector include Lockheed Martin, Johns Hopkins University Applied Physics Laboratory, and Booz Allen Hamilton, which employ 7,600, 5,000, and 3,100 people, respectively.

Government and Knowledge Modes:

Air
Class I rail
Trucks

[29] Source: Maryland Department of the Environment, "Maryland Solid Waste Management and Diversion Report, 2013," available from: http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/CountyCoordinatorResources/Documents/%2713%20MSWMR.pdf.

Government and Knowledge Inbound and Outbound Needs:

- **Operational supplies** – The major inbound goods for these industry sectors are office supplies and equipment, food, and parcels and packages. The majority of these goods move by truck. Inbound parcels and packages arrive by air. BWI/Marshall Airport is an intermodal hub where goods on the planes are transferred to truck, sorted at a nearby facility, and sent by truck for delivery. Approximately 7 million tons of such goods were shipped to Maryland office and government establishments in 2012. The volume of these goods is projected to grow 73 percent by 2040.
- **Outbound parcels and packages** – Outgoing freight needs include parcels and packages. These shipments are typically smaller and lower weight products that travel by truck to the final destination or to BWI/Marshall Airport for overseas shipment. These shipments totaled more than 6 million tons in 2012, and are projected to increase in volume to more than 10 million tons by 2040.
- **Material Waste** – Waste shipments travel by truck to local consolidation centers, and then by truck or Class I railroads to landfill sites. Government and knowledge establishments, along with other businesses and residences, contributed to the 12.3 million tons of solid waste generated in Maryland in 2012.[29]

Government and Knowledge Challenges:

- Both of these industry sectors are projected to grow through 2040, Government by 73.6 percent and PTS by 81 percent in the Washington, D.C. region. This growth will drive the need for construction and service material as new office space is built or existing space is rehabilitated or converted. Construction material will mostly use the freight infrastructure outlined above.
- As development continues to increase the number of establishments, it will be important to consider truck access in development plans and to maintain a map that keeps up with the changing streetscapes. Connected with this issue is the need for truck parking/staging facilities to accommodate drivers who are waiting for delivery acceptance times.
- A transportation issue facing these industries is congestion, as delays lead to increased operating costs for carriers that is passed on to the customer.
- Another issue, especially for the Government sector, is the lack of available drivers to operate trucks. Since many government complexes and knowledge facilities require additional security clearance, the number of available drivers is even more restricted.

4.0 GOODS MOVEMENT STRATEGIC DIRECTION

MDOT'S VISION FOR GOODS MOVEMENT: Freight travels freely and safely through an interconnected network contributing to economic viability and growth for Maryland business.

The strategies noted below are based on data analysis, the challenges and needs of private sector freight providers and users, interagency input and advice. These strategies will guide the development of programs and projects for MDOT and public and private stakeholders.

Goal: Quality of Service
Maintain and enhance the service experience for users of Maryland's multimodal freight system

Issue	Desired Outcome	Strategy
There are significant costs to maintain, upgrade, and improve State-owned short line rail infrastructure and assets.	Reliable and safe transport on State-owned short line rail system through investment that yields a return on investment or public benefits such as emissions reductions, safety improvements, or improved system performance.	• TSO, MTA, and MDTA in cooperation with shippers and receivers should identify the competitive and strategic redundancy benefits that all could gain from more effective use of State-owned rail assets. • Where justified, the State should proceed with projects to maintain, rehabilitate, and improve State-owned assets as identified in the MTA Freight Lines Strategic Plan.
Traffic congestion increases truck travel times and reduces reliability of delivery time which leads to higher transport costs for businesses that are passed on to consumers.	Reliability improvements and congestion mitigation that positively impact supply chain costs associated with driver and truck delay and fuel consumption. Improved air quality and lower climate impacts due to lower truck emissions.	• SHA and MDTA should continue to advance appropriate measures to reduce or mitigate the effects of congestion on industry supply chains.
Projected increase in passenger and freight rail demand could exacerbate conflicts over available rail network capacity.	Rail network that can meet freight and passenger demand now and in the future.	• Freight and passenger rail owners and operators should collaborate with TSO and MTA to forecast future passenger and freight rail volume on shared corridors, identify practical operating capacity on shared corridors, and detect locations where future volume may exceed capacity. • Collaboration between all groups is necessary to identify, plan and implement solutions.

