

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

Maryland State Freight Plan



July 2022 DRAFT



FHWA APPROVAL LETTER

This 2022 **Maryland State Freight Plan** has been prepared by/for:

Maryland Department of Transportation

7201 Corporate Center Drive

Hanover, Maryland, 20176

(410) 865-1000; Toll free 1-(888) 713-1414

MDStateFreightPlan@mdot.maryland.gov

<https://mdot.maryland.gov/freightplan>

It has been prepared in accordance with federal requirements for state freight plans as expanded under the 2021 Infrastructure Investment and Jobs Act (IIJA)/Bipartisan Infrastructure Law (BIL) per details in 49 U.S.C. §70202.

**Scanned image of FHWA signed approval letter
(pending future review and approval – estimated by November 2022)**

TABLE OF CONTENTS

ES	EXECUTIVE SUMMARY _____	ES-1	6	FREIGHT FOCUS AREAS AND PROGRAMS _____	6-3
1	INTRODUCTION _____	1-2	6.1	Safety and Security _____	6-3
1.1	Purpose, Vision, and Context _____	1-3	6.2	Operational Programs and Innovative/Disruptive Technologies _____	6-8
1.2	Recent Freight Actions and Resources _____	1-8	6.3	Asset Preservation and Improvement Programs _____	6-16
1.3	Stakeholders and Partnerships _____	1-12	6.4	Freight Congestion and Reliability _____	6-20
2	STRATEGIC GOALS AND OBJECTIVES _____	2-1	6.5	Truck Parking Facilities _____	6-34
2.1	Overview _____	2-2	6.6	Supply Chain Cargo Flows _____	6-41
2.2	Federal Requirements _____	2-5	6.7	Commercial Ports _____	6-45
2.3	State Refinements _____	2-7	6.8	Multistate Freight Coordination _____	6-48
3	FREIGHT DEMAND AND THE ECONOMY _____	3-2	6.9	E-Commerce and Related Planning Considerations _____	6-52
3.1	Maryland Commodity Flows _____	3-2	6.10	Military Freight Considerations _____	6-54
3.2	Maryland Freight Economic Influences _____	3-14	6.11	Freight Resilience, Environmental, and Equity Considerations _____	6-58
3.3	Maryland Freight Industry Sector Profiles _____	3-17	7	FREIGHT PROJECTS AND INVESTMENT PLAN _____	7-2
4	FREIGHT NETWORK AND INFRASTRUCTURE _____	4-2	7.1	Candidate Freight Project Identification _____	7-2
4.1	Roadways _____	4-2	7.2	National Highway Freight Program (NHFP) _____	7-3
4.2	Railroads _____	4-9	7.3	Other Project Funding and Implementation Opportunities _____	7-5
4.3	Ports and Waterways _____	4-15	7.4	Additional Unfunded Needs/Priorities _____	7-7
4.4	Air Cargo _____	4-22	8	FREIGHT IMPLEMENTATION PLAN _____	8-2
4.5	Energy Infrastructure _____	4-24	8.1	Summary Freight Strategies _____	8-2
4.6	Multimodal Freight Network _____	4-30	8.2	Implementation Tactics _____	8-11
5	FREIGHT SYSTEM PERFORMANCE, TRENDS, AND NEEDS _____	5-2	8.3	Closing and Next Step Priorities _____	8-12
5.1	Freight Performance Measures _____	5-2			
5.2	Agency and Stakeholder Perspectives _____	5-17			
5.3	Summary Freight Needs – Regional Perspectives _____	5-18			
5.4	Summary Freight Needs – Statewide Perspectives _____	5-20			

EXHIBITS

SECTION 1

EXHIBIT 1.1:	Maryland Freight At-A-Glance _____	1-2
EXHIBIT 1.2:	Maryland State Freight Plan Alignment with Federal Freight Planning Requirements _____	1-4
EXHIBIT 1.3:	MDOT Transportation Business Units/Offices and Related Freight Activities _____	1-5
EXHIBIT 1.4:	Freight Trends/Drivers for Goods Movement Demand and System Performance _____	1-7
EXHIBIT 1.5:	External Stakeholders and Partners _____	1-13

SECTION 2

EXHIBIT 2.1:	Vision, Goals, and Objectives _____	2-3
EXHIBIT 2.2:	National Freight Policy in terms of U.S.C. Definitions _____	2-6
EXHIBIT 2.3:	National Freight Policy in terms of National Freight Strategic Plan Goals and Objectives _____	2-7
EXHIBIT 2.4:	Maryland 2017-2022 Freight Goals Comparison _____	2-7

SECTION 3

EXHIBIT 3.1:	Maryland Commodity Flows – 2020 Summary by Trade Type (Domestic, Import, Export) _____	3-3
EXHIBIT 3.2:	Maryland Commodity Flows – 2020 Summary by Direction (Intrastate, Inbound, Outbound) _____	3-4
EXHIBIT 3.3:	Maryland Commodity Flows – 2020 Leading Domestic Trade Partners _____	3-4
EXHIBIT 3.4:	Maryland Commodity Flows – 2020 Freight Origin-Destination Tonnage by State (kTons) _____	3-5
EXHIBIT 3.5:	Maryland Commodity Flows – 2020 Freight Origin-Destination Value by State (\$M) _____	3-6
EXHIBIT 3.6:	Maryland Commodity Flows – 2020 Foreign Import Summary _____	3-7
EXHIBIT 3.7:	Maryland Commodity Flows – 2020 Foreign Export Summary _____	3-8
EXHIBIT 3.8:	Maryland Commodity Flows – 2020 Summary by Mode _____	3-9
EXHIBIT 3.9:	Maryland Commodity Flows – 2020 Leading Commodities by Tonnage _____	3-10

SECTION 3 (CONTINUED)

EXHIBIT 3.10:	Maryland Commodity Flows – 2020 Leading Commodities by Value _____	3-11
EXHIBIT 3.11:	Maryland Commodity Flows – 2020-2050 Overall Freight Growth Trends _____	3-12
EXHIBIT 3.12:	Maryland Commodity Flows – 2020-2050 Commodity-Specific Freight Growth Trends _____	3-13
EXHIBIT 3.13:	Maryland Freight Economic Influences – Population Projections (2010-2045) _____	3-14
EXHIBIT 3.14:	Maryland Freight Economic Influences – Establishments, Employment, and Wages (2017) _____	3-15
EXHIBIT 3.15:	Maryland Freight Economic Influences – Annual State Revenues (2019) _____	3-15
EXHIBIT 3.16:	Maryland Freight Economic Influences – Industry Sectors as Percent of Maryland GDP (2019) _____	3-16
EXHIBIT 3.17:	Maryland Freight Economic Influences – Modes and Characteristics _____	3-17
EXHIBIT 3.18:	Maryland Employment by County – 2019 Agriculture _____	3-19
EXHIBIT 3.19:	Maryland Mine and Quarry Sites (2018-2019) _____	3-22
EXHIBIT 3.20:	Maryland Employment by County – 2019 Construction and Utilities _____	3-25
EXHIBIT 3.21:	Maryland Employment by County – 2019 Manufacturing _____	3-30
EXHIBIT 3.22:	Maryland Employment by County – 2019 Wholesale Trade and Transportation _____	3-33
EXHIBIT 3.23:	Maryland Employment by County – 2019 Retail Trade _____	3-34
EXHIBIT 3.24:	Maryland Employment by County – 2019 Healthcare _____	3-37
EXHIBIT 3.25:	Maryland Employment by County – 2019 Government and Knowledge Sector _____	3-38

SECTION 4

EXHIBIT 4.1:	Maryland Highway Mileage by Functional Classification _____	4-2
EXHIBIT 4.2:	National Highway Freight Network in Maryland _____	4-4
EXHIBIT 4.3:	Maryland PHFS Routes _____	4-5
EXHIBIT 4.4:	Maryland Non-PHFS Interstate Routes _____	4-5
EXHIBIT 4.5:	Maryland PHFS Intermodal Connectors _____	4-6

SECTION 4 (CONTINUED)

EXHIBIT 4.6:	Maryland Highway Freight Routes _____	4-8
EXHIBIT 4.7:	Maryland Rail System – Rail Operators _____	4-9
EXHIBIT 4.8:	Maryland Freight Mode Share by Rail by Distance _____	4-10
EXHIBIT 4.9:	Maryland Rail System – 286k Capability _____	4-12
EXHIBIT 4.10:	Maryland Rail System – Double Stack Clearance Restrictions _____	4-13
EXHIBIT 4.11:	Maryland Rail Transfer Facilities _____	4-14
EXHIBIT 4.12:	Port of Baltimore Tonnage Estimates (2019) _____	4-15
EXHIBIT 4.13:	Port of Baltimore Marine Terminals _____	4-16
EXHIBIT 4.14:	Port of Baltimore Import/Export Loaded Twenty-foot Equivalent Units (TEUs) _____	4-17
EXHIBIT 4.15:	Seagirt Marine Terminal ICTF Activity _____	4-18
EXHIBIT 4.16:	Port of Baltimore Dredging Demand vs. Capacity (as of June 30, 2021) _____	4-19
EXHIBIT 4.17:	Maryland Key Inland Waterways for Freight Movements _____	4-20
EXHIBIT 4.18:	Maryland Air Cargo Airports _____	4-22
EXHIBIT 4.19:	Annual Cargo (Freight & Mail) at BWI Marshall Airport (2016-2021) _____	4-23
EXHIBIT 4.20:	Top 10 Freight Carriers at BWI Marshall Airport (2021) _____	4-23
EXHIBIT 4.21:	Maryland Power Generation Sites _____	4-24
EXHIBIT 4.22:	Maryland Net Electricity Generation by Source, June 2021 (Thousand MWh) _____	4-25
EXHIBIT 4.23:	Maryland Pipeline Networks _____	4-26
EXHIBIT 4.24:	Maryland Energy Storage and Terminal Sites _____	4-27
EXHIBIT 4.25:	Maryland Energy Rankings (2019) _____	4-28
EXHIBIT 4.26:	Maryland Energy Consumption by End-Use Sector, 2018 (Trillion BTU) _____	4-28
EXHIBIT 4.27:	Maryland Energy Consumption by Source, 2019 (Trillion BTU) _____	4-29
EXHIBIT 4.28:	Maryland Multimodal Freight Network _____	4-32
EXHIBIT 4.29:	Multimodal Critical Rural Freight Facilities _____	4-32

SECTION 5

EXHIBIT 5.1:	Maryland Freight Performance Measures (Summary List and General Sources)	5-2
EXHIBIT 5.2:	Maryland Freight Performance Measures (Safety, Security, and Resilience)	5-5
EXHIBIT 5.3:	Maryland Freight Performance Measures (Economic Opportunity and Efficiency)	5-7
EXHIBIT 5.4:	Maryland Freight Performance Measures (System Preservation and Modernization)	5-9
EXHIBIT 5.5:	Maryland Freight Performance Measures (Quality of Service, Efficiency, and Customer Experience)	5-11
EXHIBIT 5.6:	Maryland Freight Performance Measures (Environmental Protection and Sensitivity)	5-13
EXHIBIT 5.7:	Maryland Freight Performance Measures (Fiscal Responsibility)	5-15
EXHIBIT 5.8:	Maryland Freight Performance Measures (Transportation Choices and Connections)	5-16
EXHIBIT 5.9:	Maryland Regional Freight Needs Summary	5-18
EXHIBIT 5.10:	Maryland Summary Freight Needs by Goal	5-20

SECTION 6

EXHIBIT 6.1:	Maryland Fatal/Injury Crash Trends Involving Heavy Trucks	6-3
EXHIBIT 6.2:	Maryland Fatal Crashes involving Heavy Trucks by Region (2016-2020)	6-4
EXHIBIT 6.3:	Maryland Fatal Crashes Involving Heavy Trucks by Route (2016-2020)	6-4
EXHIBIT 6.4:	Maryland Lane Closure Hours Due to Fatal Crashes Involving Heavy Trucks	6-4
EXHIBIT 6.5:	Maryland Highway-Rail Crossing Inventory	6-5
EXHIBIT 6.6:	Maryland Highway-Rail Grade Crossing Incident Trends	6-5
EXHIBIT 6.7:	Maryland Highway-Rail Grade Crossing Incidents by Region (2016-2020)	6-6
EXHIBIT 6.8:	Maryland Highway-Rail Crossings with Two or More Incident Occurrences (2016-2020)	6-6
EXHIBIT 6.9:	Maryland Hazardous Material Release Incidents	6-7
EXHIBIT 6.10:	Number of MDTA and MDOT SHA Bridges in Poor Condition	6-17
EXHIBIT 6.11:	Percent of MDOT SHA Network in Preferred Maintenance Condition	6-18
EXHIBIT 6.12:	Overall Acceptable Pavement Condition	6-18

SECTION 6 (CONTINUED)

EXHIBIT 6.13:	Port of Baltimore Channel System and Dredging Sites	6-19
EXHIBIT 6.14:	Maryland Truck Volume Map	6-21
EXHIBIT 6.15:	Maryland Congestion Map (2019 AM Peak)	6-24
EXHIBIT 6.16:	Maryland Congestion Map (2019 PM Peak)	6-25
EXHIBIT 6.17:	Maryland Reliability Map (2019 AM Peak)	6-26
EXHIBIT 6.18:	Maryland Reliability Map (2019 PM Peak)	6-27
EXHIBIT 6.19:	Maryland 2019 Truck Bottlenecks (Ranked 1-25 by Truck Delay per Mile)	6-29
EXHIBIT 6.20:	Maryland 2019 Truck Bottlenecks (Ranked 26-50 by Truck Delay per Mile)	6-29
EXHIBIT 6.21:	Maryland 2019 Truck Bottlenecks (Ranked 51-100 by Truck Delay per Mile)	6-29
EXHIBIT 6.22:	Maryland's Least Reliable Corridors for Truck Travel (2019 TTTR Based)	6-31
EXHIBIT 6.23:	Freight Congestion Cost Components on Maryland's Freeway/Expressway System	6-32
EXHIBIT 6.24:	Freight Congestion Cost Trends (2015-2019) on Maryland's Freeway/Expressway System	6-32
EXHIBIT 6.25:	Freight Congestion Costs Due to Maryland's Top 100 Truck Bottleneck Segments	6-32
EXHIBIT 6.26:	Public and Private Truck Parking Locations in Maryland	6-36
EXHIBIT 6.27:	Emergency Truck Parking Locations in Maryland	6-37
EXHIBIT 6.28:	Priority Clusters of Undesignated Truck Parking (Map)	6-39
EXHIBIT 6.29:	Priority Clusters of Undesignated Truck Parking (Table)	6-40
EXHIBIT 6.30:	Maryland Freight Fluidity Overview Map (I-95 Test Corridor)	6-44
EXHIBIT 6.31:	M-95 Marine Highway Corridor Summary	6-47
EXHIBIT 6.32:	Maryland Metropolitan Planning Organizations	6-50
EXHIBIT 6.33:	Military Facilities in Maryland	6-55
EXHIBIT 6.34:	Strategic Defense Networks and Military Facilities in Maryland	6-56
EXHIBIT 6.35:	Maryland CTP Projects Overlapping the Strategic Defense Networks	6-57
EXHIBIT 6.36:	MDOT SHA Climate Change Vulnerability Viewer (sample)	6-59
EXHIBIT 6.37:	Maryland Alternative Fuel Corridors	6-61

SECTION 7

EXHIBIT 7.1:	NHFP Project Eligibilities and Attributes _____	7-3
EXHIBIT 7.2:	Maryland FY 2022 Estimated Formula Funding _____	7-5

SECTION 8

EXHIBIT 8.1:	Maryland Freight Goals _____	8-2
EXHIBIT 8.2:	Safety, Security, and Resilience Strategies _____	8-3
EXHIBIT 8.3:	Economic Opportunity and Efficiency Strategies _____	8-4
EXHIBIT 8.4:	System Preservation and Modernization Strategies _____	8-6
EXHIBIT 8.5:	Quality of Service, Efficiency, and Customer Experience Strategies _____	8-7
EXHIBIT 8.6:	Environmental Protection and Sensitivity Strategies _____	8-8
EXHIBIT 8.7:	Fiscal Responsibility Strategies _____	8-9
EXHIBIT 8.8:	Transportation Choices and Connections Strategies _____	8-10
EXHIBIT 8.9:	Freight Implementation Tactics _____	8-11

APPENDICES

APPENDIX 2A:	Milestone #1 Survey Feedback
APPENDIX 5A:	Milestone #2 Survey Feedback
APPENDIX 5B:	Regional Needs Maps
APPENDIX 7A:	Candidate Freight Projects
APPENDIX 7B:	Maryland Freight Investment Plan
APPENDIX 7C:	Multimodal Freight Eligible Projects

ACRONYMS/ABBREVIATIONS

\$M	Million Dollars	CAMPO	Cumberland Area MPO
120k	120,000-pounds	CAV	Connected and Automated Vehicle
286k	286,000-pounds	CCTV	Closed-Circuit Television
AADT	Annual Average Daily Traffic	CCVV	MDOT SHA Climate Change Vulnerability Viewer
AAM	Advanced Air Mobility	CFS	Commodity Flow Survey
AAR	Association of American Railroads	CHART	MDOT SHA Coordinated Highways Action Response Team
AASHTO	American Assoc. of State Highway and Transportation Officials	CMAQ	Congestion Mitigation and Air Quality Program
ADAS	Advanced Driver Assistance Systems	CMAR	Construction Management At Risk
ADHS	Appalachian Development Highway System	CO2e	Carbon dioxide equivalent or CO2e accounts for the collective impact of carbon dioxide and/or other GHG emissions using carbon dioxide as a common reference to measure their equivalent global warming potential in a single metric.
AET	All Electronic Tolling	CRFC	Critical Rural Freight Corridor
ALP	Airport Layout Plan	CRISI	Consolidated Rail Infrastructure and Safety Improvements Program
AML	Advanced Machine Learning	CRR	Canton Railroad
AMO	MDOT SHA Asset Management Office	CSX or CSXT	CSX Transportation
AMTK	Amtrak (National Passenger Railroad Corporation)	CTP	Consolidated Transportation Program
ANZ	Airport Noise Zone	CUFC	Critical Urban Freight Corridor
AR	MDOT SHA Annual Attainment Report	CVISN	Commercial Vehicle Information Systems and Networks
ARC	Appalachian Regional Commission	CY	Calendar Year
ATIS	Advanced Traffic Information System(s)	DB	Design-Build
ATMS	Advanced Transportation Management System(s)	DBED	Maryland Department of Business and Economic Development
ATRI	American Transportation Research Institute	D.C.	District of Columbia
BEA	U.S. Bureau of Economic Analysis	DDOT	District Department of Transportation
BIL	2021 Bipartisan Infrastructure Law (or IIJA)	DE	Delaware
BMC	Baltimore Metropolitan Council	DeIDOT	Delaware Department of Transportation
BRAC	Base Realignment & Closure Program	DCRR	Delmarva Central Railroad Company
BRTB	Baltimore Regional Transportation Board	DMCF	Dredged Material Containment Facility
BSBT	(CRR) Boston Street Bulk Terminal	DMMP	Dredged Material Management Program
BTS	U.S. Bureau of Transportation Statistics	DMS	Dynamic Message Sign
BTU	British Thermal Unit	DNR	Maryland Department of Natural Resources
BUILD	Better Utilizing Investments to Leverage Development	DOD	U.S. Department of Defense
BWI	Baltimore/Washington International Thurgood Marshall Airport	DOT or DOTs	Department(s) of Transportation
C&D	Chesapeake & Delaware (Canal)	DPM	Delay per Mile
CA	California	DSRC	Dedicated Short-Range Communication
C-SMMPO	Calvert-St. Mary's MPO		

ACRONYMS/ABBREVIATIONS (CONTINUED)

DVRPC	Delaware Valley Regional Planning Commission	HOS	Hours of Service
DWTC	Delmarva Water Transport Committee	HPMS	Highway Performance Monitoring System
EIAU.S.	Energy Information Administration	HSIP	Highway Safety Improvement Program
EPA	U.S. Environmental Protection Agency	HST	Howard Street Tunnel
ETC	Electronic Toll Collection	I-81CC	I-81 Corridor Coalition
EV or EVs	Electric Vehicle(s)	ICM	Innovative Congestion Management
FAA	Federal Aviation Administration	ICTF	Intermodal Container Transfer Facility
FAF or FAF5	FHWA Freight Analysis Framework (Version 5)	IIJA	2021 Infrastructure Investment and Jobs Act (or BIL)
FARS	Fatality Analysis Reporting System	INFRA	Infrastructure for Rebuilding America Program
FAST Act	2017 Fixing America's Surface Transportation Act	IoT	Internet of Things
FELU	Freight Efficient Land Use	IT	Information Technology
FFY	Federal Fiscal Year	ITS	Intelligent Transportation Systems
FHWA	Federal Highway Administration	KTONS	Kilotons (Thousand Tons)
FL	Florida	LED	Light-Emitting Diode
FMCSA	Federal Motor Carrier Safety Administration	LTG	Large Traffic Generator(s)
FMS	Freight Modeling System	LTL	Less-Than-Truckload
FRA	Federal Railroad Administration	LNG	Liquefied Natural Gas
FSMA	Food Safety Modernization Act	MAP	Intersection Map Data (typically in a CAV context)
FY	Fiscal Year	MAP-21	2012 Moving Ahead for Progress in the 21st Century Act
GC	Georges Creek Railway	MARAD	USDOT Maritime Administration
GDP	Gross Domestic Product	MARC	Maryland Area Regional Commuter Train Service
GHG	Greenhouse Gas	MCCC	Maryland Commission on Climate Change
GIS	Geographic Information System(s)	MCD	Motor Carrier Division
GPS	Global Positioning System(s)	MCY	Million Cubic Yards
GSP	Gross State Product	MD	Maryland
HAR	Highway Advisory Radio	MDA	Maryland Department of Agriculture
HAV	Highly Automated Vehicle	MDDE	The Maryland and Delaware Railroad Company
HEPMPO	Hagerstown-Eastern Panhandle MPO	MDE	Maryland Department of the Environment
HGL	Hydrocarbon Gas Liquids	MDOT	Maryland Department of Transportation
HGR	Hagerstown Regional Airport	MDOT MAA	Maryland Aviation Administration
HNI	Highway Needs Inventory	MDOT MPA	Maryland Port Administration
		MDOT MTA	Maryland Transit Administration

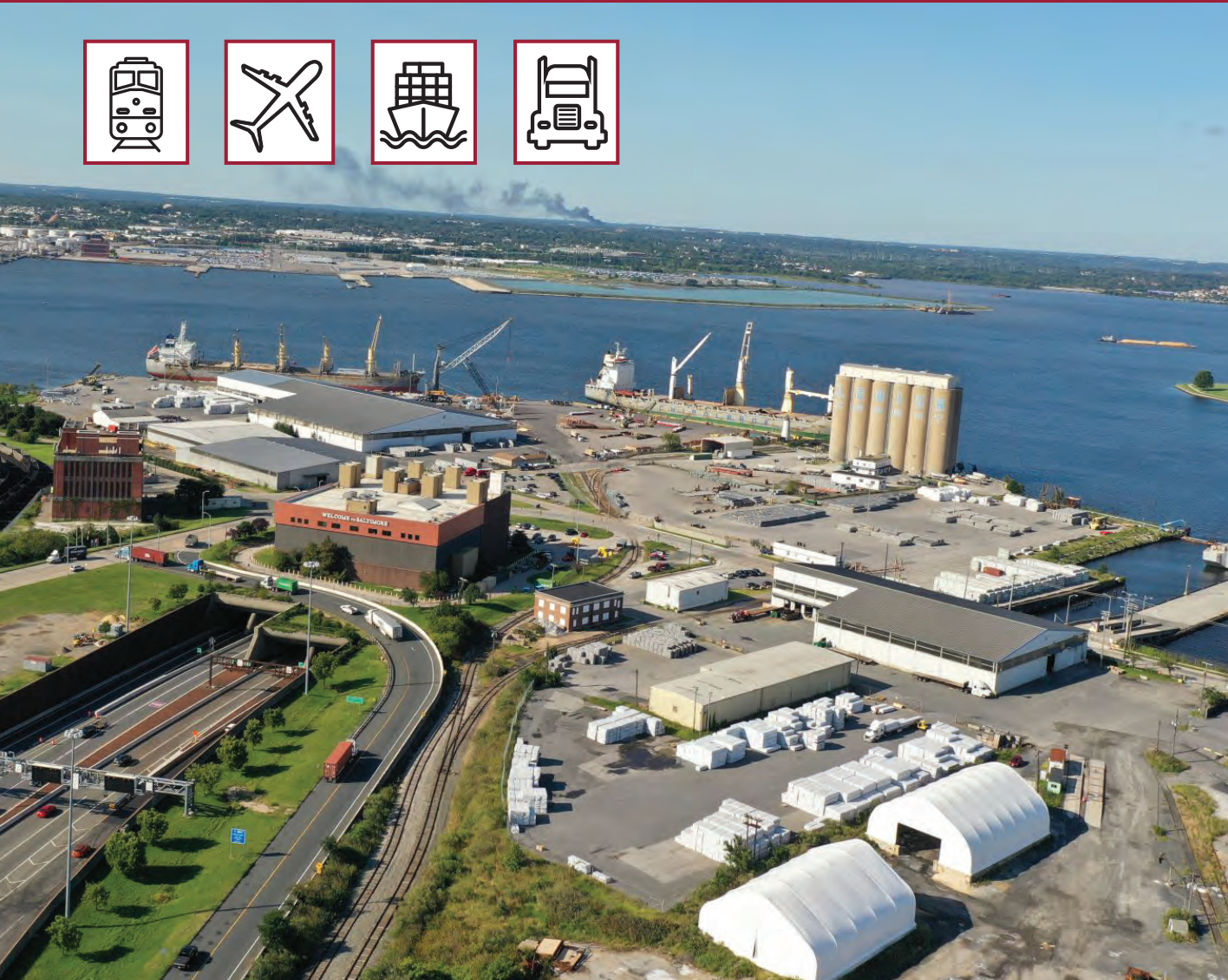
ACRONYMS/ABBREVIATIONS (CONTINUED)