Goal: System Preservation
Maintain and improve the performance of Maryland's multimodal freight system

Issue	Desired Outcome	Strategy
There is little public sector assistance available to short line railroads relative to other modes of freight transportation.	Robust short line railroad aid through transportation and economic development, and agriculture partnerships that could lead to innovative programs.	• TSO, MTA, and MDTA should coordinate with public and private short lines to seek innovative funding and financing sources and leverage available public resources with public-private partnerships where possible to fund projects that will advance the public benefit.
The advent of industry specific hauling permits may lead to a new, yet-to-be-established standard for truck size and weight in practice without the proper policy considerations.	Established, formal policy on truck size and weight for permitted and non-permitted loads based on statewide engineering and operational information.	• SHA and MDTA should conduct a study of the effects of truck size and weight for permitted and non-permitted loads on safety, infrastructure, and the economy, and the impact of inconsistent regional and national size and weight thresholds as a basis for developing a formalized policy.
The "true cost" of oversize/ overweight (OS/OW) loads traveling on Maryland highways, such as police escort, road or lane closures, and other operational disruptions, may not be captured by the permit fee.	Cost-benefit analysis of OS/OW that will reveal whether there is a need to increase permitting fees, or if the "true costs" are captured through economic benefits of the activity that requires the heavy cargo.	• SHA and MDTA should conduct a study to evaluate the costs of accommodating OS/ OW loads (pavement and bridge damage, lost economic activity due to delay to other traffic, etc.) and the economic effects of the activity the OS/OW loads support, and, if there is an evident need, identify potential strategies to capture revenue. Information sharing from shippers and carriers is critical to success.
Significant dredge placement capacity is necessary to maintain safety and viability of channels.	An effective dredging program that maintains and improves shipping channels to the Port.	• MPA should continue its strategies for innovative and beneficial use of dredged material with stakeholder input.

Goal: Environmental Stewardship
Support environmental stewardship

Issue	Desired Outcome	Strategy
Portions of the freight transportation network are, or could be, vulnerable to flooding and inundation.	An inventory of freight transportation network elements, and a process for updating the inventory, that are vulnerable to the threats of sea level rise and other environmental resources.	• MDOT should identify and inventory assets that are vulnerable to flooding and inundation, and develop adaptation strategies such as reconstruction, relocation, and protective infrastructure to address existing and potential future weaknesses.

Goal: Community Vitality
Support the vitality of Maryland's communities

Issue	Desired Outcome	Strategy
Some truck drivers will travel along inappropriate or prohibited routes because of a lack of timely information through mapping and routing systems (i.e. GPS). The wrong routing can lead truck drivers into neighborhoods or along size/weight restricted bridges.	Current and reliable truck routing that is communicated to all truck drivers in various ways, e.g. maps, GPS systems, and road signs.	• Trucking companies should educate drivers of proper truck routing and plan trips that avoid non-freight routes. • SHA should release the updated truck route map, and establish a process for periodic review and update. • TSO should partner with MPOs and municipalities to establish localized truck routing and mapping.
In urban settings and densely developed areas, the interactions among freight vehicles, the built environment, and vulnerable road users, create a challenging environment with many competing claims on limited roadway and curb space.	Technical guidance for planning agencies that informs planners about the specific needs of pick-up/delivery trucking operations in urban and densely developed areas.	• MDP should develop technical guidance for local land use agencies. Input from carriers, architects, and other stakeholders should be sought. • MDP should encourage local land use regulatory agencies to address goods movement and loading and delivery needs in zoning, subdivision regulations, and the site plan review process. MDP should develop a technical guidance with input from developers, carriers, and MDOT.

Goal: Safety & Security
Improve the safety and security of goods movers, the public at large, transportation assets, and cargo

Issue	Desired Outcome	Strategy
Freight transportation-related incidents resulting in property damage, injuries, and fatalities are threats to public safety and represent costs to Maryland business.	Reduction in incidents involving freight carriers, especially on the highways and railroads.	• MDOT should continue to collaborate with MSP, local law enforcement agencies, and the trucking industry to maintain truck safety enforcement and monitoring programs. • Freight rail owners and operators should continue to maintain rail safety enforcement and monitoring programs.
Truck drivers need safe and secure locations to park and obtain mandated amount of rest. Truck parking supply is not sufficient to meet current demand and projected need.	Expanded supply of truck parking statewide in public and private facilities, and maximum utilization of all truck parking capacity.	• TSO, SHA, and MDTA should collaborate with private travel services providers to seek innovative project delivery solutions to expand truck parking capacity and availability. • TSO, SHA, and MDTA should develop additional truck parking capacity throughout the State in public facilities. • TSO, SHA, and MDTA should evaluate current state-of-the-practice in truck parking availability technology systems and potential for implementation in Maryland.