MDOT MVA	Motor Vehicle Administration	NHPP	National Highway Performance Program
MDOT OPCP RIF	Office of Planning and Capital Programming/Rail and Intermodal Freight Team	NHS	National Highway System
MDOT SHA	State Highway Administration	NHSTA	National Highway Traffic Safety Administration
MDOT TSO	The Secretary's Office	NIPA	National Infrastructure Project Assistance Program
MDP	Maryland Department of Planning	NMNFN	National Multimodal Freight Network
MDTA	Maryland Transportation Authority	NS	Norfolk Southern
MEA	Maryland Energy Administration	NSF	Naval Support Facility
MFR	MDOT Managing for Results Program	NY	New York
MM	Maryland Midland Railway	O&M	Operations and Maintenance
MMTA	Maryland Motor Truck Association	OBU	On-Board Unit
MOU	Memorandum of Understanding	OMOC	One Maryland One Centerline
MPO or MPOs	Metropolitan Planning Organization(s)	OOTs	MDOT SHA Office of Traffic and Safety
MRPT	Maryland Roadway Performance Tool	OTMO	MDOT SHA Office of Transportation Mobility and Operations
MS	Mississippi	OS/OW	Oversize/Overweight
MSP	Maryland State Police	P3	Public/Private Partnership
MSTM	Maryland Statewide Transportation Model	PA	Pennsylvania
MSU	Morgan State University	PAC	Ports America Chesapeake
MTN	Martin State Airport	PDD	Personal Delivery Device
MTP	2040 Maryland Transportation Plan	PennDOT	Pennsylvania Department of Transportation
MWCOG	Metropolitan Washington Council of Governments	PHFS	Primary Highway Freight System
MWH	Megawatt Hours	PHMSA	Pipeline and Hazardous Materials Safety Administration
NAICS	North American Industry Classification System	PIDP	Port Infrastructure Development Program
NAS	Naval Air Station	PTI	Planning Time Index
NCFRP	National Cooperative Freight Research Program	RAISE	Rebuilding American Infrastructure with Sustainability & Equity Program
n.e.c.	not elsewhere classified (typically refers to a sub-group of a noted commodity type)	RFID	Radio Frequency Identification
NEC	Northeast Corridor	RND	Railroads for National Defense Program
NEPA	National Environmental Policy Act	RoRo	Roll-On/Roll-Off
NEVI	National Electric Vehicle Infrastructure Program	RSU	Roadside Unit
NFSP	National Freight Strategic Plan	SAMP	MDOT Strategic Asset Management Plan
NHFN	National Highway Freight Network	SB	Senate Bill
NHFP	National Highway Freight Program	SBY	Salisbury Airport
		SCTG	Standard Classification of Transported Goods

ACRONYMS/ABBREVIATIONS (CONTINUED)

SERM	MDOT MPA Safety, Environment, and Risk Management	USACE	U.S. Army Corps of Engineers
SFAC	State Freight Advisory Committee	U.S.C.	United States Code
SMT	Seagirt Marine Terminal	USCP	U.S. Capitol Police
SPaT	Signal Phase and Timing	USDOT	U.S. Department of Transportation
STAA	Surface Transportation Assistance Act (of 1982)	USGS	U.S. Geological Survey
STIP	Statewide Transportation Improvement Program	VA	Virginia
STRACNET	Strategic Rail Corridor Network	VMT	Vehicle-Miles Traveled
STRAHNET	Strategic Highway Network	VPP	Vehicle Probe Project
SUMA	Support for Urban Mobility Analysis Tool	VWS	Virtual Weigh Station
S/WMPO	Salisbury/Wicomico MPO	W&LE	Wheeling & Lake Erie Railway
SY	Square Yards	WIM	Weigh-In-Motion
TA	Tradepoint Rail LLC	WMS	Western Maryland Scenic Railroad
TAMP	MDOT Transportation Asset Management Plan	WILMAPCO	Wilmington Area Planning Council
TBU or TBUs	Transportation Business Unit(s)	WSRR	Walkersville Southern Railroad
TDM	Transportation Demand Management	WW	Winchester & Western Railway
TETC	The Eastern Transportation Coalition	ZEV	Zero Emission Vehicles
TEUs	Twenty-Foot Equivalent Units	ZEVIP	Zero Emission Vehicle Infrastructure Plan
TIP	Transportation Improvement Program	ZEEVIC	Maryland Zero Emission Electric Vehicle Infrastructure Council
TMC	Traffic Management Center		
TOD	Transit Oriented Development		
TOPS	Transportation Online Permitting System		
TPB	National Capital Region Transportation Planning Board		
TPM	Transportation Performance Measurement		
TSMO	Transportation Systems Management and Operations		
TTI	Travel Time Index (in a performance context)		
TTI	Texas A&M Transportation Institute (in an organizational context)		
TTTR	Truck Travel Time Reliability Index		
TWIS	Truck Weigh & Inspection Station(s)		
TX	Texas		
UAV	Unmanned Aerial Vehicle		
ULCV	Ultra Large Container Vessel(s)		
U.S.	United States		

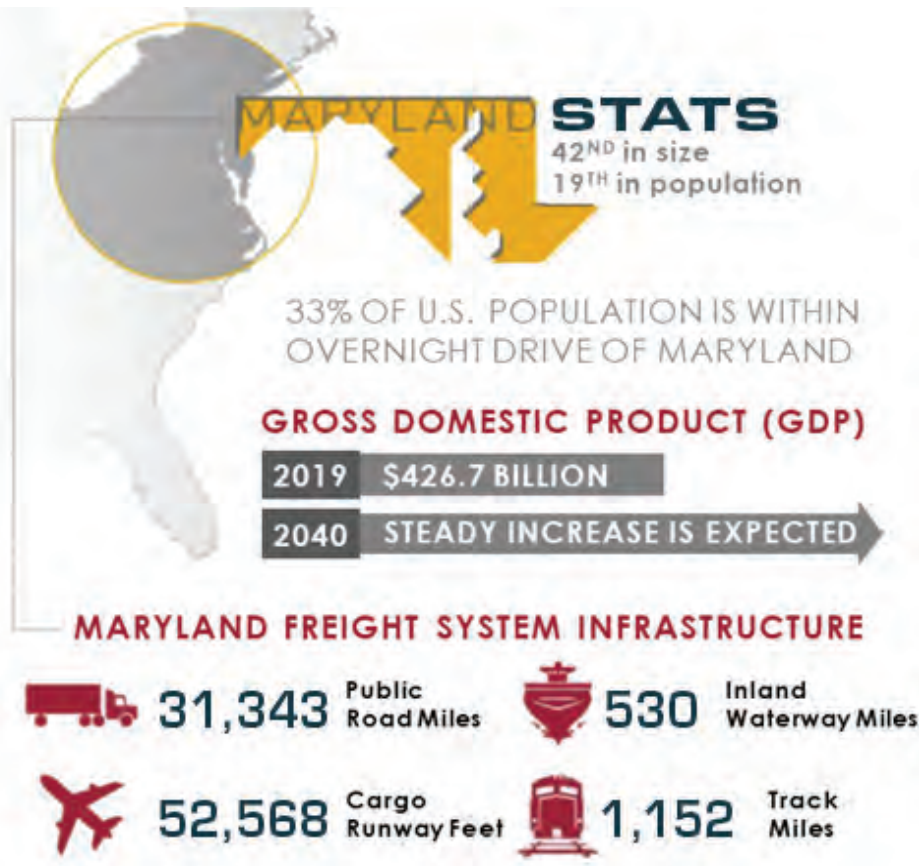
MARYLAND STATE FREIGHT PLAN Executive Summary



INTRODUCTION

The 2022 Maryland Freight Plan assesses Maryland freight movements, multimodal networks, and related details to supplement and support the overarching vision, goals, and long-range transportation planning initiatives in the 2040 Maryland Transportation Plan (MTP). It also incorporates national freight goals and guidance from federal surface transportation authorizations including the 2015 Fixing America's Surface Transportation (FAST) Act and newer requirements per the 2021 Infrastructure Investment and Jobs Act (IIJA).

EXHIBIT ES-1 MARYLAND FREIGHT AT-A-GLANCE



A **safe** and **efficient** freight system helps **lower costs** of goods that consumers and companies need for **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 for the Maryland Department of Transportation (MDOT).



MARYLAND FREIGHT PLAN VISION

Freight travels freely and safely through a modern, resilient, and interconnected multimodal network contributing to sustainable economic viability and growth for Maryland businesses and communities

EXHIBIT ES-2 VISION, GOALS, AND OBJECTIVES

PURPOSE OF THE FREIGHT PLAN

To examine existing and projected conditions, build consensus, and identify policy positions, strategies, and freight projects to improve freight movement efficiency and safety.

NATIONAL FREIGHT GOALS

NATIONAL FREIGHT STRATEGIC PLAN



SAFETY

Improve the safety, security, and resilience of the national freight system.



INFRASTRUCTURE

Modernize freight infrastructure and operations to grow the economy, increase competitiveness, and improve quality of life.



INNOVATION

Prepare for the future by supporting the development of data, technologies, and workforce capabilities that improve freight system performance.

49 U.S.C. §70101. (d) Goals (Multimodal Freight Policy)
23 U.S.C. §167. (b) Goals (Highway Freight Program)

2040 MARYLAND TRANSPORTATION PLAN (2040 MTP) GOALS



Ensure a Safe, Secure, and Resilient Transportation System



Facilitate Economic Opportunity and Reduce Congestion in Maryland through Strategic System Expansion



Maintain a High Standard and Modernize Maryland's Multimodal Transportation System



Improve the Quality and Efficiency of the Transportation System to Enhance the Customer Experience



Ensure Environmental Protection and Sensitivity



Promote Fiscal Responsibility



Provide Better Transportation Choices and Connections

MARYLAND FREIGHT PLAN GOALS

Safety, Security, and Resilience

Ensure the safe, secure, and resilient movement of goods on Maryland's multimodal freight network

Economic Opportunity and Efficiency

Enhance economic competitiveness through freight industry opportunities, mobility improvement, and strategic system expansion

System Preservation and Modernization

Modernize Maryland's multimodal freight network and operations with innovative solutions from origin to destination

Quality of Service, Efficiency, and Customer Experience

Enhance transportation services and communications for users of Maryland's multimodal freight system

Environmental Protection and Sensitivity

Support sustainable freight infrastructure, community vitality, and environmental stewardship

Fiscal Responsibility

Ensure responsible freight system investment and management through performance-based decision-making and innovative funding mechanisms and partnerships

Transportation Choices and Connections

Support alternative transportation choices and goods delivery options by improving multimodal and last-mile connections

MARYLAND FREIGHT PLAN OBJECTIVES



EXHIBIT ES-3 FEDERAL FREIGHT PLANNING REQUIREMENTS

FEDERAL REQUIREMENTS FOR STATE FREIGHT PLANS
1 Freight System Trends, Needs, and Issues
2 Freight Policies, Strategies, and Performance Measures
3 Multimodal Freight Facilities and Network
4 Alignment with National Freight Policy and Goals
5 Innovative Technologies and Operational Strategies
6 Asset Preservation and Improvements
7 Freight Bottlenecks, Mobility Issues, and Mitigation
8 Freight Induced Congestion and Mitigation
9 Freight Investment Plan
10 Truck Parking Facilities Assessment (IIJA)
11 Supply Chain Cargo Flows (IIJA)
12 Commercial Ports Inventory (IIJA)
13 Multi-state Freight Compact Consideration (IIJA)
14 E-Commerce Impacts (IIJA)
15 Military Freight Considerations (IIJA)
16 Freight Resilience and Environmental Impacts (IIJA)
17 State Freight Advisory Committee (SFAC)

Table Notes:
 (IIJA) – reflects new requirements introduced by IIJA, building onto the 10 requirements listed previously in the FAST Act

The 2022 Maryland Freight Plan contains all elements to meet federal freight planning requirements established by the FAST Act and expanded by the IIJA. These details require that the Plan cover an eight-year forecast period, be fiscally-constrained, include a freight investment plan with a list of priority projects, and describe how the state will invest and match its National Highway Freight Program (NHFP) funds. Additionally, including the expanded requirements under the IIJA, 49 U.S.C. §70202 outlines 17 required freight plan elements.

From an economic perspective, 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, and the logistics-related needs of Maryland industries and their supply chains continue to evolve, especially in the wake of the COVID-19 pandemic. Now more than ever, it is 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. To this end, the 2022 Maryland Freight Plan acknowledges key trends that drive goods movement demand and influence the performance of the goods movement transportation system.



RECENT FREIGHT ACTIONS AND RESOURCES

This update to the 2022 Maryland Freight Plan incorporates, where applicable, many of the recent freight-related actions or resources (at right) that have been advanced by MDOT and other freight stakeholders since completion of the 2017 Plan. Such actions include the implementation of recommended policies or guidance, advancements in freight data tools and performance measurement, the planning, design, or construction of significant projects, and updates to companion freight-related documents such as the 2022 Maryland State Rail Plan.

STAKEHOLDERS AND PARTNERSHIPS

Goods movement relies on a partnership between the freight transportation system owners and its users. The freight network consists of publicly and privately owned and maintained infrastructure. Efficient and safe transport of goods requires that MDOT and private sector partners work together to assess issues and develop and implement 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 2022 Maryland Freight Plan. The following describes MDOT's stakeholders and partnership roles throughout the development of this 2022 Maryland Freight Plan.

MDOT TRANSPORTATION BUSINESS UNITS

Development of the policies identified in the 2022 Maryland Freight Plan is a collective effort led by MDOT. The Freight Transportation Business Units (TBU) Roundtable represents offices throughout the MDOT TBUs and is the public agency freight voice for Maryland. It has met at key milestones during the development of the 2022 Maryland Freight Plan.

STATE FREIGHT ADVISORY COMMITTEE

Maryland's SFAC is another important institutional body that supports freight planning activities in Maryland and advocates for implementation of projects, programs, and policies to address freight-related priorities, issues, and funding needs. The SFAC represents the freight community at large and advises the state on project and program priorities, freight experience and performance, freight bottlenecks and solutions, next generation supply chain operations and technology, and how the state can support industry.

EXTERNAL STAKEHOLDERS

In addition to the MDOT Freight TBU roundtable and the SFAC, MDOT relies on partnerships with other public and private entities to help inform freight planning efforts and the 2022 Maryland Freight Plan updates.

Recent Freight Actions and Resources

- Maryland Freight Story
- Maryland Freight Economy Dashboard
- SHRP2 C20 Freight Modeling in Maryland
- Maryland Transportation Systems Management and Operations (TSMO) Strategic Plan
- Maryland Port Administration Strategic Plan
- Maryland State Highway Mobility Report
- Maryland Statewide Truck Parking Study
- BWI Marshall Airport Master Plan
- Maryland Connected and Automated Vehicles (CAV) Strategic Framework
- MDOT SHA Truck Parking Analysis
- Maryland Truck Platooning Legislation
- Maryland Personal Delivery Device Legislation
- Maryland State Rail Plan
- MDOT Attainment Report on Transportation System Performance (AR)
- Maryland Roadway Performance Tool
- Other Maryland Key Freight Projects and Studies

For links to these and other resources, refer to MDOT's Maryland Freight Plan website:

<https://mdot.maryland.gov/freightplan>

EXHIBIT ES-4 MDOT TBUS/OFFICES AND RELATED FREIGHT ACTIVITIES

MDOT TBUS/OFFICES		FREIGHT ACTIVITIES
MDOT TSO	The Secretary's Office	Statewide multimodal planning and coordination; motor carrier support, freight rail support, regional coordination, and planning
OPCP RIF TEAM	Office of Planning and Capital Programming, Rail and Intermodal Freight Team	
MDOT SHA	State Highway Administration	Commercial vehicle safety, commercial vehicle permits, highway planning and analysis
MDTA	Maryland Transportation Authority	Commercial vehicle operations and tolling on MDTA facilities, facilities planning
MDOT MPA	Maryland Port Administration	Oversight, planning, administration at the state-owned marine terminals within the Port of Baltimore
MDOT MAA	Maryland Aviation Administration	Air cargo planning, management, promotion at BWI Marshall Airport and other airports
MDOT MVA	Motor Vehicle Administration	Commercial vehicle operator licenses, support for truck platooning regulations and Personal Delivery Device (PDD) regulations, and co-lead for the Connected and Automated Vehicles (CAV) Working Group
MDOT MTA	Maryland Transit Administration	Coordination between passenger rail service and Class I railroad freight operations; and Class III railroad engineering support and property management

State Freight Advisory Committee and Mission

The Maryland **SFAC** is a high-level group of freight industry leaders* that represent the freight community at large, including the best interests of Maryland businesses and consumers, diverse geographies, and local communities that are impacted by freight movement. The SFAC helps to advise the State on freight-related priorities, policies, issues, projects, and funding needs in order to advance freight goals and objectives in Maryland.

Along with MDOT, the SFAC helps to drive the analysis of private freight operations in the state and provide insights into future goods movement patterns and needs. This group also plays an active role in directly supporting State Freight Plan updates and convened several times at important milestones throughout the 2021-2022 Maryland Freight Plan update process. Prior to the latest update, SFAC membership was revised and expanded to ensure active and engaging participation.

* **SFAC Membership List:**
www.mdot.maryland.gov/SFAC



FREIGHT DEMAND AND THE ECONOMY

MARYLAND COMMODITY FLOWS

Businesses in Maryland produce and consume raw materials and finished goods that are shipped to and from locations across the globe. Maryland's freight transportation system must be ready to handle the current and future levels and types of goods movement. To help provide an understanding of the state's commodity flows, the Maryland Freight Plan summarized freight data based on Federal Highway Administration (FHWA)'s Freight Analysis Framework Version 5 (FAF5) database. Key findings include the amount of Maryland freight by **tonnage** or **dollar value**; the **commodity types** being transported, ranging from raw resources to finished goods; the **mode** of transportation used, including truck, rail, water, air, pipeline, and multiple modes; and the origin-destination of freight movements to and from the state, including **domestic flows** inside the U.S., as well as **import/export flows** that begin or end in foreign countries.

Commodity Flow Key Findings

- **Domestic Trade Partners:** Approximately 90% of Maryland's domestic freight tonnage and 70% of its domestic freight value move within Maryland and between the surrounding states, plus New York and California.
- **Foreign Trade Partners:** Europe, Canada, and Eastern Asia may be considered among Maryland's leading international trade partners in terms of total import/export freight tonnage or value.
- **Freight Mode:** Truck is the dominant mode, carrying 78% of total freight tonnage and 76% of total freight value.
- **Commodity Types:** Maryland's freight tonnage typically consists of bulk or heavy materials such as gravel, coal and petroleum products, or nonmetallic mineral products, while freight value is more diverse, spanning motorized vehicles, electronics, mixed freight, pharmaceuticals, machinery, and other commodities.

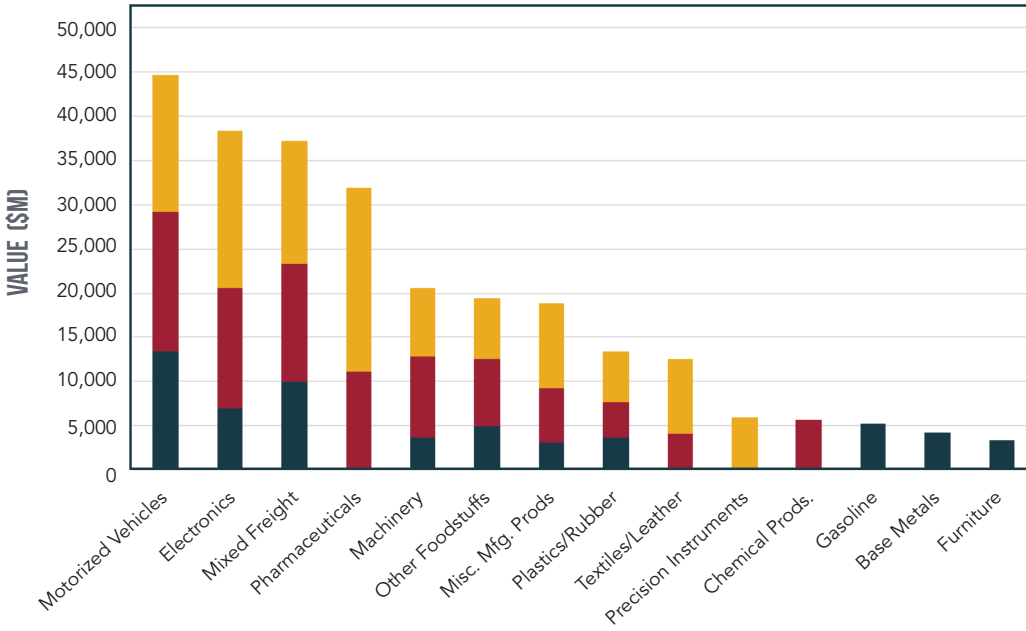
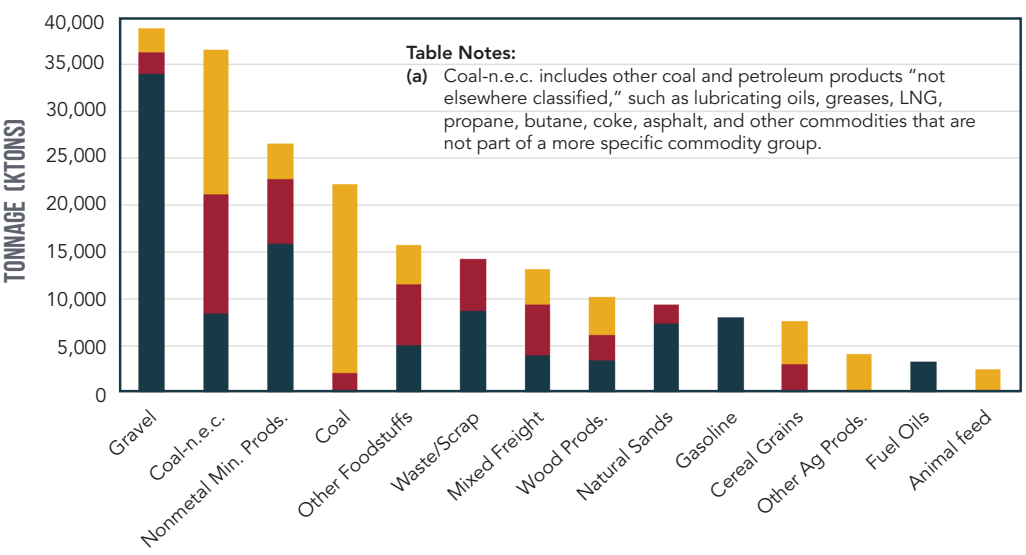


In **2020**, freight moving to, from, or within Maryland amounted to nearly **281 million tons** worth nearly **\$376 billion** (2020 FAF5).

By **2050**, freight tonnage is expected to increase by **53%** to nearly **429 million tons**, while value will increase **108%** to nearly **\$781 billion** (2020-2050 FAF5).

Moreover, these estimates do not reflect substantial **pass-through freight** that historically accounts for nearly **two-thirds** of the total goods carried on the state's multimodal freight transportation systems.

EXHIBIT ES-5 MARYLAND COMMODITY FLOWS — 2020 LEADING COMMODITIES BY TONNAGE OR VALUE



LEGEND:
■ Intrastate (within MD) ■ Outbound (within MD) ■ Inbound (within MD)

MARYLAND FREIGHT ECONOMIC INFLUENCES

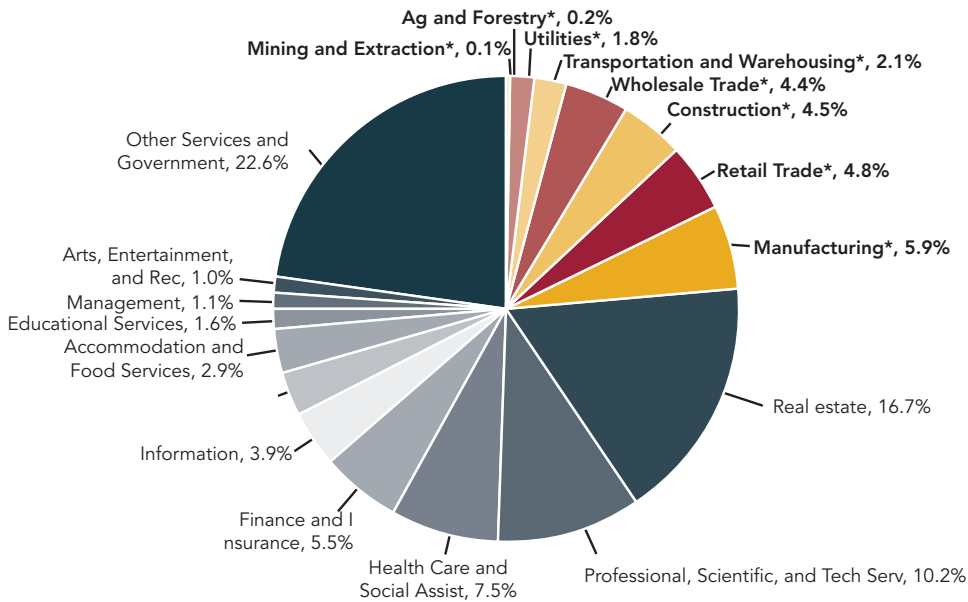
Goods movement is essential to a healthy Maryland economy, and potential freight economic growth (or constraint) can be directly influenced by the quality and performance of the state’s multimodal freight transportation, infrastructure, and support systems. Reliable and cost-effective transportation is an integral component to ensuring capacity and efficiencies within critical supply chains that keep the state’s commerce flowing. Beyond infrastructure itself, this flow of commerce influences (and is influenced by) Maryland’s steadily growing population, freight-related business and employment activities, and the characteristics of key freight industry sectors.

AGRICULTURE

The agriculture sector is vitally important to Maryland and the United States for the supply chain resources it provides as part of a much broader agribusiness industry within the state and nation. Typical commodity groups in the agriculture sector account for 9% of Maryland’s total domestic freight tonnage, and just over 5% of total freight value, with demands expected to increase steadily. Maryland has more than 12,250 farms across the state and, with major producers such as Perdue Farms and McCormick, is the third largest poultry producer in the U.S. and the first in spice making in the world.



EXHIBIT ES-6 MARYLAND FREIGHT ECONOMIC INFLUENCES – INDUSTRY SECTORS AS PERCENT OF MARYLAND GDP (2019)



MINING

Mines and quarries are an important element of Maryland’s economic history, and operations continue today with over 300 active mines statewide. Mining locations include coal field regions in Allegany and Garrett counties in western Maryland and, as of 2020, 285 non-coal mines that are mostly located in Charles, Prince George’s, and St. Mary’s counties in southern Maryland. While typical mining commodity groups reflect over \$3.3 billion of materials, this reflects less than 1% of Maryland’s total freight value due to their relatively low value-to-weight ratios. However, as extremely heavyweight materials, they account for more than 28% of Maryland’s domestic tonnage.

CONSTRUCTION AND UTILITIES

The construction and utilities sector is directly influenced by the type and pace of infrastructure and residential, commercial, or industrial development throughout Maryland. Typical commodity groups in the construction sector overlap materials that may be captured in other sectors (e.g., raw materials such as sand or gravel), plus miscellaneous building products (e.g., wood, stone, or block) and waste or scrap elements. This collective sample accounts for just over 36% of Maryland’s total domestic freight tonnage, and approximately 4% of total freight value. Demand through 2050 is expected to increase steadily.