Goal: Economic Prosperity
Maintain and improve Maryland's economic competitiveness

Issue	Desired Outcome	Strategy
The vertical clearance through privately owned rail tunnels prohibits double-stacking of domestic and international containers, impacting the region's economic competitiveness, particularly that of the Port of Baltimore relative to other ports.	Suitable double-stack intermodal rail access to and from the Port to improve its market share.	• In the short term, MDOT should evaluate creative solutions to overcome the current deficiencies. • Long term solutions require leadership from the rail infrastructure owners, namely CSX and Amtrak, to work with MDOT and regional public and private partners to determine the feasibility of creating a double-stack rail network into and out of the Port of Baltimore. Cooperation from CSX, Amtrak, and partners, will be critical in planning and funding any future projects.
There are well-paying truck driving jobs that are not filled because of a shortage of qualified drivers.	Higher rate of driver recruitment and retention in the trucking industry.	• The trucking industry should continue to promote careers in the industry through public outreach. Independent and small fleet carriers should communicate to the State their specific needs and concerns and work with the state and community colleges to devise solutions. • TSO and MVA can play an advisory role in the development of driver education and development programs. • State, county, and municipal public work agencies should consider instituting heavy equipment apprentice programs to provide on the job training.
Freight-generating businesses (warehousing and distribution, transportation, manufacturing, etc.) seek skilled workforce.	Increased availability and enrollment of freight services degree and continuing education programs.	• Maryland Higher Education Commission, community colleges, and industry should partner to further define the need for college degrees and continuing education programs in freight and logistics. • TSO can play an advisory role in the development of programs.

5.0 IMPLEMENTING THE PLAN

Reaching the desired outcomes noted above will require programs and projects from MDOT and public and private stakeholders. Each of MDOT's modal administrations will develop freight projects and programs in their own freight-related planning documents that advance the strategic direction. Private sector freight providers and system owners should use the Plan to understand MDOT's intended strategic direction for goods movement as they develop programs and projects.

Successful implementation will depend on three tactics: planning and programming, data and analysis, and communication, working in concert to meet the goals of the Strategic Goods Movement Plan.

Planning and Programming
MDOT and public and private stakeholders should emphasize projects and programs that facilitate safe and efficient freight movement in the programming process. Freight should be a relevant category in project selection and prioritization.
Short line technical expertise should be centralized within MTA for the benefit of efficiency and expediency of projects. Policy guidance and program oversight should be provided by TSO.
MDOT should identify alternative sources of public and private funding for freight projects, and seek to leverage available resources with private investments.
Data and Analysis
MDOT should monitor economic, trade and logistics, environment, technology, energy, and land use trends and assess implications, especially for MDOT capital investment programs.
The Freight Data Workgroup should continue to share information, identify data and analysis capability gaps, and to develop data and analysis tool concepts that meet the needs of member agencies. In partnership with other State agencies, MDOT should develop and acquire economic and freight data as needed.
MDOT should continue developing freight modeling capabilities that account for potential changes in state or global economic conditions, logistics patterns, transportation infrastructure or funding, and land use scenarios. The State and private sector should collaborate to better understand industry supply chains, and incorporate their impact into freight modeling and data analysis.
Communication and Partnerships
Freight transportation and the State's environmental, economic development, safety and security goals should be mutually supportive. MDOT should continue ongoing communication with sister agencies and MPOs, keep them engaged in MDOT plans and studies, and be an engaged participant in their plans and studies to ensure that the goals of all agencies are mutually-supportive and avoid potential conflicts.
TSO should conduct ongoing outreach with private sector to identify and map supply chains, and communicate with neighboring states to address freight needs one-on-one, and through forums such as the I-95 Corridor Coalition, I-81 Corridor Coalition, Delmarva Freight Planning effort, MPOs' freight committees, and others. The private sector both within and outside Maryland should be an engaged partner in the discussion in order to identify nodes, modes, and routes that are critical to the State.
MDOT should disseminate brochures or other documents summarizing federal and State safety regulations and important changes over time. MDOT should ensure all information regarding safety and security regulations on MDOT's websites are maintained and up-to-date, and develop a web based customer service tool for answering technical questions and referencing appropriate agency experts.
State and Class I railroads should develop long-standing cooperative relationships that help to facilitate projects and programs. Led by TSO and MTA, the State should establish a standing outreach program, using meetings or other forms of open communication and information-sharing. Class I railroads and Amtrak should reciprocate, and become engaged partners with the State.

MDOT, in cooperation with other State agencies and private stakeholders, will develop and implement projects or programs to advance the strategies set forth in this Plan. Examples of such projects or programs include:

- Completion of the High Speed Intercity Passenger Rail Studies, which may address rail capacity and operations issues in the State of Maryland, particularly along the Northeast Corridor.
- Convene a Goods Movement Advisory Committee to examine freight system challenges and recommend near- and long-term freight projects and initiatives.
- Development of a "Maryland Freight Finder" geographic database of freight transportation facilities, terminals, handling centers, and major freight-generating industry clusters in order to help decision-makers and the public at large better understand the connection between freight transportation observed in communities and the economic activity that transportation is supporting;
- Updating the Diesel Vehicle Emissions Control Program in cooperation with the Maryland Department of the Environment;
- Establishment of a "trucking business incubator," in partnership with the motor carrier industry and Maryland's higher education community, which would assist owner-operators and small motor carrier firms to develop skills necessary to manage their business and to survive in a dynamic and competitive environment.

6.0 TRACKING PERFORMANCE

Below are the leading indicators that point to how the freight transportation system is changing as strategies and tactics are put into place. These measures are reported in the Freight System Performance Annual Report and are intended to further the understanding of freight needs and benefits and create a common point of reference for the discussion of improvements. Performance measures, no matter how sophisticated, can never tell the full story and should not substitute for detailed analysis of freight operations and planning. Nevertheless, the continued and enhanced use and reporting of freight performance measures is a key feature of the strategic direction in this Plan.

	Performance Measure
Quality of Service – Highway	Truck Congestion Cost (in $ millions) on freeways/expressways in the Baltimore/ Washington region
	Amount of delay for trucks due to congestion on freeways/expressways
	Wasted fuel for trucks
	Truck user cost savings due to recurring congestion relief projects on State highways
	Percentage of the Maryland SHA network in overall preferred maintenance condition (AR)
Quality of Service – Marine	Average truck turn-around time at Seagirt Marine Terminal (AR)
Safety and Security – Highway	Number of fatalities in traffic crashes involving heavy trucks on all roads
	Number of persons injured in traffic crashes involving heavy trucks on all roads
	Annual number of commercial vehicle safety inspections performed
	Number of available truck parking spaces
	Peak Overnight Truck Parking volume
Safety and Security – Rail	Number of non-fatal crashes at at-grade rail crossings
	Number of fatal crashes at at-grade rail crossings
	Number of public and private at-grade highway-rail crossings
	Number of hazardous materials release incidents
Safety and Security – Marine	MPA compliance with the Maritime Transportation Security Act of 2002

System Preservation and Performance – Highway	Number or percent of bridges that are structurally deficient (AR)
	Percent of roadway miles with acceptable ride quality (AR)
	Weighed vehicles found to be overweight
System Preservation and Performance – Marine	Dredge material placement capacity remaining for Harbor and Bay sections
Economic Prosperity – Rail	Number of short line carloads on Maryland owned rail
Economic Prosperity – Marine	Port of Baltimore Foreign Cargo (AR)
	MPA General Cargo Tonnage (AR)
Economic Prosperity – Air	Total air tonnage at BWI Marshall Airport
	Number of nonstop airline markets served by BWI Marshall
Environmental Stewardship – Marine	Mid-Atlantic Dray Truck Replacement Program
	Acres of wetlands and wildlife habitat created, restored, or improved since 2000
Community Vitality	Intermodal containers moved by rail through the Port of Baltimore (AR)
	Domestic intermodal containers moved by rail

(AR) indicates that the measure is currently reported in the Annual Attainment Report.

7.0 LIST OF ACRONYMS

CSX CSX Corporation

DBED Maryland Department of Business and Economic Development

HOS Hours of Service

ITS Intelligent Transportation Systems

MAP-21 Moving Ahead for Progress in the 21st Century

MDA Maryland Department of Agriculture

MDDE Maryland and Delaware Railroad

MDE Maryland Department of the Environment

MDOT Maryland Department of Transportation

- *MAA* *Maryland Aviation Administration*
- *MPA* *Maryland Port Administration*
- *MTA* *Maryland Transit Administration*
- *MVA* *Motor Vehicle Administration*
- *TSO* *The Secretary's Office*
- *SHA* *Maryland State Highway Administration*
- *MDTA* *Maryland Transportation Authority*