ENERGY

While Maryland ranks among the 10 lowest states in the U.S. in per capita energy consumption, it also consumes more than five times as much energy as it produces. The energy industry in Maryland encompasses power generation; distribution networks for natural gas, oil, and electricity; and renewable energy sources including hydropower, solar, wind, and biomass. Typical commodity groups may include coal, gasoline, fuel oils, and other coal and petroleum products such as liquefied natural gas, propane, and coke. Such materials comprise over 26% of Maryland’s total domestic freight tonnage, but only 5% of total freight value. Changes through 2050 show significant tonnage growth specifically in the coal and petroleum products category, but overall growth is otherwise offset by notable declines in coal, gasoline, and fuel oils. Such declines are likely based on anticipated shifts in future energy sources, such as switchovers from coal to gas-fired power plants, expanded use of electric or fuel-efficient vehicle technologies, or other increased reliance on alternative energy sources.

MANUFACTURING

The manufacturing sector in Maryland reflects diverse elements ranging from traditional manufacturing (e.g., plastics, paper mills, or engine construction) to technology manufacturing (e.g., search, detection, and navigation instruments). Maryland has 4,000 manufacturing companies across the state, and the University of Maryland ranks 14th in the nation in undergraduate supply chain management/ logistics. Sample commodity groups in the manufacturing sector account for just over 6% of Maryland’s total domestic freight tonnage, but almost 23% of total freight value.

WHOLESALE TRADE, TRANSPORTATION AND WAREHOUSING, AND RETAIL TRADE

Though they represent distinctly separate industries, the wholesale trade, transportation and warehousing, and retail trade sectors together encompass a broad array of resources, products, and interrelated supply chain interests. These interests include materials for manufacturing processes, the output of those processes, and all manner of products from foodstuffs to manufactured goods to paper and publishing materials. Their supply chains cover wholesale markets and warehousing/distribution activities, retail goods to stock in-store shelves, and e-commerce deliveries directly to consumers.

Materials and products in these sectors contribute significantly to Maryland’s economy, with typical commodity groups comprising more than 17% of Maryland’s total domestic freight tonnage, but nearly 53% of total freight value. Demands are expected to increase steadily with growth of 82% in tonnage and almost a doubling in value through 2050 (2020-2050 FAF5).

FREIGHT NETWORK AND INFRASTRUCTURE

Domestic and international goods move to, from, or through Maryland by way of truck, Class I and short line rail, via coastal ports and inland waterways, by air, and by pipeline. The broader freight transportation systems also include logistics networks that often span thousands of miles over land, sea, and air with critical multimodal connections through hubs such as the Port of Baltimore, BWI Marshall Airport, or other domestic seaports and airports. At a state level, Maryland's logistics network encompasses freight shippers and receivers, freight handling facilities, waterborne freight terminals, and air cargo facilities. The collective multimodal networks provide vital connections between freight generating, receiving, and handling facilities.

Maryland's overall goods movement transportation network is composed of the state's highway network, freight rail network, waterways, seaports, air cargo airports, and energy-related infrastructure, as well as supporting elements such as intelligent transportation systems (ITS).

ROADWAYS

Maryland roadways collectively handled approximately 78% of the total freight tonnage and 76% of the total freight value moving to, from, or within the state, amounting to approximately 218 million tons worth approximately \$286 billion (2020 FAF5).

NATIONAL HIGHWAY FREIGHT NETWORK

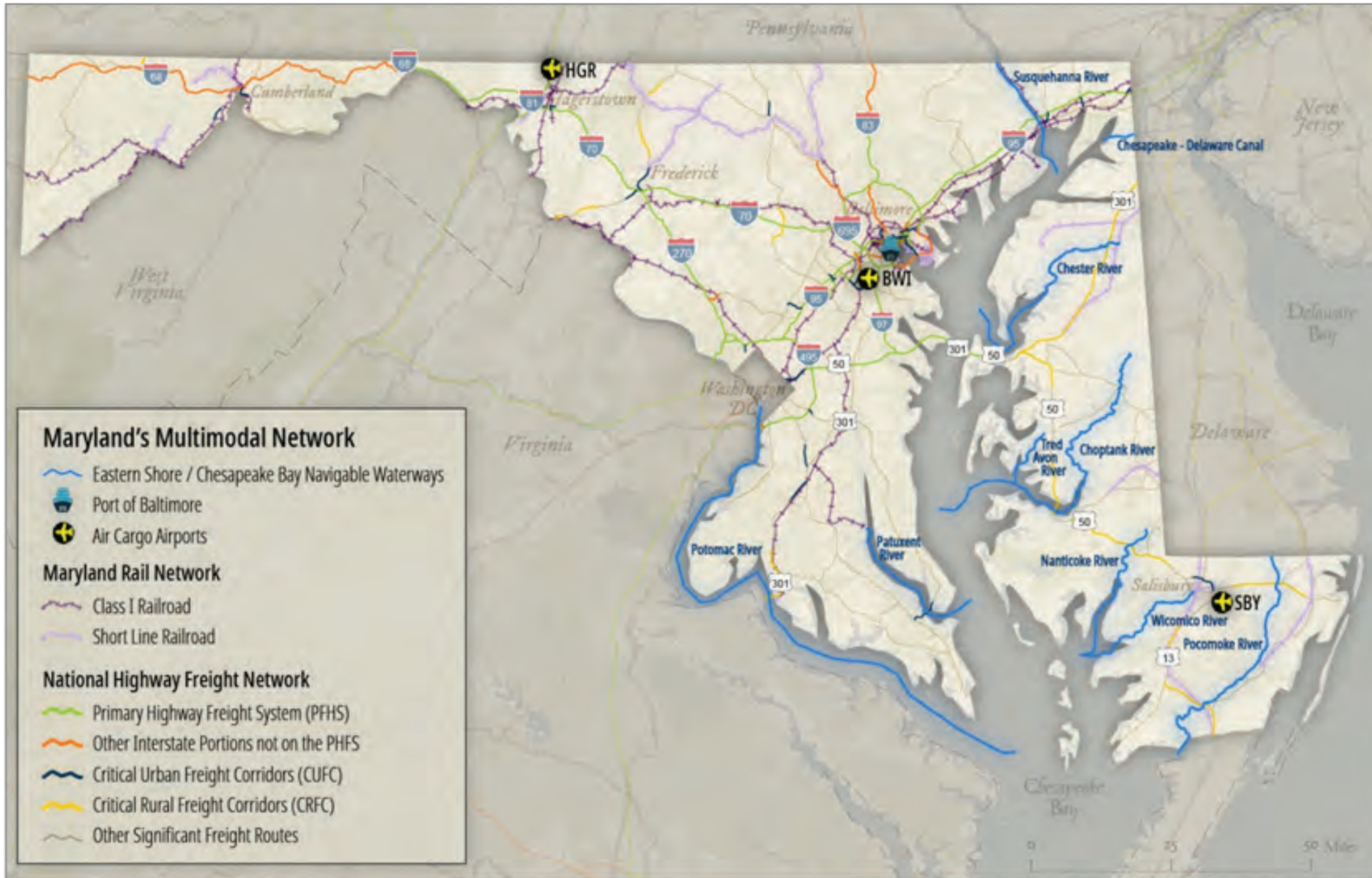
While goods generally move along the entire roadway network, the majority of freight utilizes portions of the NHFN or other significant freight routes throughout Maryland. The NHFN is a federally designated network initially set forth by the FAST Act in 2017 and consists of the Primary Highway Freight System (PHFS) and non-PHFS interstate routes, as well as state/MPO-designed Critical Urban Freight Corridors (CUFC) and Critical Rural Freight Corridors (CRFC).

MARYLAND FREIGHT NETWORK

31,343	
Public Road Miles	
1,152	
Track Miles	
530	
Inland Waterway Miles	
52,568	
Cargo Runway Feet	
16,478	
Pipeline Miles	

Newer provisions in the **2021 IJA** double the state's mileage caps to **150** total CUFC miles and **300** total CRFC miles. As such, future network expansion will occur as MDOT and MPO's coordinate and designate additional CUFCs and CRFCs for the newly allotted mileage.

EXHIBIT ES-7 MARYLAND MULTIMODAL FREIGHT NETWORK



RAILROADS

RAIL NETWORK

Maryland's rail network includes about 886 miles of active rail lines and more than 15 different rail operators of various types. Freight operations include two Class I, one Class II, and seven Class III (or short line) freight rail operators.

Freight rail transportation plays an important role in Maryland with major rail flows along the Class I lines, as well as critical first/last-mile connectivity and rural area access provided by the state's Class III operators. Maryland railroads collectively handled approximately 9% of total freight tonnage and 4% of total freight value moving to, from, or within the state, amounting to more than 25 million tons and over \$13 billion in 2017.

PORTS AND WATERWAYS

PORT OF BALTIMORE

Cargo is the lifeblood of the Port of Baltimore, which handled more than 44.2 million tons of freight in CY 2019. 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. Key commodities handled at the Port's state-owned 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 marine terminals managed by MDOT MPA plus many privately-owned terminals. It is a vital link for raw materials and manufactured goods moving into and out of Maryland, the Mid-Atlantic region, and into the Midwest United States. The Port of Baltimore ranks at or near the top of all U.S. ports in several categories, including handling farm and construction machinery, automobiles, imported forest products, imported sugar, imported gypsum, and exported coal. Total general cargo at the MDOT MPA state-owned terminals reached 10.3 million tons in FY 2020.

Containerized Freight Opportunities:

Opportunities at the Port will continue to grow with significant expansion efforts such as the 2021 arrival of four additional Neo-Panamax cranes at Seagirt Marine Terminal, and the 2021 ground-breaking for the Howard Street Tunnel project that, upon completion, will facilitate double-stacked container trains to and from the Port.

INLAND WATERWAYS

Beyond the Port of Baltimore, various inland waterways also provide vital goods movement corridors that support Maryland industries. These corridors include the Chesapeake and Delaware Canal, numerous rivers on Maryland's Eastern Shore, and other locations such as the Susquehanna, Patuxent, and Potomac Rivers

EASTERN SHORE RIVERS

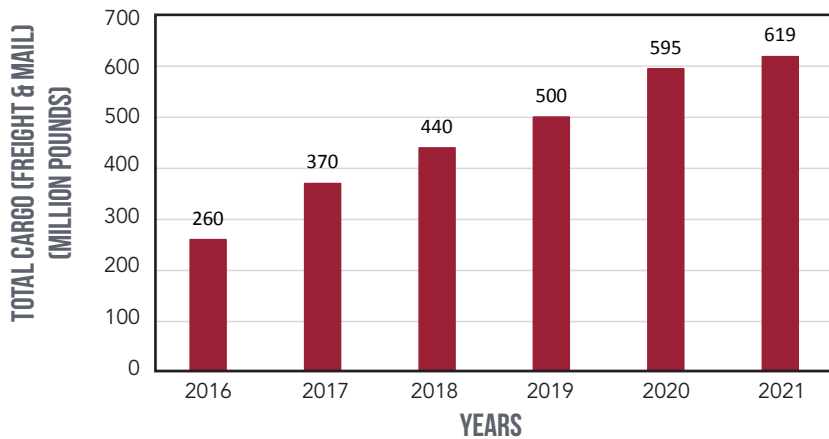
At least five rivers on Maryland's Eastern Shore actively provide important goods movement connections including, from north to south, the Tred Avon, Choptank, Nanticoke, Wicomico, and Pocomoke rivers. A sixth location along the Chester River may also see intermittent freight traffic, such as the transport of waterway improvement materials, but based on USACE data appears to have had little to no reported freight tonnage in several years. Key issues confronting waterborne commerce on Maryland's Eastern Shore include dredging to maintain adequate channel depths, securing appropriate dredge materials disposal sites, the need for truck and rail access improvements, and encroachment of residential development near waterborne industrial facilities.

AIR CARGO

MDOT MAA is responsible for airport regulation in the state and owns and operates two airports: Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall Airport) and Martin State Airport (MTN). There are 35 public use airports in Maryland; three are capable of cargo shipments including BWI Marshall Airport, Hagerstown (HGR), and Salisbury (SBY). On a much smaller scale, Martin State Airport also periodically handles charter and corporate flights that deliver supplies and materials (e.g., medical supplies) to local businesses.

BWI Marshall Airport is the state's largest cargo airport with a Foreign Trade Zone and two air cargo complexes. Air cargo (including freight and mail) is important in moving high value, time-sensitive shipments. Primary freight commodities shipped from BWI Marshall Airport include machine parts, electrical machinery, aircraft/spacecraft components, seafood, chemicals, and pharmaceutical/biological products. With the expansive growth of e-commerce and online shopping, BWI Marshall Airport has become a significant hub for small package sorting and distribution to last-mile delivery service. In 2021, BWI Marshall Airport set its annual cargo record by transporting almost 619 million pounds, which accounted for over 55% of the freight transported in the U.S. Capital Region.

EXHIBIT ES-8: ANNUAL CARGO (FREIGHT & MAIL) AT BWI MARSHALL AIRPORT (2016-2021)³⁶



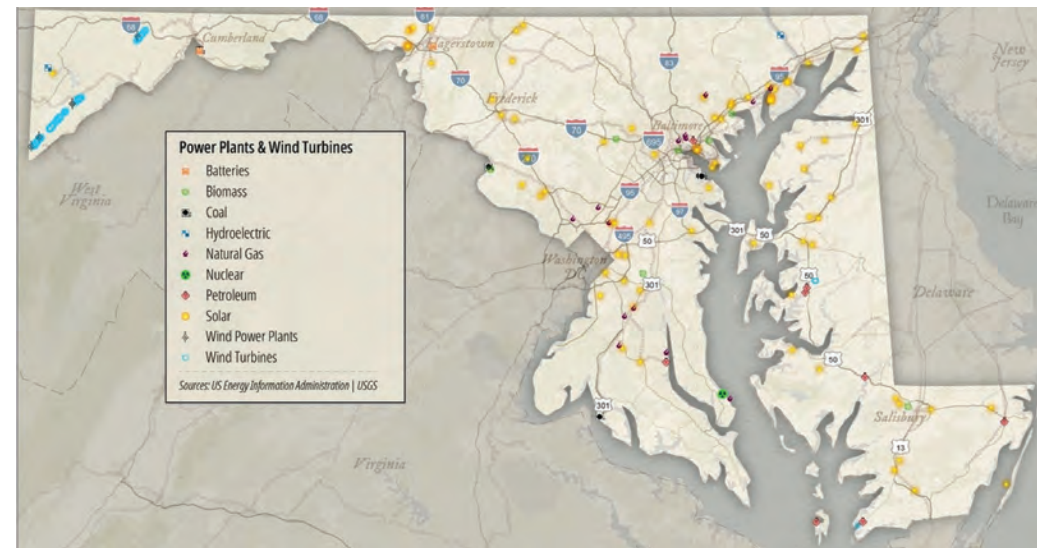
ENERGY INFRASTRUCTURE

The energy industry in Maryland encompasses power generation, distribution networks for natural gas, oil, and electricity, and renewable energy sources including hydropower, solar, wind, and biomass. The location of energy infrastructure varies across the state with clusters of activity based on resources, plant locations, and transportation links.

With these networks in mind, Maryland's overall multimodal freight network includes the NHFN and other significant highway freight routes throughout Maryland, the state's railroad network, key freight airports, the Port of Baltimore, and the inland waterway system. It also includes multimodal critical rural freight facilities based on FAST Act and IJA criteria identified in conjunction with the prior iteration of Maryland's state freight plan based on an overlay and review of key freight routes and facilities in comparison to USDOT's initial Interim NMFN.

Viewing Maryland's overall freight network from a multimodal perspective will help to support the subsequent consideration and development of multimodal improvement strategies; partnership or collaboration opportunities; and local, regional, or megaregional connectivity needs and opportunities. Such perspectives will help to serve growing regions throughout Maryland as markets shift or expand, as freight demands increase, and as overall multimodal freight connectivity and accessibility needs evolve, particularly in light of future bottlenecks or congestion that may influence freight mobility issues.

EXHIBIT ES-9 MARYLAND POWER GENERATION SITES



FREIGHT SYSTEM PERFORMANCE, TRENDS, AND NEEDS

The Maryland Freight Plan includes an evaluation of more than 50 freight-relevant performance measures that leverage new data resources and relate to the state's ongoing freight planning initiatives. These measures provide insight into how the freight transportation system is reacting as freight movement patterns or volumes change, or as strategies and tactics are put into place. They also work holistically alongside other performance reporting efforts currently used at MDOT, including:

- MDOT AR on Transportation System Performance
- MDOT Transportation Asset Management Plan (TAMP)
- MDOT Managing for Results (MFR) Program
- MAP-21 performance measures required per federal Transportation Performance Management (TPM) Policy
- Other MDOT TBU performance programs

Performance-based trends in Maryland generally imply steady or improving conditions across a healthy, well-managed, and successful multimodal freight transportation system. However, some challenges remain and will continue to be monitored. The Maryland Freight Plan combines performance data, background planning research, and extensive agency/stakeholder coordination to compile an overarching set of statewide freight needs by goal, as well as specific needs and stakeholder interests by region (see **Exhibit ES-9**). The assessment of freight needs and related focus areas (see sidebar) summarizes the overall state of affairs for goods movement and multimodal freight transportation systems and related planning in Maryland. This knowledge is used to support the project and strategy related implementation details that are ultimately set forth by the plan.



Freight Focus Areas

Providing a deeper dive into the identified freight needs, and with direct reference to the latest IIJA requirements for state freight planning, Section 6 of the Maryland Freight Plan explores a diverse set of freight interests, activities, data insights, program areas, and other freight topics that encompass:

- ☑ Safety and security
- ☑ Operational programs and innovative/disruptive technologies
- ☑ Asset preservation and improvement programs
- ☑ Freight congestion and reliability
- ☑ Truck parking facilities
- ☑ Supply chain cargo flows
- ☑ Commercial ports
- ☑ Multistate freight coordination
- ☑ E-commerce and related planning considerations
- ☑ Military freight considerations
- ☑ Freight resilience, environmental, and equity considerations

EXHIBIT ES-10 MARYLAND SUMMARY FREIGHT NEEDS BY GOAL



EXHIBIT ES-11 MARYLAND SUMMARY FREIGHT NEEDS BY REGION



WESTERN MARYLAND

- Congestion on US 219, US 40, MD 135
- Freight issues around Hagerstown and the junction of I-70/I-81
- Freight impacts along I-68, US 210, MD 51, and MD 63
- Undesignated truck parking improvements
- Multimodal freight opportunities
- Incident management
- Expansion of logistics and warehousing activities



WASHINGTON METRO REGION

- Statewide and nationally ranked truck bottlenecks, particularly on I-495 and I-270
- Congestion along I-70, US 301, US 340
- Truck parking needs
- Strategic access for military freight
- Impact of freight routing and truck travel on local roads
- Community freight impacts



BALTIMORE METRO REGION

- Statewide and nationally ranked truck bottlenecks, particularly on I-95 and I-695
- Truck bottlenecks on I-70, US 50 near the Bay Bridge, US 29, I-195
- Multimodal freight project activities related to critical rail, port, and air freight assets
- Truck parking needs
- Multimodal access and connectivity
- Roadway/pavement maintenance
- Community freight impacts



SOUTHERN MARYLAND

- Congestion on MD 2, MD 4, MD 5, MD 235, and US 301
- Congestion around highway junctions in California and Waldorf
- Coordination of freight activities/access related to CSX rail
- Freight access to Patuxent Naval Air Station
- MDTA Nice/Middleton Bridge widening and replacement



EASTERN SHORE

- Congestion on US 50, MD 213, MD 404
- Freight connections along US 50 and US 301
- Undesignated truck parking improvements
- Freight opportunities in Salisbury and Cambridge
- Dredging and multimodal access for Eastern Shore rivers
- Truck toll and weight enforcement
- Climate change impacts on freight infrastructure
- Rail/truck transloading opportunities

FREIGHT PROJECTS AND INVESTMENT PLAN

The 2022 Maryland Freight Plan comprehensively addresses the state's freight planning activities and investments to qualify for funding under the NHFP. The Plan also identifies additional projects and funding opportunities to advance freight goals and strategies. MDOT welcomes the opportunity to invest in freight improvements using additional resources provided by the IIJA. The IIJA will provide Maryland and neighboring state Departments of Transportation (DOTs) approximately 50% more annual transportation spending over the next five years, including 30% more in formula funds. Using these resources, MDOT will continue to diligently apply funds and strategies to alleviate freight bottlenecks and address freight safety, congestion, and mobility.

NHFP DESCRIPTION AND ELIGIBILITY

Per the IIJA, all states are required to update their state freight plan every four years and develop a freight investment plan to obligate their apportionment of NHFP formula funds. The NHFP formula funds are specifically intended to be used to improve the efficient movement of freight on the NHFN as prescribed in 49 U.S.C. §70202.

Maryland NHFP Projected Funding

Maryland's NHFP funding projections for FY22-FY26 total approximately **\$103.45 million**, allocated initially to:

- **\$75M** for capital improvement projects
- **\$6.9M** for truck parking facility improvements
- **\$0.9M** for freight-related innovative planning and performance management
- **\$11.8M** for CAV/TSMO related technology improvements
- **\$8.85M** for upgrading virtual weight stations (VWS) and other Motor Carrier Division (MCD) resources

NHFP Candidate Projects

Over 20 major capital improvement projects were considered for NHFP funding to improve freight related safety, congestion, and mobility.

MARYLAND'S NHFP FREIGHT INVESTMENT PLAN

This Maryland Freight Plan updates a five-year fiscally constrained Freight Investment Plan for FY22 through FY26. Project and funding details are compiled within **Appendix 7B** of the overall Maryland Freight Plan and include a focus on the following major projects and initiatives:

- I-695 TSMO from I-70 to MD 43
- I-695, Baltimore Beltway at I-70 (Triple Bridges)
- MD 4 Suitland Parkway Interchange
- Truck Parking at the I-70 Welcome Center
- Improvements to the Maryland Statewide Transportation Model (MSTM) to advance model calibration and freight-specific enhancements for trucks and freight CAV
- Advancements in mapping and GIS tools related to the freight network, truck parking, and other freight related data
- CAV/TSMO projects that encompass freight CAV implementation planning, pilot programs for freight EV charging, statewide truck parking technology enhancements, and freight-related data exchange platforms
- Virtual Weigh Station and related static scale and equipment upgrades



OTHER PROJECT FUNDING AND IMPLEMENTATION OPPORTUNITIES

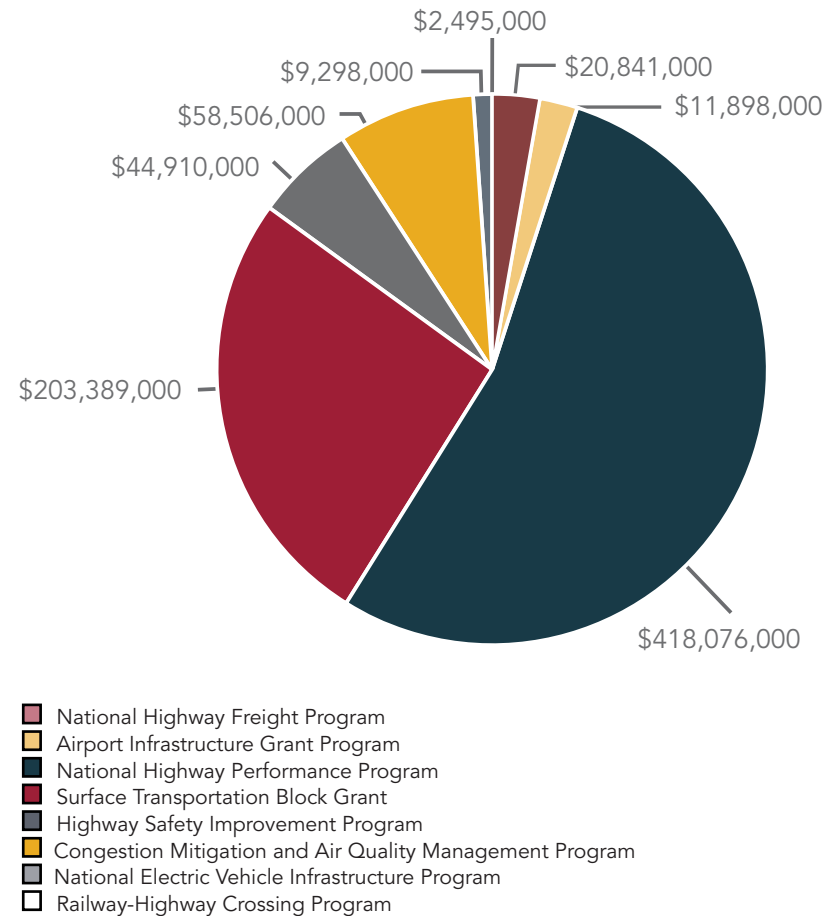
Beyond the NHFP resources, Maryland will continue to pursue other project funding and implementation opportunities through a variety of federal formula programs and discretionary grant opportunities. The IIJA notably expanded eligibility criteria of certain programs to include freight-related improvements, such as truck parking and alternative fuel initiatives. MDOT will continue to pursue funding opportunities to advance freight projects and initiatives, focusing on major formula and discretionary grant programs as listed to the right.

DISCRETIONARY GRANT FUNDING PROGRAMS

Discretionary grant funding is awarded on a competitive basis. Thus, estimating discretionary grant funding for freight projects in Maryland is challenging. However, MDOT will continue pursuing discretionary grant funding opportunities to advance freight investments identified in the Maryland Freight Plan. Notable programs and opportunities are summarized below.

- Nationally Significant Freight and Highway Projects Grant Program (Infrastructure for Rebuilding America [INFRA])
- Mega Projects (formerly National Infrastructure Project Assistance ([NIPA])
- Reduction of Truck Emissions at Port Facilities Program
- Consolidated Rail Infrastructure and Safety Improvements (CRISI)
- Rural Surface Transportation Grant Program
- Rebuilding American Infrastructure with Sustainability & Equity (RAISE)/ Local and Regional Project Assistance Program
- Railroad Crossing Elimination Grant program
- Port Infrastructure Development Program (PIDP)
- Motor Carrier Safety Assistance Program
- Bureau of Transportation Statistics (BTS)

EXHIBIT ES-12 MARYLAND FY 2022 ESTIMATED FORMULA FUNDING



ADDITIONAL UNFUNDED NEEDS/PRIORITIES

The Maryland Freight Plan also establishes a broader list of Multimodal Freight Eligible Projects to summarize funded and unfunded project needs from MDTA, MDOT SHA, MDOT MTA, MDOT MPA, and MDOT MAA (**Appendix 7C**).