MDP Maryland Department of Planning

MPO Metropolitan Planning Organization

MSP Maryland State Police

NS Norfolk Southern Corporation

OS/OW Oversize/Overweight

USDOT United States Department of Transportation

8.0 GLOSSARY

Arterial	A main road with many roads branching off of it. A type of road as defined by the Federal Highway Administration.
Barge	A marine vessel that is pushed or towed by tugboats used to transport freight. They are usually unpowered.
Carriers	Organizations or individuals that transport people or freight.
Clearance	The amount of space needed for a moving object to safely pass a stationary object. Vertical clearance is the space from the ground to the underside of a bridge or overpass. Double-stack clearance is the vertical clearance needed for a double-stacked rail freight car to pass through.
Cluster	A close geographic grouping.
Commercial vehicle	Any motor vehicle that is designed, used and maintained for the transportation of goods or property, (this does not include passenger vehicles)
Commodities	Description of the types of goods that are bought and sold.
Congestion	When movement or flow on a roadway is restricted (typically) due to the number of other vehicles.
Container	A rectangular storage unit commonly used to transport goods. Commonly associated with Intermodal transportation.
Distribution center	Central warehouse where goods are housed prior to delivery to individual stores.
Drayage	Movement of goods by truck over a short distance, often as part of a longer overall move (such as between a port and a rail terminal). These trips are normally completed within a single day.
Export	Movement of goods out of an area or region.
Freight	Goods or materials moved by truck, ship, train, pipeline, or plane

Freight volume	Space designed to store, transfer, and/or transport freight.
Freight-generating industry	An industry that is involved in the production or transport of goods.
Fulfillment center	Central warehouse where goods are housed prior to delivery directly to individuals or businesses. Typically associated with online commerce (e-commerce).
Goods movement (also freight transportation)	The movement of any product that is used in the economy. This includes "freight" which is typically identified with raw material, energy products, waste, and other "heavy" goods, as well as packages, parcels, and other "consumer" shipments.
Hours of Service (HOS)	Federal rules governing the work hours for commercial drivers.
Import	Movement of goods into an area or region.
Infrastructure	Services and facilities necessary for the economy to function.
Intelligent Transportation Systems (ITS)	Information-sharing technology integrated into the transportation system infrastructure, and in vehicles. It is designed to help monitor and manage traffic flow, reduce congestion, and provide alternate routes.
Intermodal terminal	A facility where freight is transferred between modes.
Loading zone	Locations designed for the loading and unloading of freight. They may be on-street or off-street; Loading Docks are structures which allow a truck to load/unload directly from the bed of the truck.
Logistics	The management of the freight movement system; making sure the right amount of the right products are shipped to and from the correct location.
Motor carrier	A highway passenger or freight carrier operating for compensation.
Moving Ahead for Progress in the 21st Century (MAP-21)	Federal surface transportation spending bill passed in 2012.
Multimodal	A shipment of goods utilizing several modes of transportation (air, truck, ship, etc.) combined with the connections between them (port, airport, etc.)
Omni-channel retail	A marketing approach that allows consumers to interact with a retailer seamlessly across multiple "channels," including in-store, online, mobile devices, television, catalogs, etc.
Oversize/Overweight (OS/OW)	Truck shipments that are above legal size and/or weight limits
Over-the-road	Long-distance truck moves often requiring multiple days of travel.
Railroads	Operators of rail transportation systems, including: *Class I – railroads with annual operating revenues above $250 million* *Shortline – railroads with annual operating revenues under $20 million* *Commuter – railroads move passengers during peak times to/from or within a metropolitan area; and* *Intercity Passenger- railroads that move passengers longer distances, often from one metropolitan area to another or from one state to another.*
Resiliency	Ability to withstand or overcome changes or challenges
Shipper and Receiver	The shipper is responsible for sending cargo. A receiver is the party to which the goods are transported.
Supply chain	The sequence of movements needed to move raw materials through production and to the final consumer.
Trading partners	Regions that are origins or destinations for goods.
Trip	Movement of goods from one location to another.
Truck parking	Facilities located on-highway (such as a state-operated rest area) or off-highway (such as a private truck stop), which provide spaces for trucks to park and drivers to rest.

Maryland Department of Transportation

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Maryland Aviation Administration

Port of Baltimore 1706

MTA Maryland

Maryland Transportation Authority

MVA Motor Vehicle Administration

SHA State Highway Administration

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