Despite the increases in Federal funding programs, the total freight needs exceed the forecasted funding allotments for Maryland. This list of unfunded projects will be periodically updated through continuous coordination with the SFAC, MDOT TBUs, and other stakeholders to reflect ongoing changes in freight needs and advancement of projects.

Additional projects from the detailed list in Appendix 7C will be advanced and prioritized as funding opportunities are identified through other formula programs or discretionary grants.

FREIGHT IMPLEMENTATION PLAN

The final overall Freight Implementation Plan consists of the freight projects and funding opportunities, as well as overarching strategies and next step action items.



SUMMARY FREIGHT STRATEGIES

Summary freight strategies are intended as overarching guidance to support the development and execution of freight programs, projects, and related planning efforts throughout MDOT and in collaboration with its public and private partners.



SAFETY, SECURITY, AND RESILIENCE

Strategies under this goal strive to reduce the number of lives lost or injured due to freight activities; secure the movement of people, goods, and data; provide a resilient multimodal system; and improve roadway clearance to facilitate emergency response.

- 1.01 Infrastructure Safety Improvements
- 1.02 Railroad Crossing Upgrades
- 1.03 Truck/Rail Safety Monitoring Programs
- 1.04 Airport Zoning Permit Process
- 1.05 Security Infrastructure Upgrades
- 1.06 Vulnerability Assessments and Adaptation Strategies
- 1.07 Incident Management Technologies
- 1.08 Rail Safety, Security, and Resilience Strategies
- 1.09 Truck Parking Improvement Strategies

SUMMARY FREIGHT STRATEGIES (CONTINUED)



ECONOMIC OPPORTUNITY AND EFFICIENCY

Strategies aligned with this goal invest in and pursue opportunities to promote system improvements that support economic development, reduce congestion, and improve the movement of people and goods. These strategies promote economic opportunity and efficiency by pursuing capital improvements to improve economic growth opportunities, alleviate major bottlenecks, and reduce overall congestion in the multimodal system.

- 2.01 Performance Reporting
- 2.02 Economic Modeling
- 2.03 Significant Corridor Congestion Reduction
- 2.04 Supply Chain Congestion Reduction
- 2.05 Key Freight Bottleneck Improvements
- 2.06 Property Acquisition for Port/Terminal Expansion
- 2.07 Identification of Rail Capacity Constraints
- 2.08 TSMO Improvements
- 2.09 Air Cargo Facility Expansion
- 2.10 Freight and Logistics Workforce Development
- 2.11 Freight and Logistics Educational Programs
- 2.12 Truck Industry Career Outreach
- 2.13 Truck Driver Education Programs
- 2.14 Heavy Equipment Apprentice Programs
- 2.15 Port Growth Strategies



SYSTEM PRESERVATION AND MODERNIZATION

Strategies under this goal focus on maintaining state of good repair, leveraging new and innovative technologies and practices, and optimizing public investment to ensure a sustainable transportation system.

- 3.01 Truck Size and Weight Studies
- 3.02 Airport Facility and Runway Maintenance
- 3.03 Navigation Channel Maintenance
- 3.04 State-Owned Rail Asset Maintenance
- 3.05 CAV Deployment
- 3.06 Truck Platooning Opportunities
- 3.07 Rural Freight Needs and Funding Opportunities
- 3.08 PDD/UAV/Future Technology Assessments
- 3.09* Rail Infrastructure Modernization
- 3.10 Planning to Support Technology

SUMMARY FREIGHT STRATEGIES (CONTINUED)



QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE

Strategies under this goal focus on improving the transportation system's reliability and predictability through enhanced communications relaying real-time information.

- 4.01 Truck Size and Weight Studies
- 4.02 Airport Facility and Runway Maintenance
- 4.03 Navigation Channel Maintenance
- 4.04 State-Owned Rail Asset Maintenance
- 4.05 CAV Deployment
- 4.06 Truck Platooning Opportunities
- 4.07 Rural Freight Needs and Funding Opportunities
- 4.08 PDD/UAV/Future Technology Assessments
- 4.09 Rail Infrastructure Modernization
- 4.10 Planning to Support Technology



FISCAL RESPONSIBILITY

Fiscal responsibility strategies focus on accelerating project completion through alternative project delivery methods, strategic partnerships, and identifying consistent revenue or funding opportunities.

- 6.01 TSMO Program Coordination
- 6.02 Collaboration for Double Stack Rail-Port Connectivity
- 6.03 Partnerships/Funding to Expand Truck Parking
- 6.04 Partnerships/Funding to Enhance Short Line Rail
- 6.05 Partnerships/Funding to Maximize Rail Investment Benefits
- 6.06 Discretionary Grant Funding



ENVIRONMENTAL PROTECTION AND SENSITIVITY

Strategies under this goal focus on understanding the infrastructure risks associated with climate change, employing conservation and innovative use/reuse/recycle materials, and promoting initiatives to reduce fossil fuel consumption.

- 5.01 Infrastructure Vulnerability, Risk, and Adaptation Studies
- 5.01 Sustainable Seaport Strategies
- 5.02 Dredging Program Management and Priorities
- 5.03 Dredging Program Outreach and Education
- 5.04 Fuel Efficient Truck Technologies
- 5.05 Rail Diesel Engine Retrofits/Replacements
- 5.06 Port Environmental, Energy, and Social Responsibility Goals
- 5.07 Alternative Energy Applications



TRANSPORTATION CHOICES AND CONNECTIONS

Strategies under this goal seek to improve transportation connectivity and support alternative transportation options for the movement of people and goods in a manner that balances freight needs alongside environmental and community interests in the state.

- 7.01 Multimodal Connectivity and Access Improvements
- 7.02 Inland Transportation Capabilities for Port Operations
- 7.03 Landside and Freight Rail Capabilities for Port Access
- 7.04 Freight Transportation and Land Use Planning Guidance
- 7.05 Public/Private Sector Plan Coordination
- 7.06 Last Mile Logistics Considerations
- 7.07 Curb Management Strategies
- 7.08 Land Use Planning/Zoning for Truck Parking

IMPLEMENTATION TACTICS

Reaching the Maryland Freight Plan's desired outcomes will require the implementation of projects and programs by MDOT and public and private stakeholders. Each of MDOT's TBUs will help to advance the strategic direction of the plan through the planning and development of freight projects and programs in their own freight-relevant planning documents and related operations. Public and private sector freight stakeholders, freight providers, and system owners should also reference the Maryland Freight Plan to better understand MDOT's intended strategic direction as they develop programs and projects.

Successful implementation of the Maryland Freight Plan will rely, in part, on three overarching sets of implementation actions or tactics that emphasize (1) planning and programming, (2) data and analysis, and (3) communication. As MDOT takes these steps, they will continue to participate in studies, collaborative efforts, and pilot programs that advance the state's understanding of freight and how it moves in and around Maryland.

CLOSING AND NEXT STEP PRIORITIES

Completion of the 2022 Maryland Freight Plan should not be construed as an end, or even a pause, in MDOT's freight planning efforts. Rather, the compilation of projects, strategies, implementation tactics, and other details within this Plan should serve as a resource to help MDOT, in cooperation with other state agencies and private stakeholders, continue efforts that will manage and enhance Maryland's multimodal freight transportation systems and related opportunities.

To help support the continuation of the state's freight planning efforts, there are several near-term "next steps" that could be prioritized for completion as time and resources become available. Notable efforts that would continue to advance the vision, goals, and objectives of the Maryland Freight Plan include, but are not limited to, the following specific actions:

1. **CUFC/CRFC Expansion:** Evaluate expansion opportunities for additional mileage authorized by the IJA and coordinate the nomination and approval process with MDOT SHA and Maryland's MPOs.
2. **Intermodal Connectors:** Review Intermodal Connector designations on the NHS, PHFS, or other facilities throughout Maryland to leverage opportunities that support critical first/last-mile links between major port, rail, airport, and intermodal freight facilities, including potential refinement or expansion of Maryland's designated connections in coordination with FHWA and with reference to FHWA's 2017 Freight Intermodal Connectors Study.
3. **Project Implementation Opportunities:** Prioritize freight-related capital project programming efforts, as well as the pursuit of discretionary grant opportunities for notable candidate freight projects.
4. **SFAC Coordination:** Continue to convene the SFAC to examine freight system challenges, monitor evolving freight influences, and recommend near-term and long-term freight projects or initiatives.
5. **Freight Data Insights** Continue utilizing freight data to help decision-makers and the public better understand the connection between freight transportation observed in communities and the economic activity that transportation is supporting.
6. **Alternative Fuel Funding** Coordinate with the Maryland Department of the Environment and the Maryland Department of Energy to explore and leverage alternative fuel funding opportunities.
7. **Truck Parking Improvements** Improve truck parking throughout Maryland by continuing to implement recommendations from the 2020 Maryland Statewide Truck Parking Study, including advanced data analysis to identify parking needs and promote sharing of parking information and additional collection of data.
8. **Technology Integration** Continue developing frameworks and guidance to manage impacts or opportunities related to new, evolving, innovative, and disruptive technologies that influence freight transportation, such as truck platooning, freight CAV, personal delivery devices, or drone/UAV deliveries.
9. **Technology Integration** Continue to coordinate multi-state opportunities that may influence major freight corridors.
10. **Environmental Performance Measures** Review/refine MDOT's performance measurement approach related to GHG emissions and/or other environmental justice details in coordination with the implementation of the federal government's Justice40 Initiative and future updates to MDOT's annual Attainment Report or other applicable plans.
11. **Rail Studies** Complete the High-Speed Intercity Passenger Rail Studies, which address rail capacity and operations issues in Maryland, particularly along the Northeast Corridor.

With Federal approvals of the Plan anticipated by late 2022, the next (four-year) formal update of the Maryland Freight Plan will be required by the end of 2026. Prior to the 2026 update, MDOT will continue monitoring and evaluating freight needs and investment priorities, and may periodically update the NHFP-focused Freight Investment Plan, as needed.

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

Maryland State Freight Plan



JUNE 3, 2022 DRAFT



SECTION 1 INTRODUCTION

SECTION TABLE OF EXHIBITS

Exhibit 1.1: Maryland Freight At-A-Glance _____	1-2
Exhibit 1.2: Maryland State Freight Plan Alignment with Federal Freight Planning Requirements _____	1-4
Exhibit 1.3: MDOT Transportation Business Units/Offices and Related Freight Activities _____	1-5
Exhibit 1.4: Freight Trends/Drivers for Goods Movement Demand and System Performance _____	1-7
Exhibit 1.5: External Stakeholders and Partners _____	1-13

SECTION TABLE OF CONTENTS

1 INTRODUCTION _____	1-2
1.1 Purpose, Vision, and Context _____	1-3
1.2 Recent Freight Actions and Resources _____	1-8
1.3 Stakeholders and Partnerships _____	1-12
1.3.1 MDOT Transportation Business Units (TBUs) _____	1-12
1.3.2 State Freight Advisory Committee (SFAC) _____	1-12
1.3.3 External Stakeholders _____	1-13

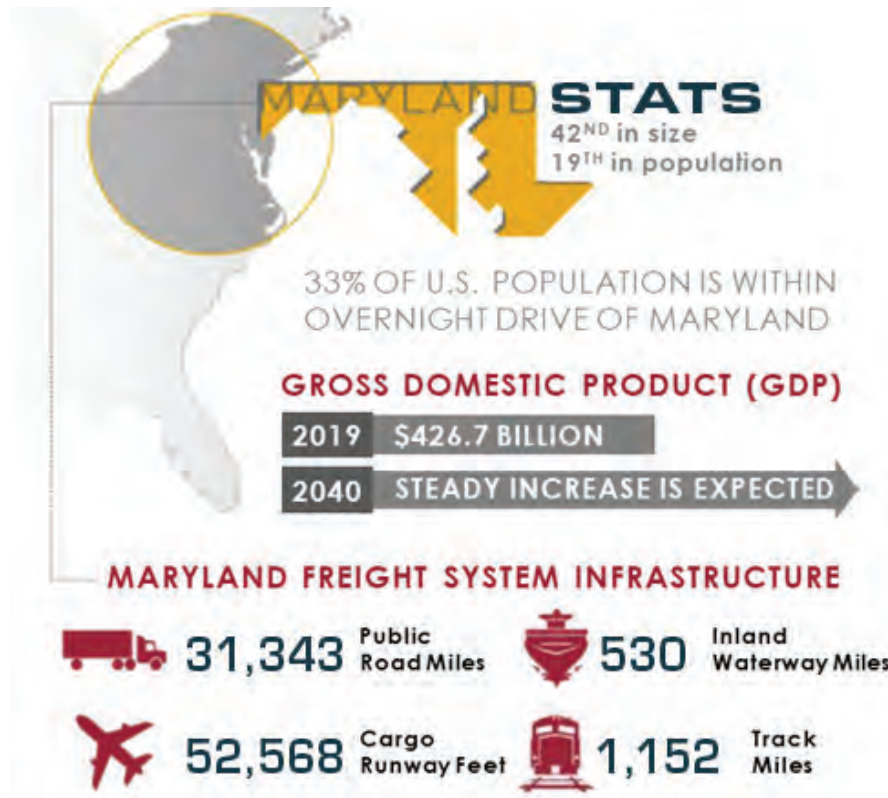


1 INTRODUCTION

The 2022 Maryland State Freight Plan assesses Maryland freight movements, multimodal networks, and related details to supplement and support the overarching vision, goals, and long-range transportation planning initiatives in the 2040 Maryland Transportation Plan (MTP). It also incorporates national freight goals and guidance from federal surface transportation authorizations including the 2015 Fixing America's Surface Transportation (FAST) Act and newer requirements per the 2021 Infrastructure Investment and Jobs Act (IIJA).

Ensuring the safe and efficient movement of freight is critical for Maryland businesses and the economy (**Exhibit 1.1**). Planning and coordination with freight stakeholders is of utmost importance for the success of Maryland commerce. Goods in Maryland travel on a high-quality multimodal freight transportation network that supports diverse companies and institutions not only in the state, but regionally and nationally. Maryland is a significant crossroads of goods and people movement as it provides nationally and regionally significant highway, rail, marine, and aviation links. As such, reliable access to air and water ports, highways, and rail networks enable businesses to meet customers' needs in the state and beyond.

A **safe** and **efficient** freight system helps **lower costs** of goods that consumers and companies need for **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 for the Maryland Department of Transportation (MDOT).



EMPLOYEES



2,380,865 Maryland Total (2019)

652,769 (27.4%) Freight-Related

81,392 (3.4%) Transportation & Warehousing

BUSINESS ESTABLISHMENTS



139,449 Maryland Total (2019)

40,368 (28.9%) Freight-Related

3,542 (2.5%) Transportation & Warehousing

PAYROLL



\$136.8 Billion Maryland Total (2019)

\$34.3 Billion (25.1%) Freight-Related

\$4.1 Billion (3.0%) Transportation & Warehousing

1.1 Purpose, Vision, and Context

The 2022 Maryland Freight Plan replaces the 2017 Maryland Strategic Goods Movement Plan and includes updates that:

1. Meet the latest federal freight planning requirements under the IJA (**Exhibit 1.2**);
2. Provide a comprehensive overview of freight movement in Maryland;
3. Expand insights into the latest freight supply chain and technology influences;
4. Identify policy needs and strategies to ensure the efficient movement of freight in Maryland; and
5. Identify freight project priorities and related investment plans for federal fiscal year (FFY) 2023-2027.

The 2022 Maryland Freight Plan provides a Freight Vision and Freight Goals that aim to align with national freight goals and the 2040 MTP vision and goals. The Freight Vision and Freight Goals coalesce around several key themes summarized in the adjacent sidebar and detailed in **Section 2** of this 2022 Maryland Freight Plan.

MDOT's Transportation Business Units (TBUs) (**Exhibit 1.3**) also develop freight projects and programs in their own freight-related planning documents (including those listed in **Section 1.2**) that align with the strategic direction specified in this document. MDOT considers these modal plans together with the 2022 Maryland Freight Plan as a complete MDOT freight plan package. This alignment of plans is comparable to other transportation planning efforts within MDOT that stem from the 2040 MTP, which provides overarching policy direction, goals, and objectives that are then delivered through the TBUs' functional plans and business plans.



2022 MARYLAND STATE FREIGHT PLAN

PURPOSE OF THE FREIGHT PLAN

To examine existing and projected conditions, build consensus, and identify policy positions, strategies, and freight projects to improve freight movement efficiency and safety.

FREIGHT VISION

Freight travels freely and safely through a modern, resilient, and interconnected multimodal network contributing to sustainable economic viability and growth for Maryland businesses and communities.

FREIGHT GOALS

-  SAFETY, SECURITY, AND RESILIENCE
-  ECONOMIC OPPORTUNITY AND EFFICIENCY
-  SYSTEM PRESERVATION AND MODERNIZATION
-  QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE
-  ENVIRONMENTAL PROTECTION AND SENSITIVITY
-  FISCAL RESPONSIBILITY
-  TRANSPORTATION CHOICES AND CONNECTIONS

EXHIBIT 1.2: MARYLAND STATE FREIGHT PLAN ALIGNMENT WITH FEDERAL FREIGHT PLANNING REQUIREMENTS

FEDERAL REQUIREMENTS FOR STATE FREIGHT PLANS	2022 MARYLAND FREIGHT PLAN (BY SECTION)							
	Introduction	Strategic Goals and Objectives	Freight Demand and the Economy	Freight Network and Infrastructure	Freight System Performance, Trends, and Needs	Freight Focus Areas and Programs	Freight Projects and Investment Plan	Freight Plan Implementation
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
The 2021 IIJA (also known as the <i>Bipartisan Infrastructure Law</i>) expands upon previous FAST Act guidance and identifies 17 federally required elements for a state freight plan.								
1 Freight System Trends, Needs, and Issues			●		●	○		
2 Freight Policies, Strategies, and Performance Measures	○	●			●			●
3 Multimodal Freight Facilities and Network			○	●	○	○		
4 Alignment with National Freight Policy and Goals	○	●				●	○	○
5 Innovative Technologies and Operational Strategies		○			○	●		○
6 Asset Preservation and Improvements		○			○	●		○
7 Freight Bottlenecks, Mobility Issues, and Mitigation		○			○	●		○
8 Freight Induced Congestion and Mitigation		○			○	●		○
9 Freight Investment Plan		○					●	○
10 Truck Parking Facilities Assessment (IIJA)		○			○	●		○
11 Supply Chain Cargo Flows (IIJA)		○	●			●		
12 Commercial Ports Inventory (IIJA)		○	○	●	○	●		○
13 Multi-state Freight Compact Consideration (IIJA)		○				●		○
14 E-Commerce Impacts (IIJA)		○	●			●		○
15 Military Freight Considerations (IIJA)						●		
16 Freight Resilience and Environmental Impacts (IIJA)		○			○	●		
17 State Freight Advisory Committee (SFAC)	Influence throughout plan development via survey, review, and discussion opportunities, including formal SFAC meetings conducted on 3/3/2021, 9/1/2021, and 4/6/2022							

TABLE LEGEND:

● Primary Coverage

○ Secondary or Supplemental Coverage

(IIJA) – reflects new requirements introduced by IIJA, building onto the 10 requirements listed previously in the FAST Act

EXHIBIT 1.3: MDOT TBUS/OFFICES AND RELATED FREIGHT ACTIVITIES

MDOT TBUS/OFFICES		FREIGHT ACTIVITIES	WEBSITE
MDOT TSO OPCP RIF TEAM	The Secretary's Office Office of Planning and Capital Programming, Rail and Intermodal Freight Team	Statewide multimodal planning and coordination; motor carrier support, freight rail support, regional coordination, and planning	https://mdot.maryland.gov
MDOT SHA	State Highway Administration	Commercial vehicle safety, commercial vehicle permits, highway planning and analysis	https://www.roads.maryland.gov
MDTA	Maryland Transportation Authority	Commercial vehicle operations and tolling on MDTA facilities, facilities planning	https://mdta.maryland.gov/
MDOT MPA	Maryland Port Administration	Oversight, planning, and administration at the state-owned marine terminals within the Port of Baltimore	https://mpa.maryland.gov/
MDOT MAA	Maryland Aviation Administration	Air cargo planning, management, and promotion at BWI Marshall Airport and other airports	https://marylandaviation.com/
MDOT MVA	Motor Vehicle Administration	Commercial vehicle operator licenses, support for truck platooning regulations and Personal Delivery Device (PDD) regulations, and co-lead for the Connected and Automated Vehicles (CAV) Working Group	https://www.mva.maryland.gov/
MDOT MTA	Maryland Transit Administration	Coordination between passenger rail service and Class I railroad freight operations; and Class III railroad engineering support and property management	https://www.mta.maryland.gov/

The 2022 Maryland Freight Plan recognizes that goods movement (see text box to the right) relies on both public and private infrastructure. The strategies in this document will help Maryland reach its goals through engagement with, and participation by, the private sector. Private sector freight providers and system owners should use the 2022 Maryland Freight Plan to understand MDOT's intended strategic goods movement direction as they develop programs and projects. As evidence of this coordination, MDOT maintains a strong relationship with the SFAC (see **Section 1.3.2**), which includes participants from the public and private sectors.

What is "Goods Movement?"

Goods movement in the context of this Maryland Freight Plan describes the conveyance of raw materials and finished goods from supplier to end user. Use of this term attempts 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.

Raw materials typically focus on heavy cargo such as energy products, construction materials, and agricultural products. These types of cargo move through industrial, manufacturing, and agricultural supply chains.

Finished goods typically focus on business materials and consumer items that are moved via a range of transportation services through wholesale, retail, and service support supply chains.



From an economic perspective, 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, and the logistics-related needs of Maryland industries and their supply chains continue to evolve, especially in the wake of the COVID-19 pandemic (see text box to the right). Now more than ever, it is important

Critical Goods Movement during a Pandemic

The COVID-19 pandemic affected product demands and supply chains across the globe, testing the resilience of goods movement transportation systems and highlighting the criticality of essential deliveries to the front doorstep of Maryland customers, often echoing statements like this:

Emergency medical supplies like masks, ventilators, and soap need to be transported from manufacturers to medical centers, and the raw materials that help manufacturers build those things — paper, plastic, alcohol — need to get to the factory. Grocery shelves must be restocked, and quickly, while customers like schools no longer need their regular shipments. Americans everywhere cry out for more toilet paper.²

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. To this end, the 2022 Maryland Freight Plan acknowledges key trends that drive goods movement demand and influence the performance of the goods movement transportation system (**Exhibit 1.4**).

EXHIBIT 1.4: FREIGHT TRENDS/DRIVERS FOR GOODS MOVEMENT DEMAND AND SYSTEM PERFORMANCE

FREIGHT DEMAND AND THE ECONOMY	
	Maryland's population will continue to grow.
	Maryland's economy will continue to grow.
	Freight volumes moving in Maryland will continue to grow.
	The current transportation and logistics workforce does not meet current or future demand.
FREIGHT NETWORK AND INFRASTRUCTURE	
	Modal shares will remain constant.
	Truck volumes will increase and continue to carry most freight.
	Intermodal port and rail access will continue to be important.
	Transportation assets nearing their end of useful life will require preservation/modernization .
FREIGHT TRENDS AND FOCUS AREAS	
	Greenhouse gas (GHG) emissions and pollutant reduction targets will require increased emphasis on operational improvements and accountability.
	Rapid growth in e-commerce and first/last-mile delivery demands will continue to increase.
	Freight technologies and related innovation opportunities will continue to evolve rapidly.
	Resilience of freight transportation systems and supply chains will continue to be important.



1.2 Recent Freight Actions and Resources

This update to the 2022 Maryland Freight Plan incorporates, where applicable, many of the recent freight-related actions or resources that have been advanced by MDOT and other freight stakeholders since completion of the 2017 Plan. Such actions include the implementation of recommended policies or guidance; advancements in freight data tools and performance measurement; the planning, design, or construction of significant projects; and updates to companion freight-related documents such as the 2022 Maryland State Rail Plan. While not all-encompassing, the list below highlights key efforts related to overall freight planning initiatives in Maryland since 2017.

2017 Maryland Freight Story

<https://bit.ly/2017freightstory>

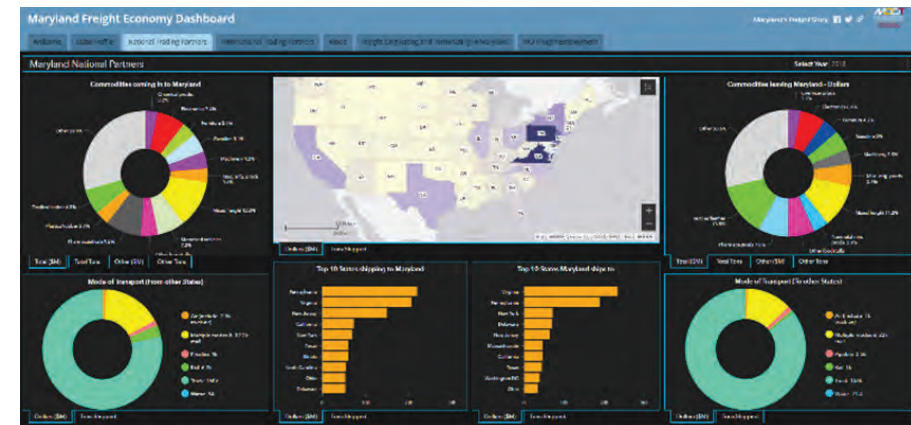
This resource, compiled after the completion of the 2017 Plan, is an online story board that features freight-related mapping and data. The maps and data visualizations illustrate Maryland's freight system infrastructure, asset management, mobility and accessibility, safety and security, freight projects, truck parking, freight commodities and the economy, and planning steps.



2017 Maryland Freight Economy Dashboard

<https://bit.ly/mdeconomydashboard>

This resource, also compiled after the completion of the 2017 Plan, is an online data dashboard that profiles Maryland's commodity flows, trading partners, freight transportation modes, and high-level freight employment summaries.



2018 SHRP2 C20 Freight Modeling in Maryland

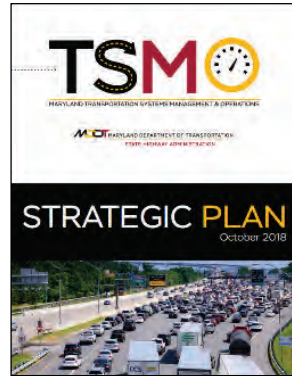
<https://bit.ly/2018freightmodeling>

This cooperative initiative with MDOT SHA and the Baltimore Metropolitan Council (BMC) replaces a 2001 Truck Model in the BMC Travel Demand Model with a multimodal Freight Modeling System (FMS).

2018 Maryland TSMO Strategic Plan

<https://bit.ly/2018tsmo>

The Transportation Systems Management and Operations (TSMO) Plan is a means to effectively manage and operate existing facilities and systems to maximize their full-service potential. It includes strategies to address capacity limitations due to recurring and non-recurring congestion through business processes, ITS technologies, and collaboration.



2019 Maryland Port Administration Strategic Plan

<https://bit.ly/2019mdotmpa>

The 2019 MDOT MPA Strategic Plan updates strategic goals and objectives and charts a course for growth through 2025 for the Port of Baltimore to remain competitive among East Coast ports. It reflects major trends such as shipping consolidation, shifts in global supply chains, changes in cargo demand, and growth in containerized cargo.

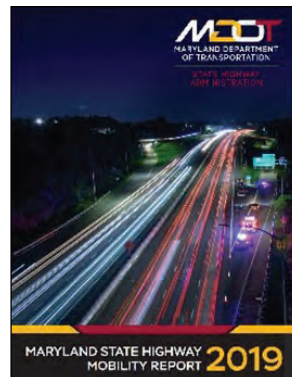


2019 Maryland State Highway Mobility Report

<https://bit.ly/mdotshamobilityreport>

The 2019 update to MDOT SHA's annual Mobility Report highlights recent freight specific project implementations that include:

- Activation of virtual weigh stations at the I-95 Susquehanna River/Tydings Memorial Bridge, I-81, I-95 (Ft. McHenry Tunnel), and I-695 (Bear Creek);
- Overnight truck parking expansion at I-70 Eastbound/Westbound Welcome Centers in Frederick County, and planning for the I-95/I-495 site in Prince George's County;
- At-grade crossing improvements at Gill Avenue and Shiloh Avenue in Carroll County; and
- Enhancements to MDOT SHA's Maryland One Permit System.

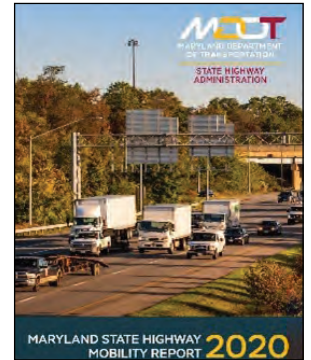


2020 Maryland State Highway Mobility Report

<https://bit.ly/mdotshamobilityreport>

Ongoing updates to MDOT SHA's annual Mobility Report will continue to assess mobility and reliability trends throughout Maryland. Sample freight details from the 2020 update include:

- Truck congestion based on calendar year 2019 data, reflecting the last/latest full year of information pre-dating the influence of the COVID-19 pandemic on travel in 2020;
- Identification of the highest truck volume and percent-truck locations in Maryland, showing significant activity along I-81, I-95, and the Capital Beltway;
- Identification of high-demand truck parking locations with reference to I-95, I-95/I-495, I-70, and US 1/MD 175; and
- Updated truck bottleneck perspectives based on truck delay per mile (DPM) and reliability perspectives based on Truck Travel Time Reliability (TTTR) index.



2020 Maryland Statewide Truck Parking Study

<https://bit.ly/2020truckparkingstudy>

The 2020 Maryland Truck Parking Study provides data, context, and actionable solutions needed to advance priority projects, policies, and partnerships to improve truck parking statewide.



BWI Airport Master Plan

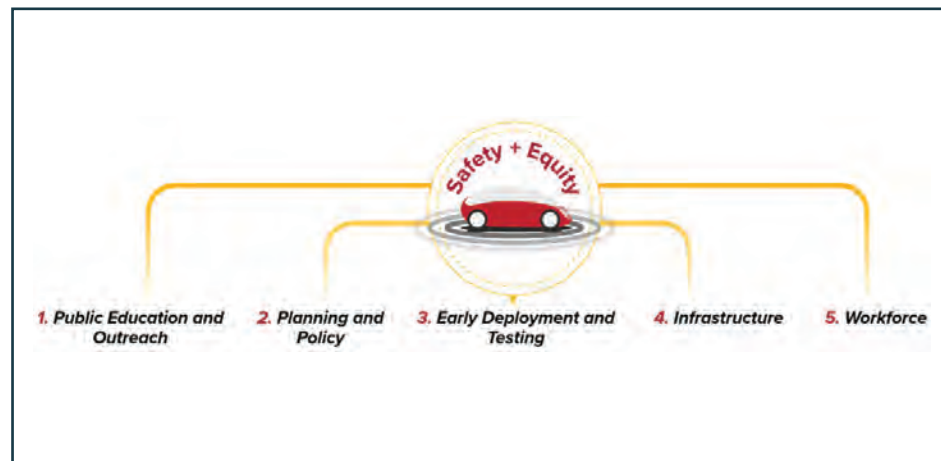
<https://www.bwiairport.com/>

Existing and projected air cargo demands and related facility requirements are an integral part of the overall Airport Master Plan and Strategic Vision of BWI Marshall Airport. Existing and planned facility needs are also reflected in the Airport Layout Plan (ALP). The ALP generally aligns with the Master Plan and serves as more of a living document with details updated more frequently to reflect updated planning/facility needs and market conditions.

2020 Maryland CAV Strategic Framework

<https://bit.ly/2020mdcav>

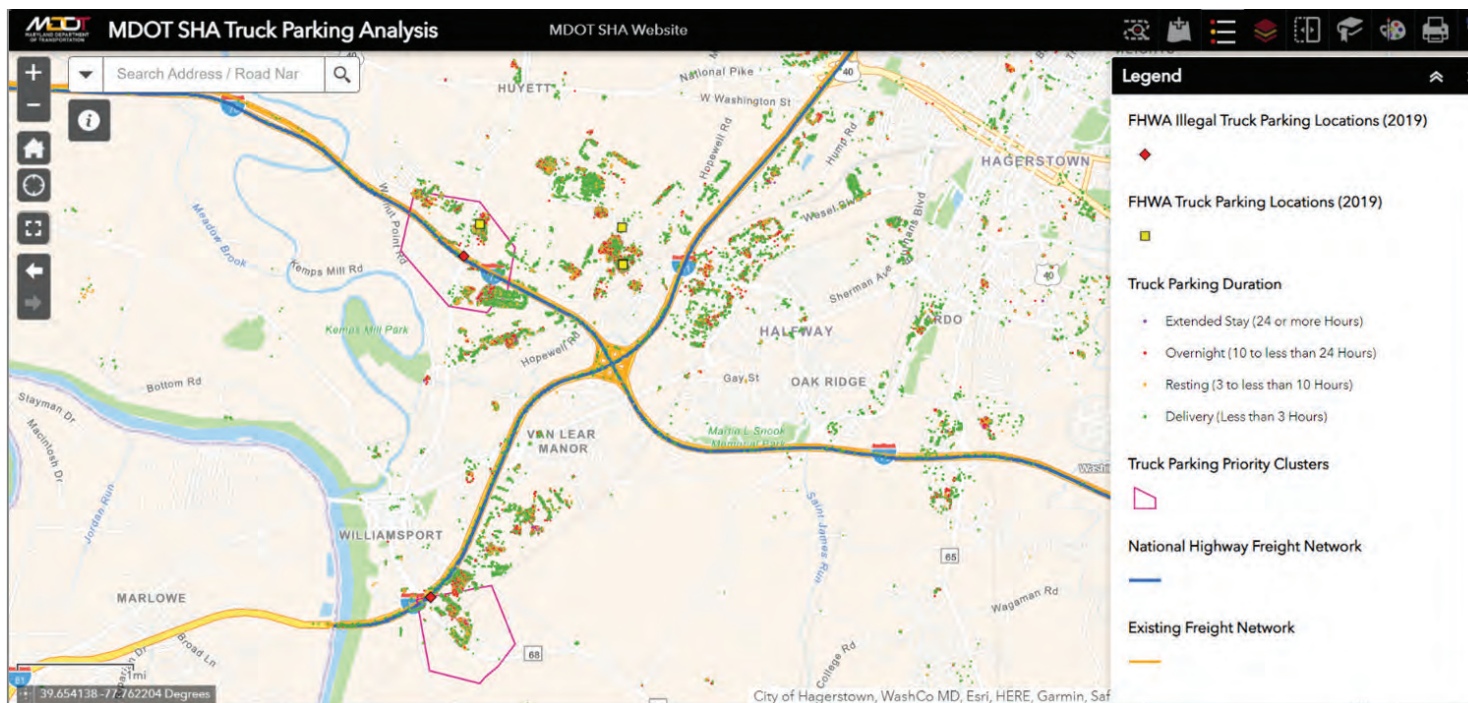
The 2020 Maryland Connected and Automated Vehicle (CAV) Framework outlines five key focus areas (at right) for agencies and other organizations to pursue. The focus areas encompass a coordinated approach to CAV planning and integration throughout the state. The document recommends the incorporation of CAV technology considerations into all planning and policy documents, including freight plans.



2021 MDOT SHA Truck Parking Analysis

<https://bit.ly/2021parkinganalysis>

The 2021 MDOT SHA Truck Parking Analysis tool is an ArcGIS Online web application. It showcases the geospatial data products that provide a complex overview of truck parking throughout Maryland.



2021 Maryland Truck Platooning Legislation

<https://bit.ly/mdtruckplatooning>

Effective October 1, 2021, Senate Bill 291 (*Motor Vehicle Offenses – Following Too Closely – Unified Truck Travel*) makes legislative changes to allow for truck platooning in Maryland.

2022 Maryland State Rail Plan

<https://bit.ly/staterailplan2022>

The latest update of the federally required State Rail Plan outlines public and private investments and policies that will ensure the efficient, safe, and sustainable movement of freight and passengers by rail.

2022 Personal Delivery Device Legislation

<https://bit.ly/senatebill726>

Effective May 18, 2021, Senate Bill 726 (*Vehicle Laws - Personal Delivery Devices - Standards and Requirements*) makes legislative changes to allow for the implementation of the operation of personal delivery devices (PDD) in Maryland.



MDOT Attainment Report on Transportation System Performance

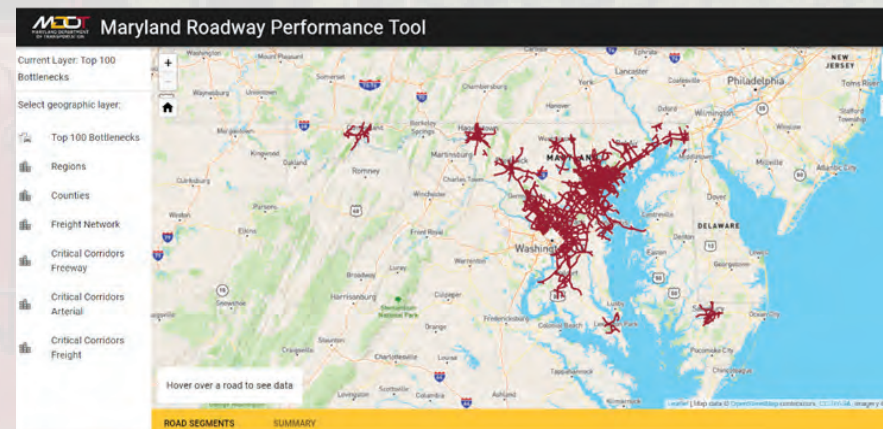
<https://bit.ly/mdotar>

The MDOT Attainment Report on Transportation System Performance tracks MDOT's progress on an annual basis. Performance is measured against the state's long-range transportation planning goals and objectives. This allows MDOT to identify successes, challenges, and strategies for improving the transportation services delivered to Maryland residents.

Maryland Roadway Performance Tool (MRPT)

<https://bit.ly/roadwayperformance>

The MRPT uses the One Maryland One Centerline (OMOC) Highway Performance Monitoring System (HPMS) and aligns INRIX travel time data for calendar year 2018 to the HPMS network with volume data. Performance can be measured across the network or for specific segments or corridors, providing the ability to isolate truck/freight traffic and bottlenecks.



Key Freight Projects and Studies

<https://bit.ly/freightprojectsandstudies>

MDOT continues to advance key projects that influence the overall freight system in Maryland, including projects from the previous iteration of the freight financial plan (which covered fiscal years 2018-2022 per Section 8.0 of the 2017 Maryland Strategic Goods Movement Plan), as well as large-scale projects such as the B&P Tunnel, Susquehanna River Rail Bridge, BWI Rail Station and 4th Track, and the Howard Street Tunnel.

1.3 Stakeholders and Partnerships

Goods movement relies on a partnership between the freight transportation system owners and its users. The freight network consists of publicly and privately owned and maintained infrastructure. Efficient and safe transport of goods requires that MDOT and private sector partners work together to assess issues and develop and implement 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 2022 Maryland Freight Plan. The following describes MDOT's stakeholders and partnership roles throughout the development of this 2022 Maryland Freight Plan.

1.3.1 MDOT TRANSPORTATION BUSINESS UNITS

Development of the policies identified in the 2022 Maryland Freight Plan is a collective effort led by MDOT. The Freight TBU Roundtable represents offices throughout the MDOT TBUs (previous **Exhibit 1.3**) and is the public agency freight voice for Maryland. It has met at key milestones during the development of the 2022 Maryland Freight Plan. Members represent their TBU's economic, environmental, and transportation needs relative to goods movement. The roundtable seeks ways to enhance freight mobility in Maryland, increase Maryland's global connectivity and competitiveness, enhance safety and security of the freight system, and balance freight demand with environmental preservation. The roundtable supports the analysis of statewide, multi-jurisdictional, regional, and corridor freight movement challenges beyond the capacity of individual agencies, metropolitan planning organizations (MPO), and local jurisdictions.

1.3.2 STATE FREIGHT ADVISORY COMMITTEE

Maryland's SFAC is another important institutional body that supports freight planning activities in Maryland and advocates for implementation of projects, programs, and policies to address freight-related priorities, issues, and funding needs. The SFAC represents the freight community at large and advises the state on project and program priorities, freight experience and performance, freight bottlenecks and solutions, next generation supply chain operations and technology, and how the state can support industry.

SFAC membership includes representatives from MDOT including all of the TBUs, Maryland's MPOs, other Maryland and adjacent state agencies, plus executive-level representatives of trucking companies, freight-rail carriers, steamship lines, major shippers, facility operators, and advocacy groups/associations. In addition, representatives from the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and Federal Motor Carrier Safety Administration (FMCSA) participate in this committee. The SFAC aims to meet regularly (at least twice a year) to inform MDOT, other state agencies, or the General Assembly of public and private sector freight needs.

State Freight Advisory Committee and Mission

The Maryland **SFAC** is a high-level group of freight industry leaders* who represent the freight community at large, including the best interests of Maryland businesses and consumers, diverse geographies, and local communities that are impacted by freight movement. The SFAC helps to advise the state on freight-related priorities, policies, issues, projects, and funding needs to advance freight goals and objectives in Maryland.

Along with MDOT, the SFAC helps drive the analysis of private freight operations in the state and provide insights into future goods movement patterns and needs. This group also plays an active role in directly supporting State Freight Plan updates and convened several times at important milestones throughout the 2021-2022 Maryland Freight Plan update process. Prior to the latest update, SFAC membership was revised and expanded to ensure active and engaging participation.

* **SFAC membership list:**
www.mdot.maryland.gov/SFAC

1.3.3 EXTERNAL STAKEHOLDERS

In addition to the MDOT Freight TBU roundtable and the SFAC, MDOT relies on partnerships with other public and private entities to help inform freight planning efforts and the 2022 Maryland Freight Plan updates (**Exhibit 1.5**). These efforts benefit from external stakeholder input that spans private sector freight service providers; system users; state, regional, and local agencies; MPOs; and education and advocacy groups. Opinions on the direction and needs for freight transportation in Maryland were captured through extensive stakeholder engagement and blended alongside data and information analysis to help update content throughout the 2022 Maryland Freight Plan.

Outreach and Engagement

Stakeholder and public outreach opportunities and plan development updates were made available on a dedicated MDOT website for the Maryland Freight Plan:

<https://mdot.maryland.gov/freightplan>

Initial engagement included online presentations, live polls, and interactive surveys (detailed in **Section 2**). This helped affirm and refine the goals, objectives, strategies, and general focus areas that the Maryland Freight Plan would explore.

EXHIBIT 1.5: EXTERNAL STAKEHOLDERS AND PARTNERS

STATE AGENCIES

MDOT TBUs: MDOT TSO, MDOT MAA, MDTA, MDOT MPA, MDOT MTA, MDOT MVA, MDOT SHA; Maryland State Police (MSP)

REGIONAL AND LOCAL GOVERNMENT

Baltimore City Department of Transportation, BMC, City of Hagerstown, Calvert-St. Mary's MPO (C-SMMPO), Cumberland Area MPO (CAMPO), Frederick County, Hagerstown-Eastern Panhandle MPO (HEPMPO), Metropolitan Washington Council of Governments (MWCOG), Montgomery County, Salisbury/Wicomico MPO (S/WMPO), Washington County, Wilmington Area Planning Council (WILMAPCO), and other Maryland counties

ECONOMIC DEVELOPMENT

Maryland Department of Commerce, Baltimore Development Corporation

PRIVATE SECTOR

Aggregate Industries, Case Industrial Partners, Delmarva Water Transport Committee (DWTC), Genesee and Wyoming, Johns Hopkins University, Maryland Chamber of Commerce, Maryland Midland Railway, Maryland Motor Truck Association (MMTA), Maryland Retailers Association, Perdue Agribusiness, Wawa

EDUCATION AND ADVOCACY

Anne Arundel Community College Transportation, Logistics, and Cargo Security Program; Preservation Maryland

ENDNOTES

- 1 Based on a compilation of data from multiple sources including:
MDOT SHA, Maryland Freight Story, <https://maryland.maps.arcgis.com/apps/MapJournal/index.html?appid=874cb859a5c346498d61a80157beda30>.
MDOT SHA, Maryland Freight Economy Dashboard, <https://maryland.maps.arcgis.com/apps/MapSeries/index.html?appid=cc2c5487486941c1be260de4654a84e8>.
MDOT SHA, 2019 Mileage Reports, https://www.roads.maryland.gov/OPPEN/2019_Mileage_Reports.pdf.
U.S. Census Bureau, 2019 SUSB Annual Data Tables by Establishment Industry, <https://www.census.gov/data/tables/2019/econ/susb/2019-susb-annual.html>
- 2 Marshall, Aarian, "As Covid-19 Spreads, Truckers Need to Keep on Trucking," WIRED, March 20, 2020, <https://www.wired.com/story/covid-19-spreads-truckers-keep-trucking/>.



SECTION 2 STRATEGIC GOALS AND OBJECTIVES

SECTION TABLE OF EXHIBITS

Exhibit 2.1: Vision, Goals, and Objectives	2-3
Exhibit 2.2: National Freight Policy in terms of U.S.C. Definitions	2-6
Exhibit 2.3: National Freight Policy in terms of National Freight Strategic Plan Goals and Objectives	2-7
Exhibit 2.4: Maryland 2017-2022 Freight Goals Comparison	2-7

SECTION TABLE OF CONTENTS

2 STRATEGIC GOALS AND OBJECTIVES	2-1
2.1 Overview	2-2
2.2 Federal Requirements	2-5
2.3 State Refinements	2-7
2.3.1 2040 Maryland Transportation Plan	2-7
2.3.2 Agency and Stakeholder Outreach	2-7
2.3.3 Update Summary	2-7



2 STRATEGIC GOALS AND OBJECTIVES

2.1 Overview

The Maryland Freight Plan refines the goals and objectives from the 2017 Maryland Strategic Goods Movement Plan to ensure they support the latest federal requirements while also aligning with the 2040 MTP. The update process also was supported by input from key planning partners, including the MDOT TBUs, the SFAC, and other external stakeholders. The resulting set of strategic goals and objectives for the 2022 Maryland Freight Plan are summarized in the Vision, Goals, and Objectives matrix (**Exhibit 2.1**). As the matrix illustrates, the 2022 Maryland Freight Plan promotes a freight vision that is centered around seven strategic Maryland freight goals as follows:

- **Safety, Security, and Resilience:** Ensure the safe, secure, and resilient movement of goods on Maryland's multimodal freight network.
- **Economic Opportunity and Efficiency:** Enhance economic competitiveness through freight industry opportunities, mobility improvement, and strategic system expansion.
- **System Preservation and Modernization:** Modernize Maryland's multimodal freight network and operations with innovative solutions from origin to destination.
- **Quality of Service, Efficiency, and Customer Experience:** Enhance transportation services and communications for users of Maryland's multimodal freight system.
- **Environmental Protection and Sensitivity:** Support sustainable freight infrastructure, community vitality, and environmental stewardship.
- **Fiscal Responsibility:** Ensure responsible freight system investment and management through performance-based decision making and innovative funding mechanisms and partnerships.
- **Transportation Choices and Connections:** Support alternative transportation choices and goods delivery options by improving multimodal and last-mile connections.

To ensure consistency, the Maryland Freight Plan also evaluated the other relevant MDOT TBU modal plans that together comprise a broader MDOT freight plan package with freight-critical elements in the 2040 MTP, the Maryland State Rail Plan (2022), Maryland Statewide Truck Parking Study (2020), and the Maryland Port Administration Strategic Plan (2019). While the Maryland Freight Plan does not aim to duplicate the details from these other relevant modal plans in their entirety, it should be understood that it includes a direct linkage with those plans



EXHIBIT 2.1 VISION, GOALS, AND OBJECTIVES

PURPOSE OF THE FREIGHT PLAN

To examine existing and projected conditions, build consensus, and identify policy positions, strategies, and freight projects to improve freight movement efficiency and safety.

NATIONAL FREIGHT GOALS

NATIONAL FREIGHT STRATEGIC PLAN



SAFETY

Improve the safety, security, and resilience of the national freight system.



INFRASTRUCTURE

Modernize freight infrastructure and operations to grow the economy, increase competitiveness, and improve quality of life.



INNOVATION

Prepare for the future by supporting the development of data, technologies, and workforce capabilities that improve freight system performance.

49 U.S.C. §70101. (d) Goals (Multimodal Freight Policy)
23 U.S.C. §167. (b) Goals (Highway Freight Program)

2040 MARYLAND TRANSPORTATION PLAN (2040 MTP) GOALS



Ensure a Safe, Secure, and Resilient Transportation System



Facilitate Economic Opportunity and Reduce Congestion in Maryland through Strategic System Expansion



Maintain a High Standard and Modernize Maryland's Multimodal Transportation System



Improve the Quality and Efficiency of the Transportation System to Enhance the Customer Experience



Ensure Environmental Protection and Sensitivity



Promote Fiscal Responsibility



Provide Better Transportation Choices and Connections

MARYLAND FREIGHT PLAN GOALS

Safety, Security, and Resilience

Ensure the safe, secure, and resilient movement of goods on Maryland's multimodal freight network

Economic Opportunity and Efficiency

Enhance economic competitiveness through freight industry opportunities, mobility improvement, and strategic system expansion

System Preservation and Modernization

Modernize Maryland's multimodal freight network and operations with innovative solutions from origin to destination

Quality of Service, Efficiency, and Customer Experience

Enhance transportation services and communications for users of Maryland's multimodal freight system

Environmental Protection and Sensitivity

Support sustainable freight infrastructure, community vitality, and environmental stewardship

Fiscal Responsibility

Ensure responsible freight system investment and management through performance-based decision-making and innovative funding mechanisms and partnerships

Transportation Choices and Connections

Support alternative transportation choices and goods delivery options by improving multimodal and last-mile connections

EXHIBIT 2.1 VISION, GOALS, AND OBJECTIVES (CONTINUED)



2.2 Federal Requirements

The 2022 Maryland Maryland Freight Plan contains all elements to meet federal freight planning requirements established by the FAST Act and expanded by the IIJA. These details require that the Plan cover an eight-year forecast period, be fiscally constrained, include a freight investment plan with a list of priority projects, and describe how the state will invest and match its National Highway Freight Program (NHFP) funds. Additionally, including the expanded requirements under the IIJA, 49 U.S.C. §70202 outlines 17 required freight plan elements as listed below (see also previous **Exhibit 1.2** for a section-specific alignment summary to these requirements):

1. An identification of significant freight system trends, needs, and issues with respect to the state.
2. A description of the freight policies, strategies, and performance measures that will guide the freight-related transportation investment decisions of the state.
3. When applicable, a listing of (a) multimodal critical rural freight facilities and corridors designated within the state under 49 U.S.C. §70103 (National Multimodal Freight Network (NMFN)); and (b) critical rural and urban freight corridors designated within the state under 23 U.S.C. §167 NHFP.
4. A description of how the Plan will improve the ability of the state to meet the National Multimodal Freight Policy goals described in 49 U.S.C. §70101(b) and the NHFP goals described in 23 U.S.C. §167.
5. A description of how innovative technologies and operational strategies, including freight intelligent transportation systems, that improve the safety and efficiency of the freight movement, were considered.
6. In the case of roadways on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate the condition of the roadways, a description of improvements that may be required to reduce or impede the deterioration.
7. An inventory of facilities with freight mobility issues, such as bottlenecks, within the state, and for those facilities that are state owned or operated, a description of the strategies the state is employing to address those freight mobility issues.
8. Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion or delay.
9. A freight investment plan that, subject to 49 U.S.C. §70202(c), includes a list of priority projects and describes how funds made available to carry out 23 U.S.C. §167 would be invested and matched.
10. The most recent commercial motor vehicle parking facilities assessment conducted by the state under 49 U.S.C. §70202(f).
11. The most recent supply chain cargo flows in the state, expressed by mode of transportation.
12. An inventory of commercial ports in the state.
13. If applicable, consideration of the findings or recommendations made by any multi-state freight compact to which the state is a party under 49 U.S.C. §70204.
14. The impacts of e-commerce on freight infrastructure in the state.
15. Considerations of military freight.
16. Strategies and goals to decrease: (a) the severity of impacts of extreme weather and natural disasters on freight mobility; (b) the impacts of freight movement on local air pollution; (c) the impacts of freight movement on flooding and stormwater runoff; and (d) the impacts of freight movement on wildlife habitat loss.
17. Consultation with the SFAC, if applicable.

Related to planning requirement #4 at left, relevant federal policy details and requirements in terms of the National Multimodal Freight Policy Goals and the NHFP Goals are summarized for reference in **Exhibit 2.2**.

In addition to the listed requirements, the Maryland Maryland Freight Plan further reflects alignment with the 2021 update to the National Freight Strategic Plan (NFSP) with its emphasis on goals and objectives related to safety, infrastructure, and innovation, as summarized for reference in **Exhibit 2.3**.



EXHIBIT 2.2: NATIONAL FREIGHT POLICY IN TERMS OF U.S.C. DEFINITIONS^{1,2}

NATIONAL MULTIMODAL FREIGHT POLICY GOALS (49 U.S.C. §70101)	NATIONAL HIGHWAY FREIGHT PROGRAM GOALS (23 U.S.C. §167)
<ol style="list-style-type: none"> 1. To identify infrastructure improvements, policies, and operational innovations that: <ol style="list-style-type: none"> a. Strengthen the contribution of the NMFN to the economic competitiveness of the United States b. Reduce congestion and eliminate bottlenecks on the NMFN c. Increase productivity, particularly for domestic industries and businesses that create high value jobs 2. To improve the safety, security, efficiency, and resiliency of multimodal freight transportation 3. To achieve and maintain a state of good repair on the NMFN 4. To use innovation and advanced technology to improve the safety, efficiency, and reliability of the NMFN 5. To improve the economic efficiency and productivity of the NMFN 6. To improve the reliability of freight transportation 7. To improve the short- and long-distance movement of goods that: <ol style="list-style-type: none"> a. Travel across rural areas between population centers b. Travel between rural areas and population centers c. Travel from the Nation's ports, airports, and gateways to the NMFN 8. To improve the flexibility of states to support multi-state corridor planning and the creation of multi-state organizations to increase the ability of states to address multimodal freight connectivity 9. To reduce the adverse environmental impacts of freight movement on the NMFN 10. To pursue the goals described in this subsection in a manner that is not burdensome to state and local governments 	<ol style="list-style-type: none"> 1. To invest in infrastructure improvements and to implement operational improvements on the highways of the United States that: <ol style="list-style-type: none"> a. Strengthen the contribution of the National Highway Freight Network (NHFN) to the economic competitiveness of the United States b. Reduce congestion and bottlenecks on the NHFN c. Reduce the cost of freight transportation d. Improve the year-round reliability of freight transportation e. Increase productivity, particularly for domestic industries and businesses that create high value jobs 2. To improve the safety, security, efficiency, and resiliency of freight transportation in rural and urban areas 3. To improve the state of good repair of the NHFN 4. To use innovation and advanced technology to improve the safety, efficiency, and reliability of the NHFN 5. To improve the efficiency and productivity of the NHFN 6. To improve the flexibility of states to support multi-state corridor planning and the creation of multi-state organizations to increase the ability of states to address highway freight connectivity 7. To reduce the environmental impacts of freight movement on the NHFN

EXHIBIT 2.3: NATIONAL FREIGHT POLICY IN TERMS OF NATIONAL FREIGHT STRATEGIC PLAN (NFSP) GOALS AND OBJECTIVES³

NFSP GOAL	NFSP STRATEGIC OBJECTIVES
<p>Safety</p> <p>Improve the safety, security, and resilience of the national freight system</p>	<ul style="list-style-type: none"> ■ Support the development and adoption of automation, connectivity, and other freight safety technologies ■ Modernize safety oversight and security procedures ■ Minimize the effects of fatigue and human error on freight safety ■ Reduce conflicts between passenger and freight traffic ■ Protect the freight system from natural and human-caused disasters and improve system resilience and recovery speed
<p>Infrastructure</p> <p>Modernize freight infrastructure and operations to grow the economy, increase competitiveness, and improve quality of life</p>	<ul style="list-style-type: none"> ■ Fund targeted investments in freight capacity and national goals ■ Improve consideration of freight in transportation planning ■ Prioritize projects that improve freight intermodal connectivity, enhance freight flows on first- and last-mile connectors and at major trade gateways ■ Develop a methodology for identifying freight bottlenecks across modes ■ Advance freight system management and operation practices ■ Stimulate job growth and economic competitiveness in rural and urban communities ■ Mitigate the impacts of freight movement on communities
<p>Innovation</p> <p>Prepare for the future by supporting the development of data, technologies, and workforce capabilities that improve freight system performance</p>	<ul style="list-style-type: none"> ■ Support the development and adoption of automation and connectivity, including V2X technologies ■ Support the safe deployment of UAS technology ■ Streamline or eliminate regulations to improve governance, efficiency, and economic competitiveness ■ Improve freight data, modeling, and analytical tools and resources ■ Strengthen workforce professional capacity ■ Invest in freight research ■ Support regulatory frameworks that foster freight innovation

2.3 State Refinements

2.3.1 2040 MTP

As illustrated in previous **Exhibit 2.1**, the 2022 Maryland Maryland Freight Plan goals were designed to directly align with the 2040 MTP, resulting in a direct relationship with an emphasis on the multimodal freight network. Similarly, specific freight-relevant objectives, strategies, and performance measures from the MTP are also included where applicable.

2.3.2 AGENCY AND STAKEHOLDER OUTREACH

As part of the update process for development of the 2022 Maryland Maryland Freight Plan, Milestone #1 also focused on development and refinement of the Plan’s Vision, Goals, and Objectives in a manner that directly incorporated feedback from the MDOT TBUs; the SFAC; MPOs; and other agency, stakeholder, and public participants. Input received helps to better understand needs and priorities that may be newly emerging, outdated, or unresolved, as well as potentially opposing views from different stakeholders. Outreach efforts included polling conducted during planning meetings and through an online survey in early 2021. Milestone #1 survey and feedback details are documented in **Appendix 2A**.

2.3.3 UPDATE SUMMARY

Through the processes described above, the 2022 Maryland Maryland Freight Plan goals were refined and expanded beyond those in the prior (2017) plan (**Exhibit 2.4**). With these updates, the Maryland Freight Plan also reorganizes, refines, and expands the objectives from the prior plan (previously referred to as “desired outcomes”). The latest Maryland Freight Plan objectives (**Exhibit 2.1**) help articulate the intent of advancing the Plan’s goals and serve as a framework for identification of future implementation strategies. The 2017 objectives were also refined to reflect newer freight-related objectives from the 2040 MTP, remove outdated objectives that are outside of MDOT’s jurisdiction and link to freight-relevant details in other MDOT TBU modal plans.

EXHIBIT 2.4: MARYLAND 2017-2022 FREIGHT GOALS COMPARISON

INITIAL FREIGHT GOALS PER THE 2017 STRATEGIC GOODS MOVEMENT PLAN	REVISED FREIGHT GOALS PER THE 2022 MARYLAND FRIEGHT PLAN
<ul style="list-style-type: none"> ■ Quality of Service ■ System Preservation ■ Safety & Security ■ Economic Prosperity ■ Community Vitality 	<ul style="list-style-type: none"> ■ Quality of Service, Efficiency, and Customer Experience ■ System Preservation and Modernization ■ Safety, Security, and Resilience ■ Economic Opportunity and Efficiency ■ Environmental Protection and Sensitivity ■ Fiscal Responsibility ■ Transportation Choices and Connections

ENDNOTES

- 1 United States Code, Title 49 – Transportation, Subtitle IX – Multimodal Freight Transportation, Chapter 701 – Multimodal Freight Policy, Sec. 70101. National Multimodal Freight Policy (49 U.S.C. §70101), effective October 1, 2015, <https://uscode.house.gov/browse.xhtml>.
- 2 United States Code, Title 23 – Highways, Chapter 1 – Federal-Aid Highways, Sec. 167. National Highway Freight Program (23 U.S.C. §167), amended October 1, 2015, <https://uscode.house.gov/browse.xhtml>.
- 3 USDOT, National Freight Strategic Plan, 2021, <https://www.transportation.gov/freight/NFSP>.



SECTION 3 FREIGHT DEMAND AND THE ECONOMY

SECTION TABLE OF EXHIBITS

SECTION TABLE OF CONTENTS

3	FREIGHT DEMAND AND THE ECONOMY	3-2
3.1	Maryland Commodity Flows	3-2
3.2	Maryland Freight Economic Influences	3-14
3.2.1	Population Growth	3-14
3.2.2	Population Density	3-15
3.2.3	Employment	3-15
3.2.4	State Revenues	3-15
3.2.5	State GDP	3-15
3.3	Maryland Freight Industry Sector Profiles	3-17
3.3.1	Agriculture	3-18
3.3.2	Mining	3-21
3.3.3	Construction and Utilities	3-24
3.3.4	Energy	3-27
3.3.5	Manufacturing	3-29
3.3.6	Wholesale Trade, Transportation and Warehousing, and Retail Trade	3-32
3.3.7	Other Industry Sector Influences	3-36

Exhibit 3.1:	Maryland Commodity Flows – 2020 Summary by Trade Type (Domestic, Import, Export)	3-3
Exhibit 3.2:	Maryland Commodity Flows – 2020 Summary by Direction (Intrastate, Inbound, Outbound)	3-4
Exhibit 3.3:	Maryland Commodity Flows – 2020 Leading Domestic Trade Partners	3-4
Exhibit 3.4:	Maryland Commodity Flows – 2020 Freight Origin-Destination Tonnage by State (kTons)	3-5
Exhibit 3.5:	Maryland Commodity Flows – 2020 Freight Origin-Destination Value by State (\$M)	3-6
Exhibit 3.6:	Maryland Commodity Flows – 2020 Foreign Import Summary	3-7
Exhibit 3.7:	Maryland Commodity Flows – 2020 Foreign Export Summary	3-8
Exhibit 3.8:	Maryland Commodity Flows – 2020 Summary by Mode	3-9
Exhibit 3.9:	Maryland Commodity Flows – 2020 Leading Commodities by Tonnage	3-10
Exhibit 3.10:	Maryland Commodity Flows – 2020 Leading Commodities by Value	3-11
Exhibit 3.11:	Maryland Commodity Flows – 2020-2050 Overall Freight Growth Trends	3-12
Exhibit 3.12:	Maryland Commodity Flows – 2020-2050 Commodity-Specific Freight Growth Trends	3-13
Exhibit 3.13:	Maryland Freight Economic Influences – Population Projections (2010-2045)	3-14
Exhibit 3.14:	Maryland Freight Economic Influences – Establishments, Employment, and Wages (2017)	3-15
Exhibit 3.15:	Maryland Freight Economic Influences – Annual State Revenues (2019)	3-15
Exhibit 3.16:	Maryland Freight Economic Influences – Industry Sectors as Percent of Maryland GDP (2019)	3-16
Exhibit 3.17:	Maryland Freight Economic Influences – Modes and Characteristics	3-17
Exhibit 3.18:	Maryland Employment by County – 2019 Agriculture	3-19
Exhibit 3.19:	Maryland Mine and Quarry Sites (2018-2019)	3-22
Exhibit 3.20:	Maryland Employment by County – 2019 Construction and Utilities	3-25
Exhibit 3.21:	Maryland Employment by County – 2019 Manufacturing	3-30
Exhibit 3.22:	Maryland Employment by County – 2019 Wholesale Trade and Transportation	3-33
Exhibit 3.23:	Maryland Employment by County – 2019 Retail Trade	3-34
Exhibit 3.24:	Maryland Employment by County – 2019 Healthcare	3-37
Exhibit 3.25:	Maryland Employment by County – 2019 Government and Knowledge Sector	3-38

3 FREIGHT DEMAND AND THE ECONOMY

3.1 Maryland Commodity Flows

Businesses in Maryland produce and consume raw materials and finished goods that are shipped to and from locations across the globe. Maryland's freight transportation system must be ready to handle the current and future levels and types of goods movement. Meeting these demands and related opportunities is crucial to help ensure successful enterprise, lower cost of goods, and better quality of life for businesses, supply chains, and consumers across the state, region, and nation – especially as the economy recovers from the effects of the COVID-19 pandemic.

Summary freight data and key findings are illustrated throughout this section to help provide an understanding of Maryland commodity flows. Based on Federal Highway Administration (FHWA)'s Freight Analysis Framework Version 5 (FAF5) dataset, these summaries include reference to freight tonnage, value, commodity type, and trade type, defined as follows:

- **Freight Tonnage:** the total weight of commodities shipped.¹
- **Freight Value:** the total monetary value for the reported year (in 2017 dollars, unadjusted for inflation) of commodities shipped.²
- **Commodity Type:** the category of goods or resources per the Bureau of Transportation Statistics (BTS)'s Standard Classification of Transported Goods (SCTG), referenced at a two-digit level from SCTG 01 (live animals and fish) through SCTG 43 (mixed freight).³
- **Trade Type:** a distinction between domestic freight, which only includes domestic shipments moved between origins and destinations inside the U.S., and foreign trade flows, which include imports (from foreign origins to domestic destinations) and exports (from domestic origins to foreign destinations).

Additional commodity details can also be explored using online tools and resources via the Maryland Freight Economy Dashboard at <https://bit.ly/mdeconomydashboard> (see Section 1.2 of this plan).⁴



In **2020**, freight moving to, from, or within Maryland amounted to almost **281 million tons** worth almost **\$376 billion** (2020 FAF5).

By **2050**, freight tonnage is expected to increase by **53%** to almost **429 million tons**, while value will increase **108%** to almost **\$781 billion** (2020-2050 FAF5).

Moreover, these estimates do not reflect substantial **pass-through freight** that historically accounts for almost **two-thirds** of the total goods carried on the state's multimodal freight transportation systems.

Commodity Flow Key Findings

- **Trade Type:** The vast majority of freight moving in Maryland, representing approximately 87% in total tonnage and 83% in total value, originates from and is destined for locations within the U.S. (**Exhibit 3.1**).
- **Directionality:** Most freight tonnage in Maryland moves within the state (44%) with more inbound (32%) than outbound (24%). Most freight value enters from other states (42%) (**Exhibit 3.2**).
- **Domestic Trade Partners:** Approximately 90% of Maryland's domestic freight tonnage and 70% of its domestic freight value move within Maryland and between the surrounding states, plus New York and California (**Exhibit 3.3** through **Exhibit 3.5**).
- **Foreign Trade Partners:** Europe, Canada, and Eastern Asia may be considered among Maryland's leading international trade partners in terms of total import/export freight tonnage or value. However, the state's overall international trade patterns encompass a complex web of freight movements across the globe that allow for imports/exports directly to/from Maryland, but also indirectly via freight transfers through U.S. entry/exit regions in almost every other state across the nation (**Exhibit 3.6** and **Exhibit 3.7**).
- **Freight Mode:** Truck is the dominant mode, carrying 78% of total freight tonnage and 76% of total freight value (**Exhibit 3.8**). Pipeline and rail freight account for the next largest proportions of freight tonnage. Multiple modes and mail account for the next largest proportion of freight value which, based on FAF definitions, includes shipments by multiple modes and by parcel delivery services, U.S. Postal Service, or couriers (capped at 150 pounds).⁵
- **Commodity Types:** Maryland's freight tonnage typically consists of bulk or heavy materials such as gravel, coal and petroleum products, or nonmetallic mineral products, while freight value is more diverse, spanning motorized vehicles, electronics, mixed freight, pharmaceuticals, machinery, and other commodities (**Exhibit 3.9** and **Exhibit 3.10**).

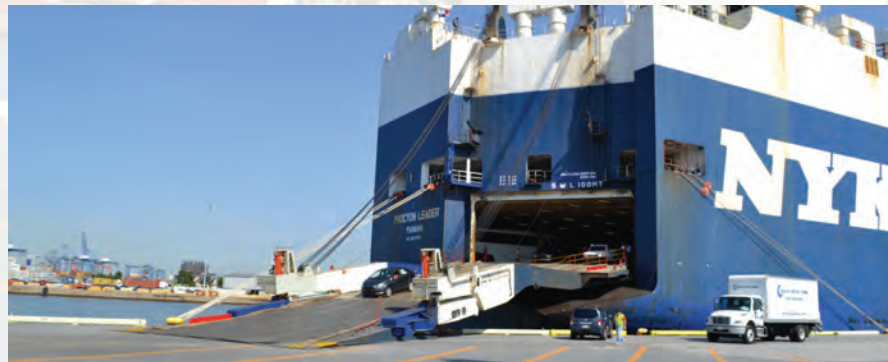


EXHIBIT 3.1: MARYLAND COMMODITY FLOWS – 2020 SUMMARY BY TRADE TYPE (DOMESTIC, IMPORT, EXPORT)⁶

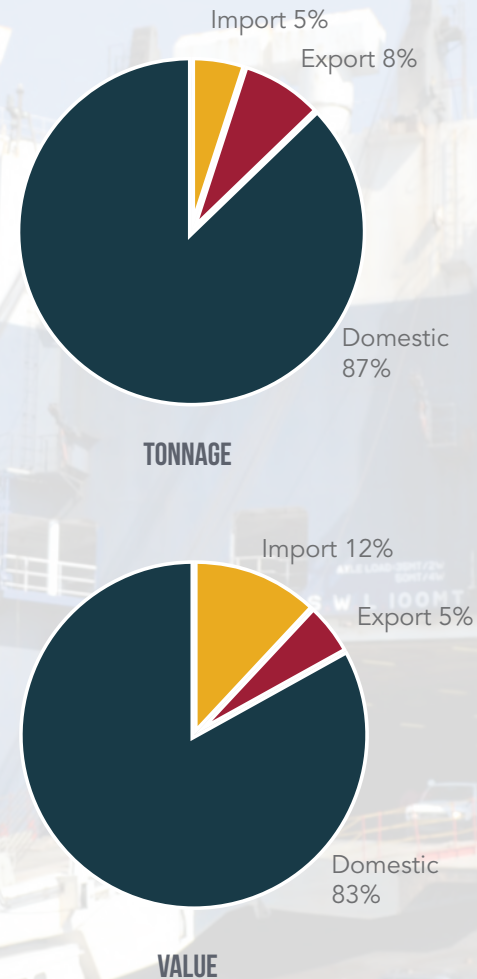


EXHIBIT 3.2: MARYLAND COMMODITY FLOWS – 2020 SUMMARY BY DIRECTION (INTRASTATE, INBOUND, OUTBOUND)⁷

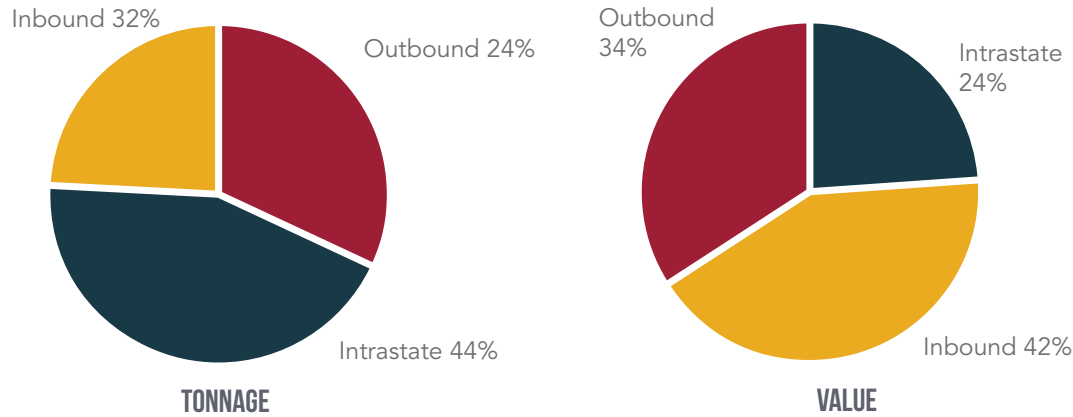


EXHIBIT 3.3: MARYLAND COMMODITY FLOWS – 2020 LEADING DOMESTIC TRADE PARTNERS⁸

TONNAGE		% of Total Domestic Freight	
Rank	Partner	From MD	To MD
Intrastate	Maryland	65.3%	63.0%
1	Virginia	15.1%	9.0%
2	Pennsylvania	5.9%	12.5%
3	Delaware	2.6%	2.1%
4	New Jersey	1.2%	2.0%
5	West Virginia	1.4%	1.0%
--	Other States	8.5%	10.4%

VALUE		% of Total Domestic Freight	
Rank	Partner	From MD	To MD
Intrastate	Maryland	39.2%	32.6%
1	Virginia	11.7%	8.6%
2	Pennsylvania	8.6%	11.2%
3	New Jersey	3.5%	7.3%
4	California	3.5%	4.4%
5	New York	4.1%	2.4%
--	Other States	29.4%	33.5%

EXHIBIT 3.4: MARYLAND COMMODITY FLOWS – 2020 FREIGHT ORIGIN-DESTINATION TONNAGE BY STATE (KTONS)⁹

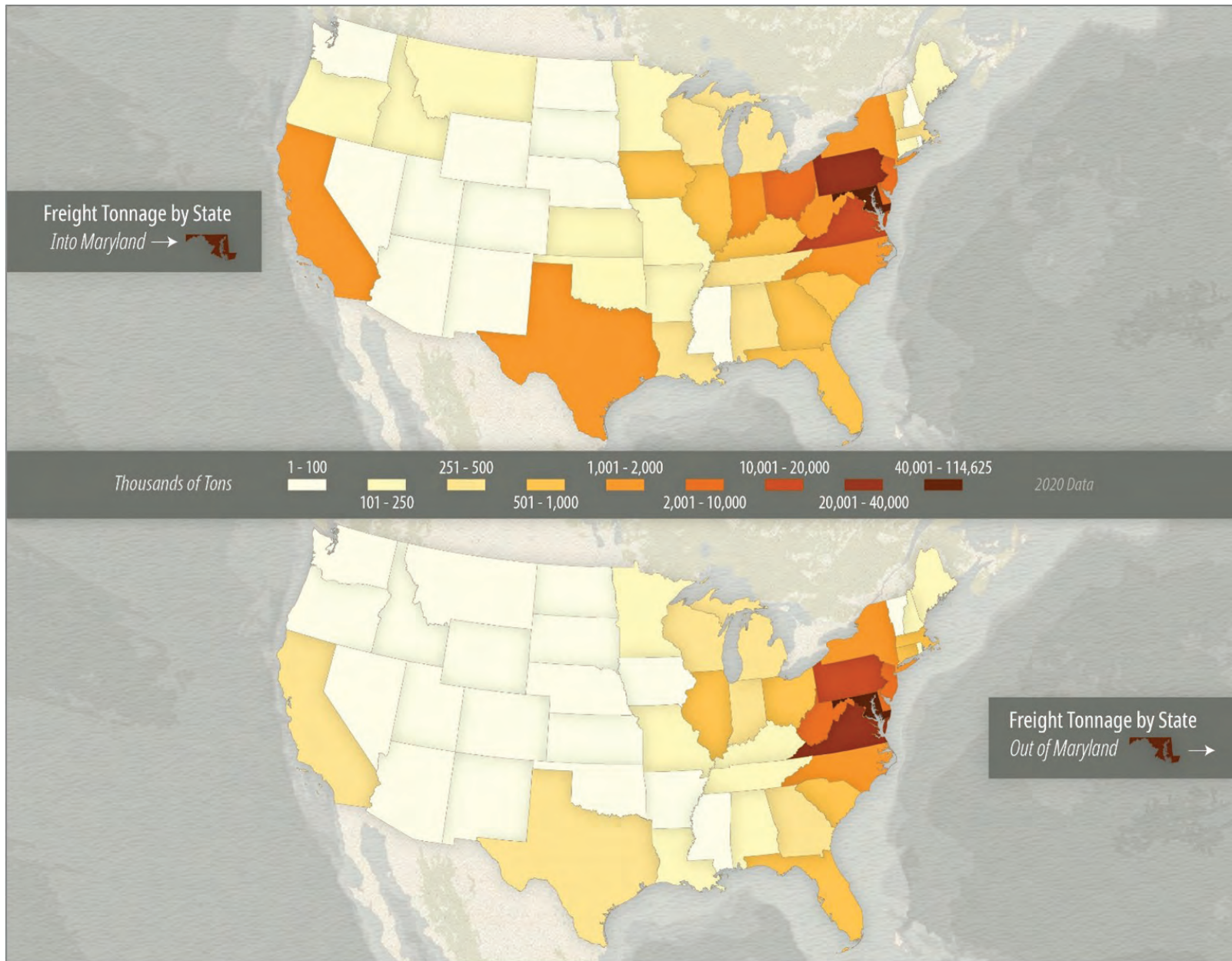


EXHIBIT 3 5: MARYLAND COMMODITY FLOWS – 2020 FREIGHT ORIGIN-DESTINATION VALUE BY STATE (\$M)¹⁰

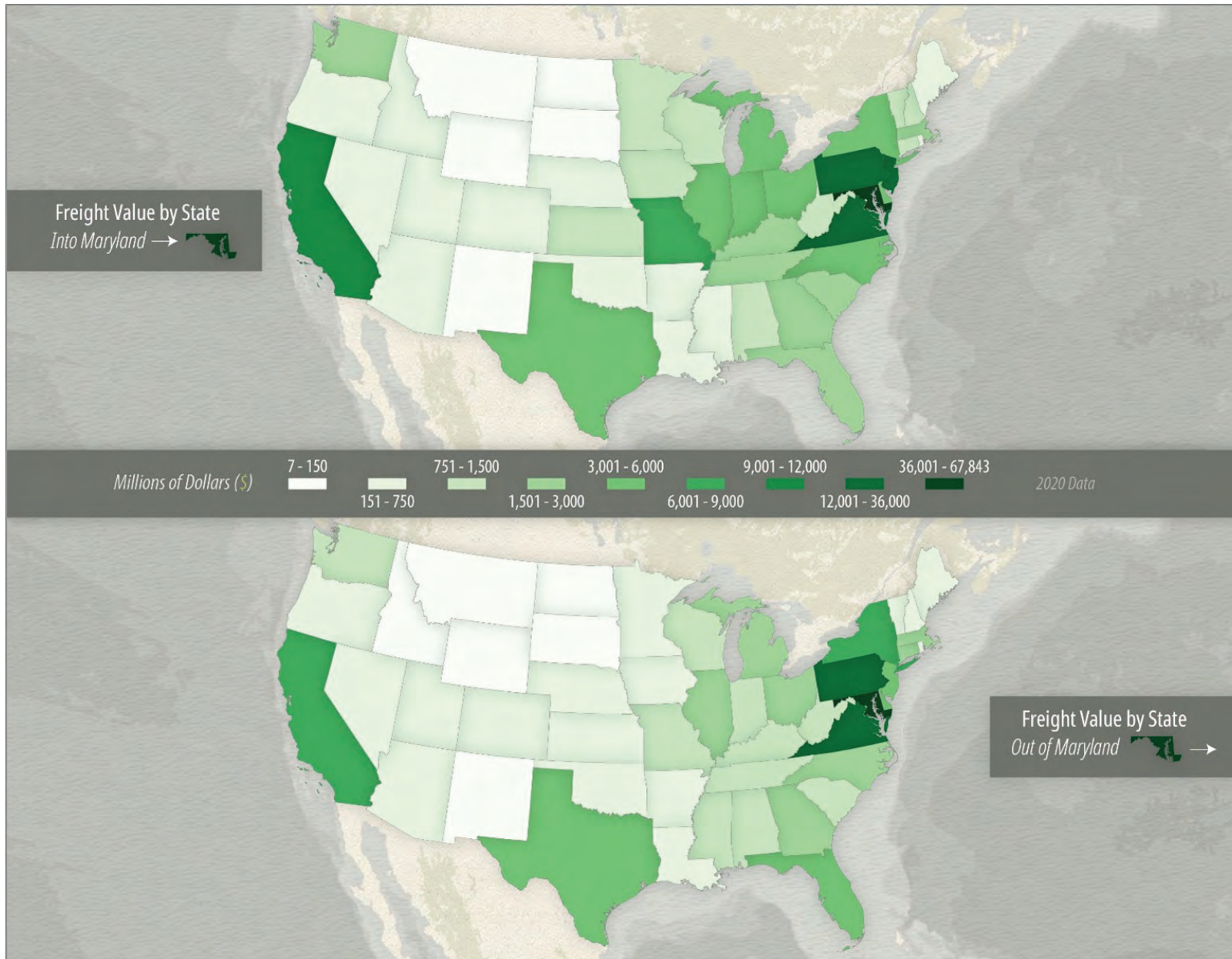
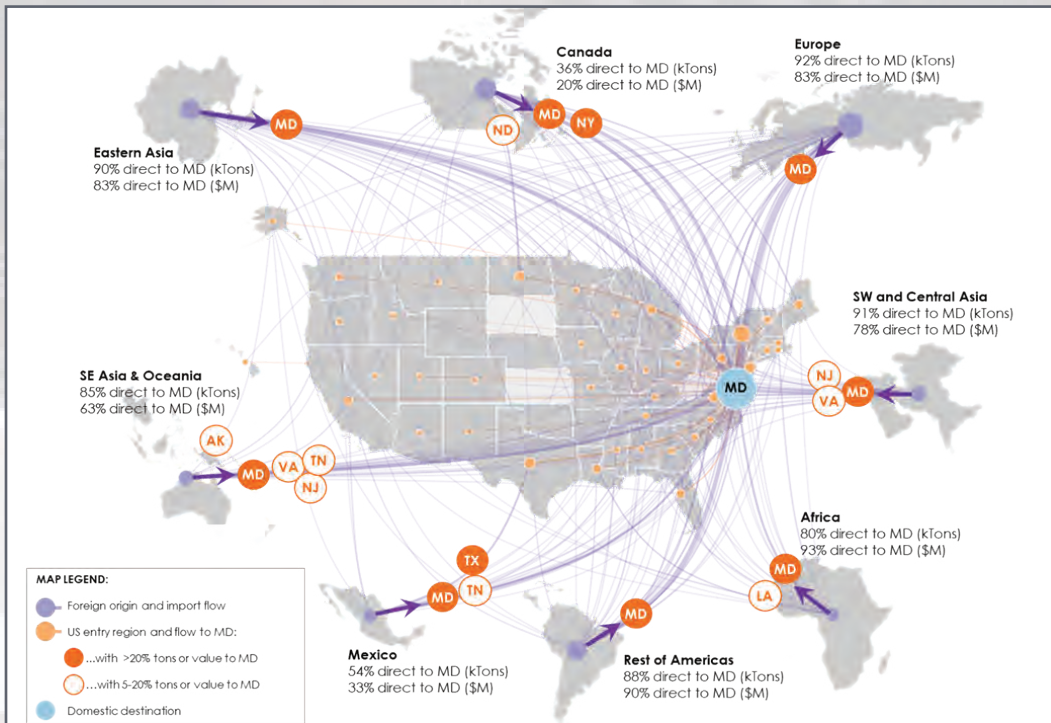
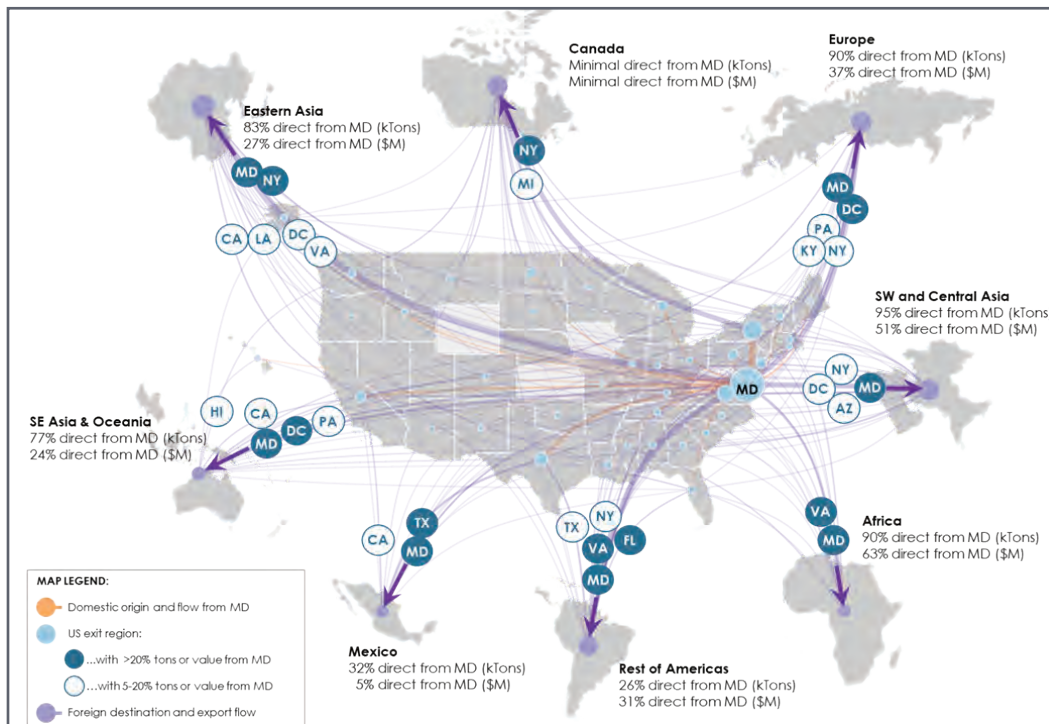


EXHIBIT 3.6: MARYLAND COMMODITY FLOWS – 2020 FOREIGN IMPORT SUMMARY¹¹



TRADE PARTNER	IMPORT KTONS	IMPORT \$M	LEADING IMPORT COMMODITIES
EASTERN ASIA	1,157 (12%)	\$6,273 (21%)	vehicles, machinery, electronics, metals
CANADA	2,298 (24%)	\$2,142 (7%)	wood products, nonmetallic minerals, metals, foodstuffs
EUROPE	2,740 (29%)	\$11,249 (38%)	vehicles, machinery, metals, newsprint/paper, fertilizers, wood products
SW AND CENTRAL ASIA	511 (5%)	\$1,174 (4%)	metals, agricultural products, chemical products, textiles/leather
AFRICA	189 (2%)	\$516 (2%)	foodstuffs, agricultural products, metallic ores, metals, basic chemicals
REST OF AMERICAS	1,483 (16%)	\$2,053 (7%)	wood products, foodstuffs, metals, newsprint/paper, agricultural products
MEXICO	384 (4%)	\$3,476 (12%)	vehicles, nonmetallic minerals, machinery, electronics
SE ASIA AND OCEANIA	673 (7%)	\$2,638 (9%)	metals, chemical products, foodstuffs, plastics/rubber, miscellaneous manufacturing products
TOTAL	9,435	\$29,522	by weight: wood products, metals, nonmetallic minerals, newsprint/paper by value: vehicles, metals, electronics, machinery

EXHIBIT 3.7: MARYLAND COMMODITY FLOWS – 2020 FOREIGN EXPORT SUMMARY¹²



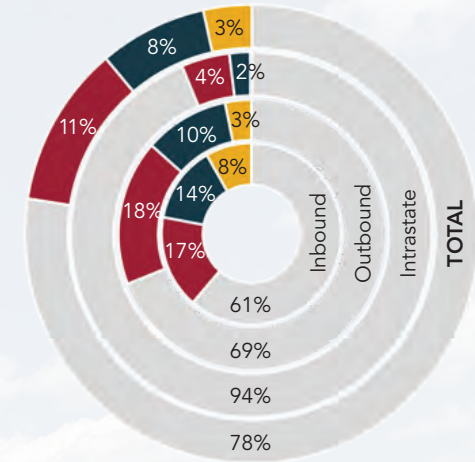
TRADE PARTNER	EXPORT KTONS	EXPORT \$M	LEADING EXPORT COMMODITIES
EASTERN ASIA	501 (14%)	\$1,169 (14%)	waste/scrap, coal, metals, chemical products, plastics/rubber, electronics
CANADA	683 (19%)	\$1,768 (21%)	waste/scrap, sands, foodstuffs, electronics, machinery, chemical products
EUROPE	721 (20%)	\$2,497 (29%)	metallic ores, coal, transportation equipment, chemical products, machinery, electronics
SW AND CENTRAL ASIA	766 (21%)	\$915 (11%)	waste/scrap, electronics, motorized vehicles, chemical products
AFRICA	148 (4%)	\$742 (9%)	vehicles, waste/scrap, fuel oils, transportation equipment, electronics
REST OF AMERICAS	526 (14%)	\$680 (8%)	coal, waste/scrap, fuel oils, machinery, chemical products, miscellaneous manufacturing products
MEXICO	141 (4%)	\$354 (4%)	waste/scrap, newsprint/paper, foodstuffs, plastics/rubber, machinery, electronics
SE ASIA AND OCEANIA	160 (4%)	\$500 (6%)	waste/scrap, fuel oils, agricultural products, chemical products, electronics, machinery
TOTAL	3,645	\$8,624	by weight: waste/scrap, coal, metallic ores by value: electronics, chemical products, machinery, transportation equipment, vehicles

EXHIBIT 3.8: MARYLAND COMMODITY FLOWS – 2020 SUMMARY BY MODE¹³

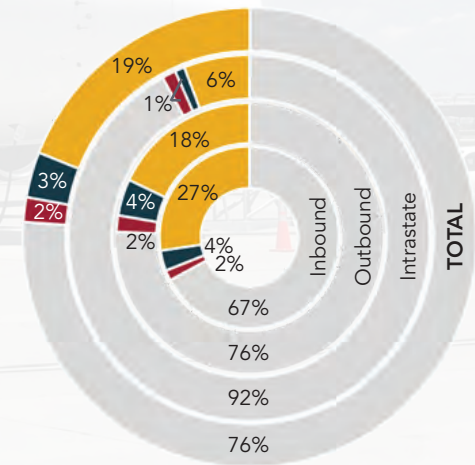
MODE	QUANTITY	TOTAL	INTRASTATE	OUTBOUND	INBOUND
Truck	kTons	217,600 (78%)	116,200 (94%)	46,600 (69%)	54,800 (61%)
	\$M	\$286,000 (76%)	\$84,100 (92%)	\$95,100 (76%)	\$106,800 (67%)
Pipeline	kTons	32,000 (11%)	5,400 (4%)	11,800 (18%)	14,800 (17%)
	\$M	\$6,600 (2%)	\$1,100 (1%)	\$2,500 (2%)	\$3,000 (2%)
Rail	kTons	21,600 (8%)	2,300 (2%)	7,000 (10%)	12,300 (14%)
	\$M	\$12,100 (3%)	\$800 (1%)	\$5,500 (4%)	\$5,800 (4%)
Water ^(a)	kTons	3,100 (1%)	---	300 (<1%)	2,800 (3%)
	\$M	\$500 (<1%)	---	\$100 (<1%)	\$400 (<1%)
Air ^(b)	kTons	60 (<1%)	---	40 (<1%)	20 (<1%)
	\$M	\$6,000 (2%)	---	\$2,800 (2%)	\$3,200 (2%)
Multiple Modes and Mail	kTons	6,400 (2%)	120 (<1%)	1,800 (3%)	4,500 (5%)
	\$M	\$64,600 (17%)	\$5,400 (6%)	\$19,600 (15%)	\$39,600 (24%)

Exhibit Notes:

- (a) Domestic water includes shallow and deep draft, Great Lakes, and intra-port shipments, but not international waterborne trade through the Port of Baltimore. Domestic (landside) moves of Port of Baltimore trade are accounted for in other modes.
- (b) 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.



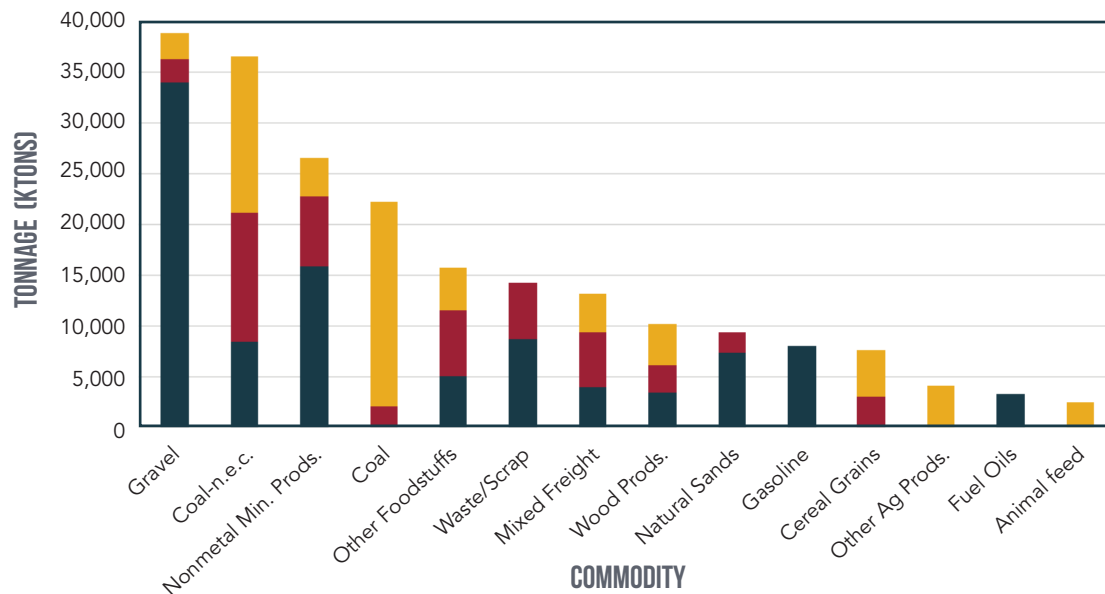
TONNAGE BY MODE



VALUE BY MODE

LEGEND: Truck Pipeline Rail Other

EXHIBIT 3.9: MARYLAND COMMODITY FLOWS – 2020 LEADING COMMODITIES BY TONNAGE¹⁴



TOP 10 RANK	INTRASTATE (WITHIN MD)	OUTBOUND (FROM MD)	INBOUND (TO MD)
1	Gravel	Coal-n.e.c. ^(a)	Coal
2	Nonmetallic Mineral Products	Nonmetallic Mineral Products	Coal-n.e.c. ^(a)
3	Waste/Scrap	Other Foodstuffs	Cereal Grains
4	Coal-n.e.c. ^(a)	Waste/Scrap	Other Ag Products
5	Gasoline	Mixed Freight	Other Foodstuffs
6	Natural Sands	Cereal Grains	Wood Products
7	Other Foodstuffs	Wood Products	Nonmetallic Mineral Products
8	Mixed Freight	Gravel	Mixed Freight
9	Wood Products	Coal	Gravel
10	Fuel Oils	Natural Sands	Animal Feed

Table Notes:

(a) Coal-n.e.c. includes other coal and petroleum products “not elsewhere classified,” such as lubricating oils, greases, LNG, propane, butane, coke, asphalt, and other commodities that are not part of a more specific commodity group.

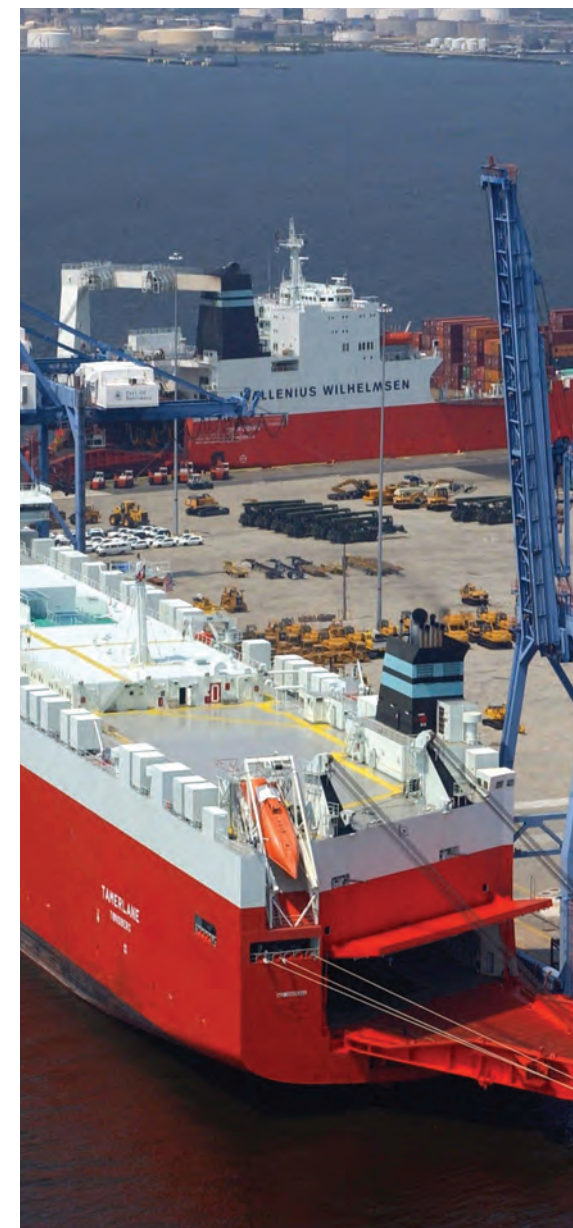
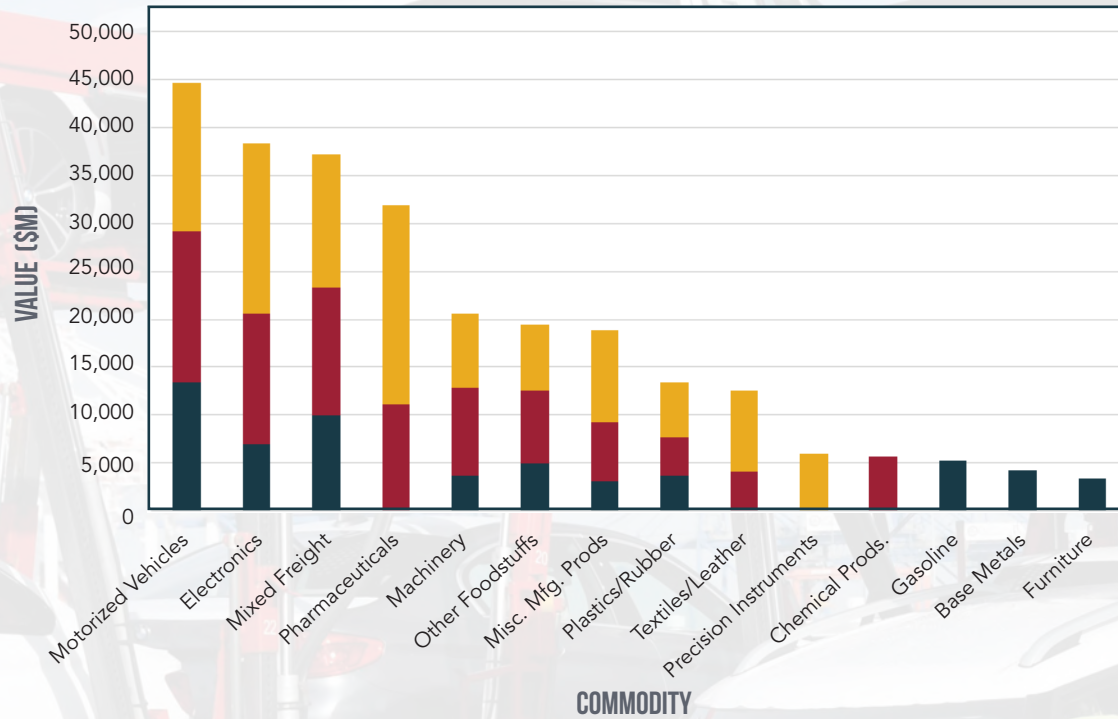


EXHIBIT 3.10: MARYLAND COMMODITY FLOWS – 2020 LEADING COMMODITIES BY VALUE ¹⁵



TOP 10 RANK	INTRASTATE (WITHIN MD)	OUTBOUND (FROM MD)	INBOUND (TO MD)
1	Motorized Vehicles	Motorized Vehicles	Pharmaceuticals
2	Mixed Freight	Electronics	Electronics
3	Electronics	Mixed Freight	Motorized Vehicles
4	Gasoline	Pharmaceuticals	Mixed Freight
5	Other Foodstuffs	Machinery	Miscellaneous Manufacturing Products
6	Base Metals	Other Foodstuffs	Textiles/Leather
7	Machinery	Miscellaneous Manufacturing Products	Machinery
8	Plastics/Rubber	Chemical Products	Other Foodstuffs
9	Furniture	Textiles/Leather	Precision Instruments
10	Miscellaneous Manufacturing Products	Plastics/Rubber	Plastics/Rubber

Freight Growth

While freight and economic demands are constantly evolving, Maryland freight projections through 2050 show increases of 53% in tonnage to almost 429 million tons, and 108% in value to almost \$781 billion (2020-2050 FAF5) (Exhibit 3.11). Notable growth trends by commodity (Exhibit 3.12) also reveal the following:

- **High tonnage growth** for gravel (+56%), coal and petroleum products (+57%), and nonmetallic mineral products (+56%);
- **High value growth** for pharmaceuticals (+220%), motorized vehicles (+134%), electronics (+89%), and miscellaneous manufacturing products (+153%);
- **Balanced growth** (in both tonnage and value) for mixed freight, plastics and rubber, and other foodstuffs;
- **Minimal growth** for cereal grains, printed products, building stone, and metallic ores; and expected declines for coal, gasoline, fuel oils, and tobacco products.

EXHIBIT 3.11: MARYLAND COMMODITY FLOWS – 2020-2050 OVERALL FREIGHT GROWTH TRENDS¹⁶

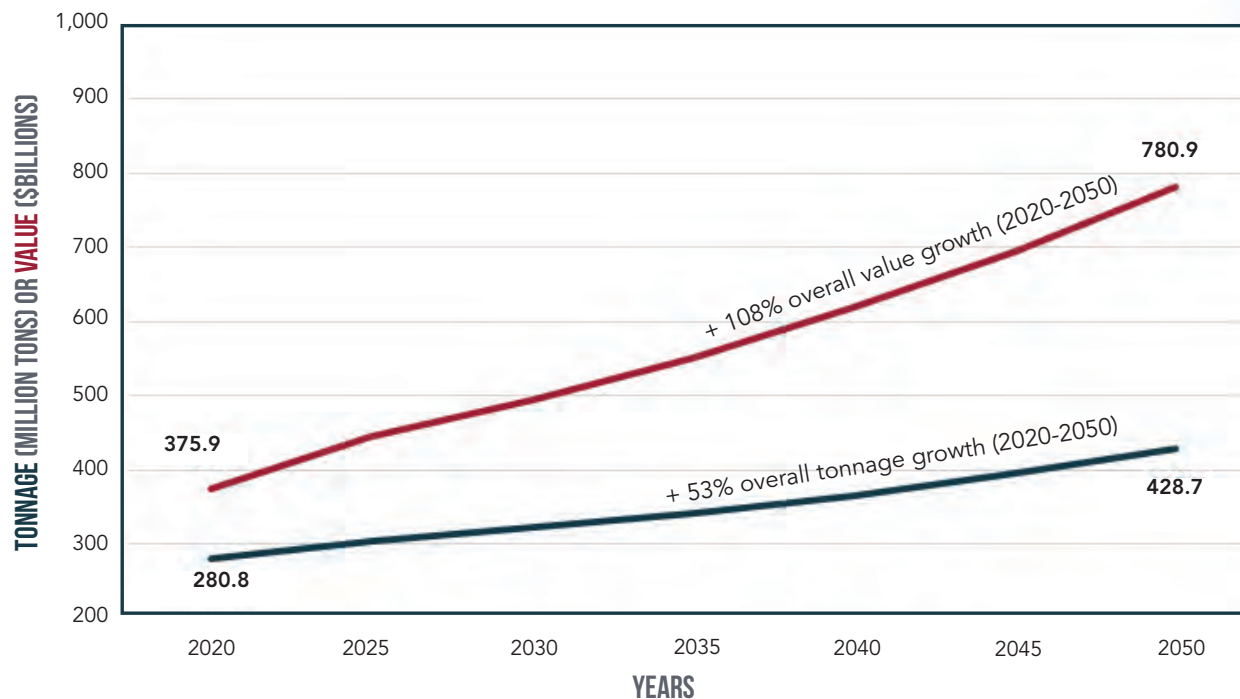
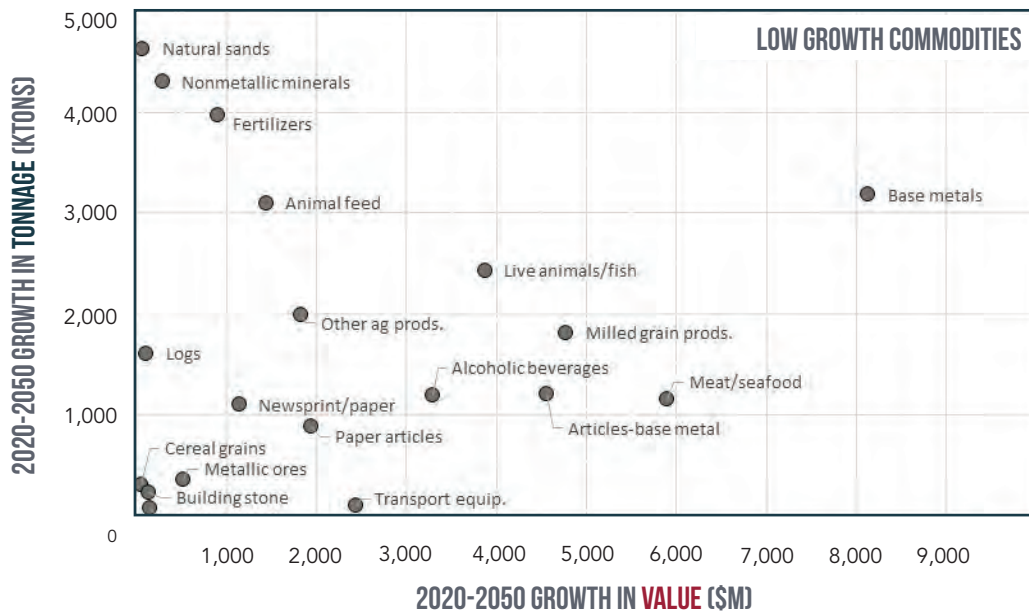
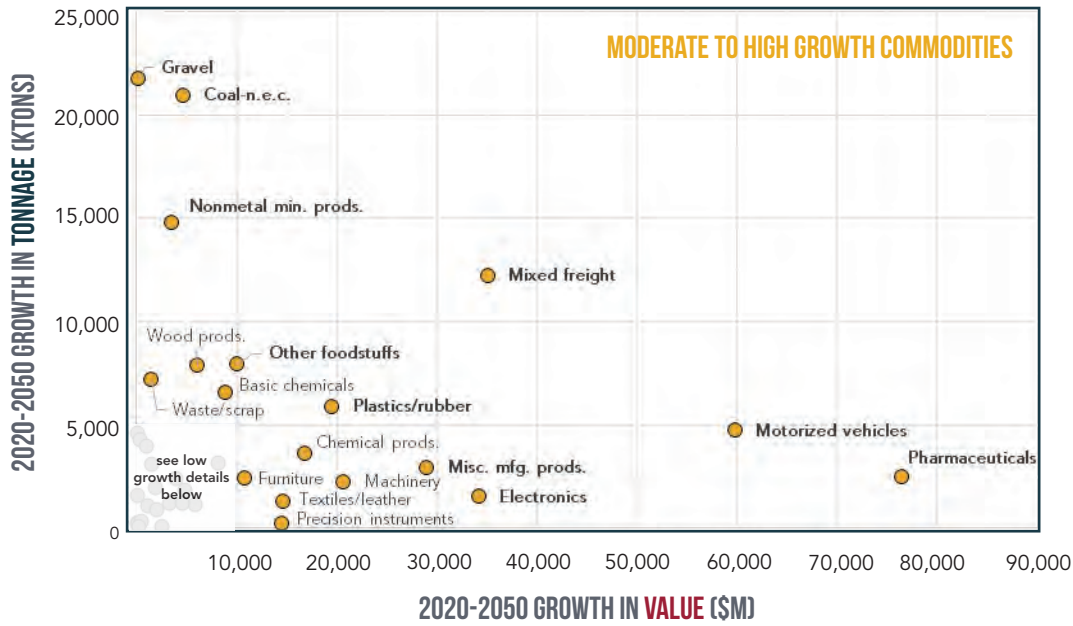


EXHIBIT 3.12: MARYLAND COMMODITY FLOWS — 2020-2050 COMMODITY-SPECIFIC FREIGHT GROWTH TRENDS¹⁷



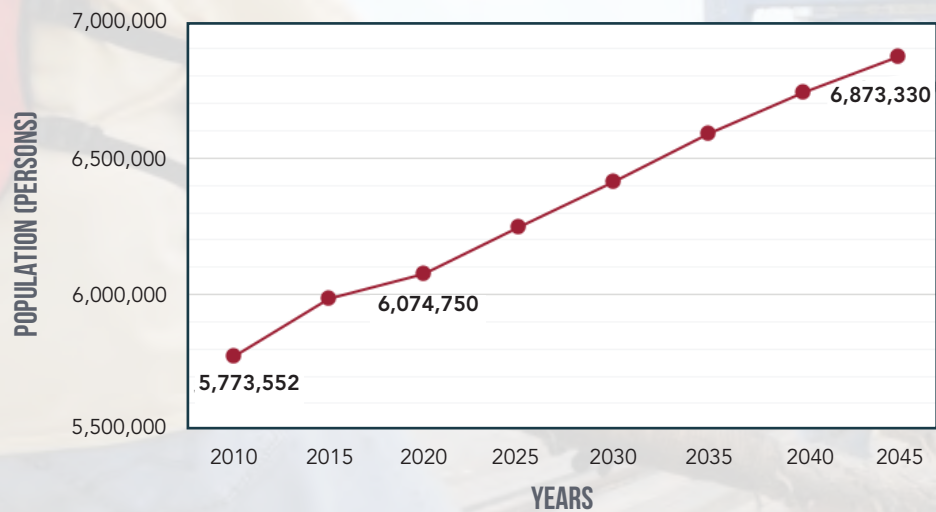
3.2 Maryland Freight Economic Influences

Goods movement is essential to a healthy Maryland economy, and potential freight economic growth (or constraint) can be directly influenced by the quality and performance of the state's multimodal freight transportation, infrastructure, and support systems. Reliable and cost-effective transportation is an integral component to ensuring capacity and efficiencies within critical supply chains that keep the state's commerce flowing. Beyond infrastructure itself, this flow of commerce influences (and is influenced by) Maryland's steadily growing population, freight-related business and employment activities, and the characteristics of key freight industry sectors. While not exhaustive, relevant influences are illustrated in the sections below.

3.2.1 POPULATION GROWTH

Maryland's population increased 7% from the 2010 to 2020 census timeframes. Any increase in population typically brings a corresponding increase in demand for products and services that influence the overall goods movement system.¹⁸ Steady population growth is expected to continue, increasing over the next 25 years by more than 13% from around 6.1 million persons in 2020 to just under 6.9 million in 2045 (**Exhibit 3.13**). The overall rate of growth is generally consistent with national averages, with Maryland consistently representing approximately 1.8% of the total U.S. population.

EXHIBIT 3.13: MARYLAND FREIGHT ECONOMIC INFLUENCES – POPULATION PROJECTIONS (2010-2045)¹⁹



3.2.2 POPULATION DENSITY

Maryland's population is characterized by exceptionally high densities, which presents both opportunities and challenges to the state's freight transportation system. As of 2020, Maryland was ranked 7th in the nation in terms of population density with 636.1 persons per square mile, versus a national average of 93.8 persons per square mile.²⁰

3.2.3 EMPLOYMENT

Freight-related industries represent a significant portion of Maryland's overall economy, including sectors such as transportation and warehousing that serve as key junctions between logistics and supply chains, acting as a catalyst for jobs in the state. Freight industries make up approximately 32% of the state's total number of business establishments, 31% of total employment, and 28% of annual payroll dollars (Exhibit 3.14)

EXHIBIT 3.14: MARYLAND FREIGHT ECONOMIC INFLUENCES – ESTABLISHMENTS, EMPLOYMENT, AND WAGES (2019)²¹

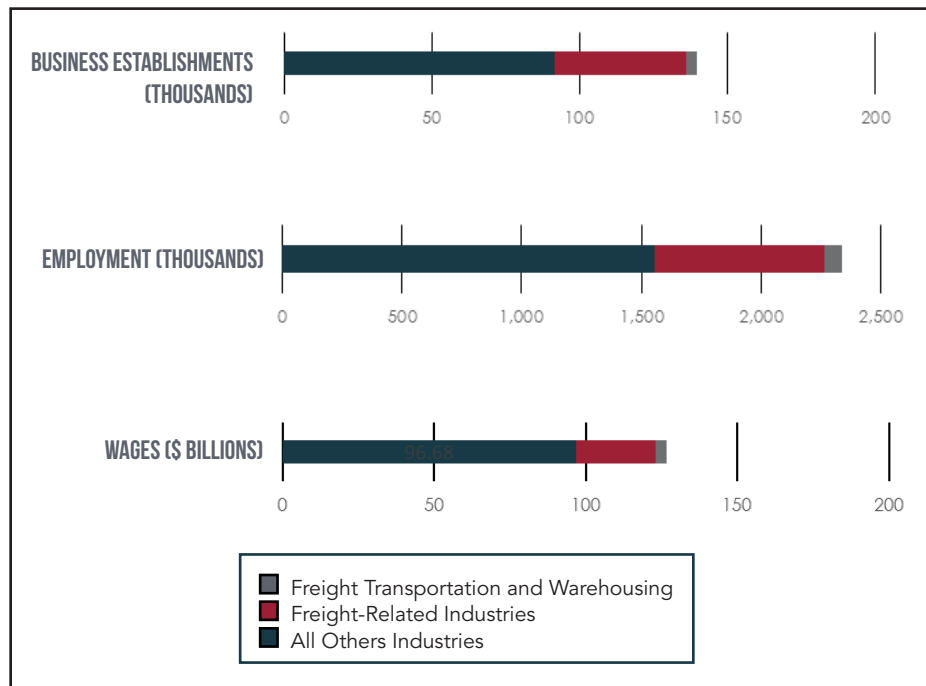


Table Notes:

(a) In the context of industry establishment data, freight-related industries for the exhibit above assumed North American Industry Classification System (NAICS) codes that encompass agriculture, forestry, fishing, and hunting (NAICS 11); mining, quarrying, and oil and gas extraction (NAICS 21); construction (NAICS 23); manufacturing (NAICS 31-33); wholesale trade (NAICS 42); retail trade (NAICS 44-45); and transportation and warehousing (NAICS 48-49).

3.2.4 STATE REVENUES

From a direct revenue perspective, commercial vehicle permit fees, fuel taxes, toll revenues, and other sales and use tax receipts from freight-generating businesses contribute more than \$4.4 billion annually to the state of Maryland (Exhibit 3.15).

EXHIBIT 3.15: MARYLAND FREIGHT ECONOMIC INFLUENCES – ANNUAL STATE REVENUES (2019)²²

Revenue Source	Estimated Revenue
Motor Carrier Fuel Tax Temporary Permit Fees	\$0.2M
Motor Carrier Fuel Tax Gross Revenue	\$5.7M
Licensing and Permits, non-Bus. Motor Carrier	\$0.4M
Toll Revenue ^(a)	\$222M
Sales and Use Tax ^(b)	\$4,177M
Total Freight Industry-Generated State Revenues	> \$4.4 Billion

Table Notes:

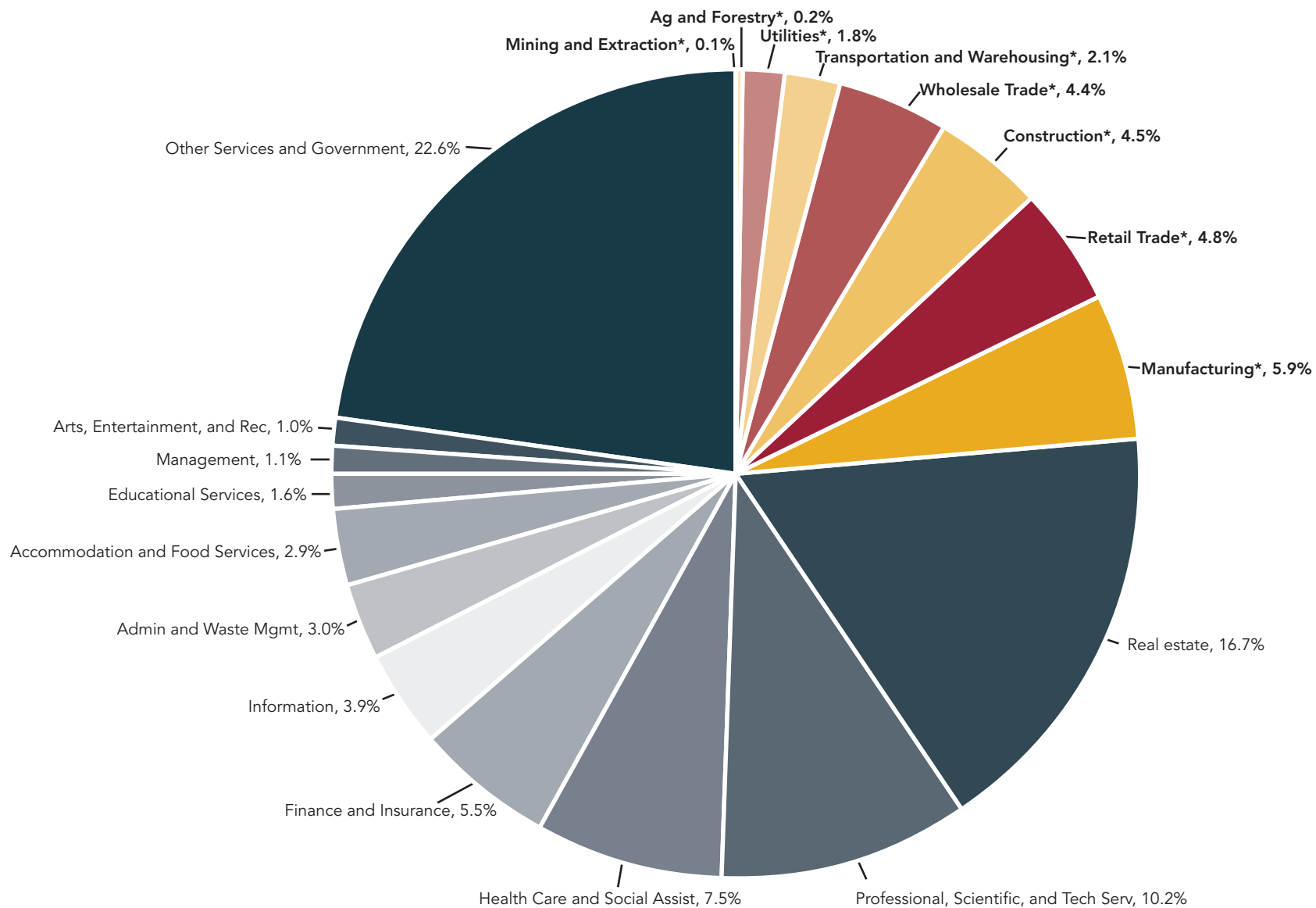
- (a) Includes Toll Revenue for Class 3, 4, 5 & 6 Vehicles only, including video tolling and accounting for commercial vehicle electronic toll collection (ETC) usage discounts.
- (b) In the context of Maryland state sales and use tax receipts, freight generating businesses for the exhibit above assumed tax categories that encompass food and beverage, apparel, general merchandise, automotive, furniture and appliances, building and contractors, utilities and transportation, and hardware machinery and equipment.

3.2.5 STATE GROSS DOMESTIC PRODUCT

The economic output of freight industry sectors accounts for almost one quarter (23.8%) of Maryland's total gross domestic product (GDP) (Exhibit 3.16). While freight intensive sectors include those most directly linked with commodity production, consumption, or related freight transportation needs, significant relationships also span other non-freight intensive sectors. For example, the freight transportation system supports deliveries and waste transport within the health care, government, and accommodation and food services sectors. Broader freight trends and developments also influence the real estate or finance and insurance sectors.



EXHIBIT 3.16: MARYLAND FREIGHT ECONOMIC INFLUENCES – INDUSTRY SECTORS AS PERCENT OF MARYLAND GDP (2019) ²³



*Exhibit Note: Freight-related industries are shown in red/yellow and bold.



3.3 Maryland Freight Industry Sector Profiles

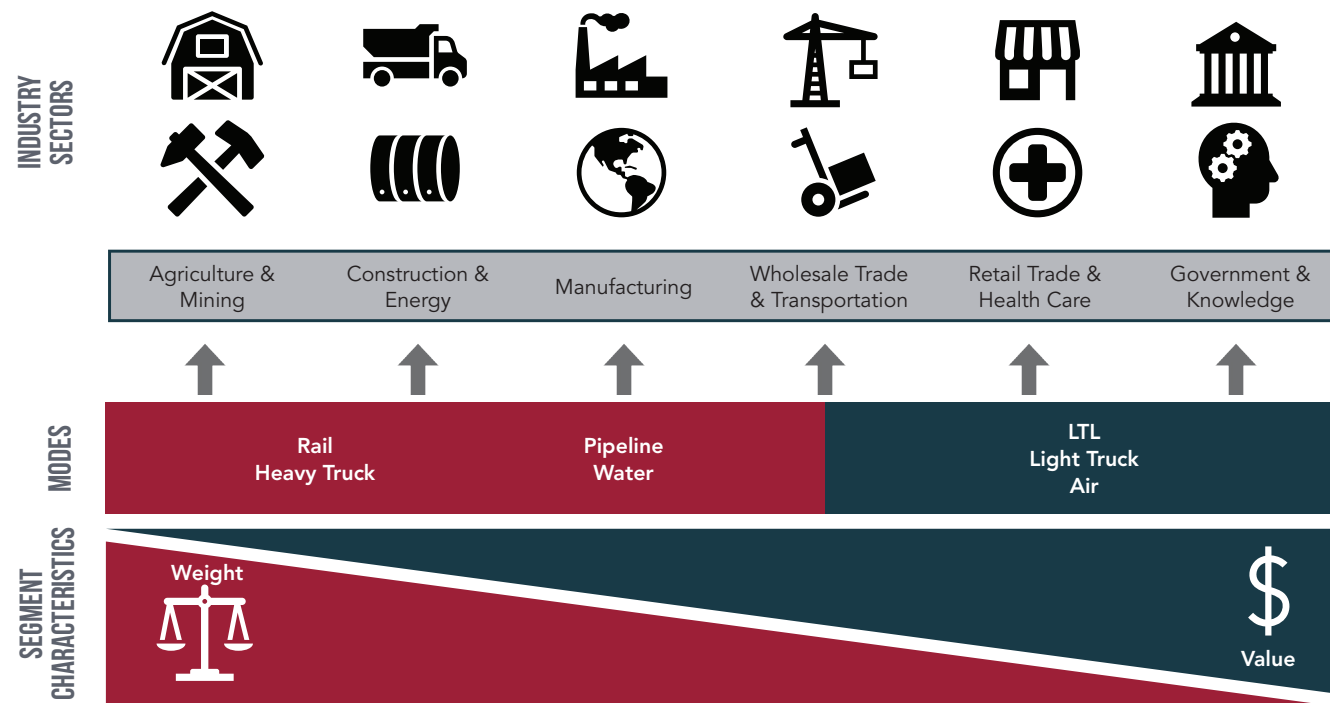
A diverse array of industry sectors makes up Maryland's economy, which calls for an equally diverse set of supply chain needs. A reliable multimodal freight transportation system is crucial to fulfilling this broad spectrum of goods movement needs (Exhibit 3.17). These needs can vary widely by sector:

- 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, truck, or in permitted oversized/overweight trucks.
- Wholesale trade and transportation industries are often engaged in the movement of both heavy and light commodities. Their supply chains may be more balanced in terms of inbound-outbound movements or weight-to-value ratios, and they rely on all modes of transportation as well as significant freight transfer between combinations of modes.

- Service industries (including retail trade, health care, and government) and knowledge industries (including professional, scientific, and technical services) may rely on more frequent deliveries of food, office supplies, instruments and equipment, or parcels. These lighter-weight, higher-value goods often move by truck, less-than-truckload (LTL), parcel shipments, or air.

To better understand the unique needs and challenges spanning industries that contribute to Maryland's freight economy, key industry sectors are profiled on the following pages. These profiles do not explain all aspects of the state's economic activity or their critical supply chains. Every industry or individual business has a unique approach to their logistics needs. However, the profiles are intended to illustrate industry-specific raw material and product movement needs, including sample commodity types and movement patterns based on available details from FHWA's FAF5 database for applicable commodity groups by two-digit SCTG codes. The profiles also summarize the freight transportation modes that are typically used within each industry sector, industry-specific trends and demands on Maryland's multimodal freight transportation system, and key needs or challenges potentially to consider during the development of a statewide freight action plan.

EXHIBIT 3.17: MARYLAND FREIGHT ECONOMIC INFLUENCES – MODES AND CHARACTERISTICS



3.3.1 AGRICULTURE

AGRICULTURE FREIGHT ACTIVITY IN MARYLAND ²⁴	
ECONOMIC IMPACTS	17,500 Jobs (2019) (16% increase since 2009)
	\$960M GDP (2019) (14% increase since 2009)
TYPICAL COMMODITIES	SCTG 01-05: Live Animals and Fish; Cereal Grains; Other Agricultural Products; Animal Feed, Eggs, Honey, and other Products of Animal Origin; Meat, Poultry, Fish, Seafood, and Their Preparations
DOMESTIC FREIGHT	2020: 25,177 kTons (9.0% MD); \$19.7 billion (5.2% MD)
	2050: 35,154 kTons (8.0% MD); \$32.8 billion (4.2% MD); Growth ~ 36% kTons; 67% value
DOMESTIC TRADE PATTERNS	50% inbound; 26% outbound; 24% intrastate (2020 tonnage-based)
	86% from: MD (31%); VA (26%); PA (12%); DE (11%); OH (6%)
	97% to: MD (47%); VA (21%); PA (16%); DE (11%); NJ (2%)
FOREIGN TRADE PATTERNS	2020 Imports: 619.6 kTons, including Agricultural Products (55%); with key trade partners in Rest of Americas (29%), Europe (19%), Canada (14%), SE Asia/Oceania (11%)
	2020 Exports: 189.5 kTons, including Animal Feed (51%) and Agricultural Products (36%); with key trade partners in Rest of Americas (33%), Canada (29%), Eastern Asia (13%), and SE Asia/Oceania (12%)

TRANSPORTATION MODES

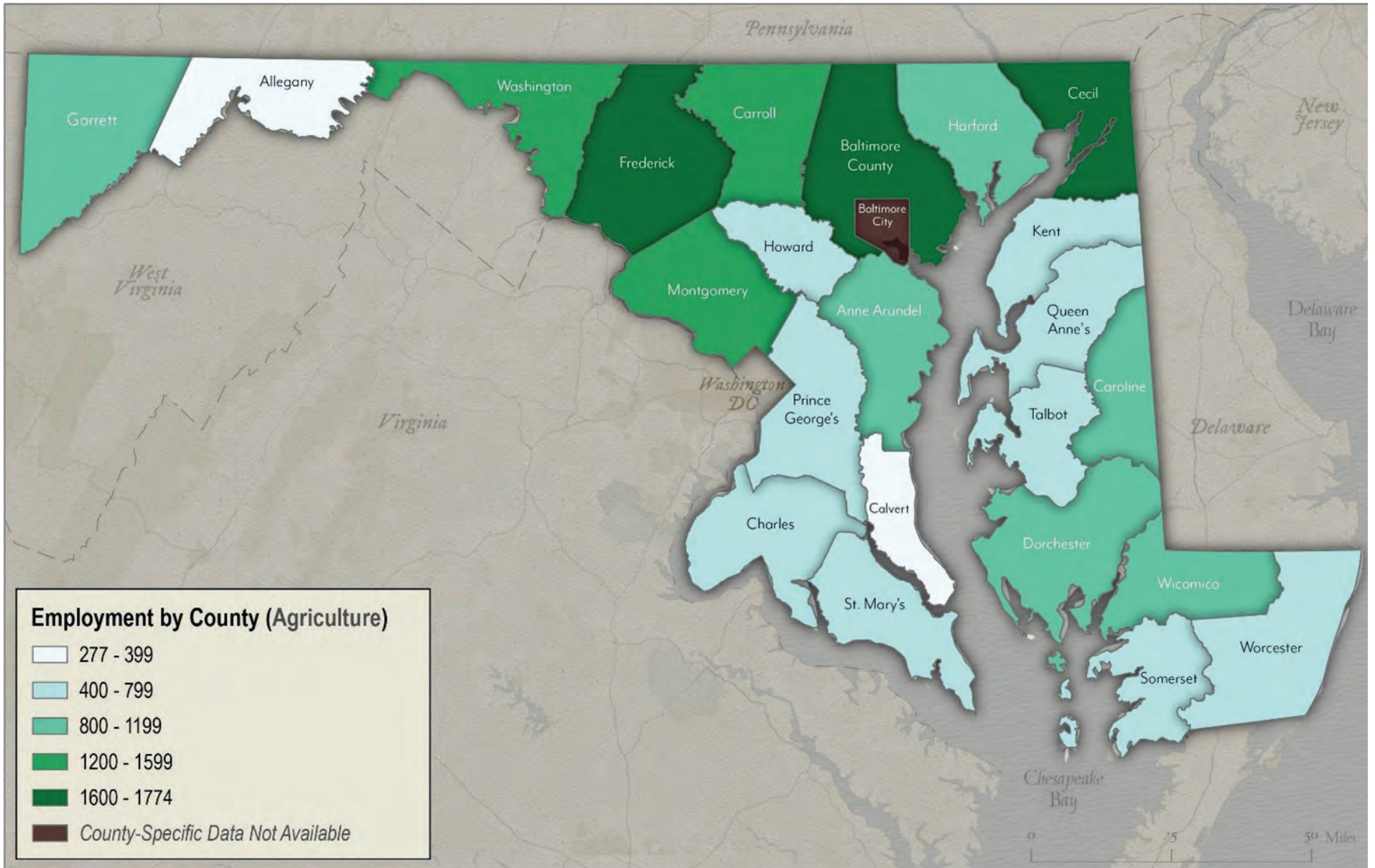
- CLASS I RAIL 
- SHORT LINE RAIL 
- BARGE 
- CONTAINER VESSELS 
- TRUCK 

The agriculture sector is vitally important to Maryland and the United States for the supply chain resources it provides as part of a much broader agribusiness industry within the state and nation. Typical commodity groups in the agriculture sector account for 9% of Maryland's total domestic freight tonnage, and just over 5% of total freight value, with demands expected to increase steadily. Maryland has more than 12,250 farms across the state and, with major producers such as Perdue Farms and McCormick, is the third largest poultry producer in the U.S. and the first in spice making in the world.²⁵

Concentrations of activity based on employees by county are shown in **Exhibit 3.18**.



EXHIBIT 3.18: MARYLAND EMPLOYMENT BY COUNTY – 2019 AGRICULTURE²⁶



Agriculture Sector Highlights

Maryland's freight transportation system carries goods related to and supporting the state's agricultural sector, including:

- **Agricultural Products:** Miscellaneous agricultural products include 8.6 million tons (2020 FAF5) of soybeans and a variety of fruits and vegetables that serve important markets related to food distribution and wholesale operations or artisanal items. These markets span the Baltimore-Washington metropolitan region, New York, New Jersey, Pennsylvania, and New England with shipments "to market" via truck. Low-to-moderate future growth is anticipated with a 34% increase in value outpacing a 23% increase in tonnage (2020-2050 FAF5).
- **Cereal Grains:** This group includes over 9.0 million tons (2020 FAF5) of grains and corn with 66% to Maryland and 34% outbound. More than 87% of inbound traffic originates from Virginia, Maryland, or Delaware. Smaller portions originate from as far as Indiana or Montana. Outbound traffic primarily goes to the surrounding states. Only minimal future growth (approximately 4%) is expected (2020-2050 FAF5).
- **Animal Feed:** This group includes more than 4.5 million tons (2020 FAF5) of feed with more than 72% moving inbound or within Maryland to serve farms across the state. Almost half (49.4%) of that demand is produced in Maryland or Delaware, likely with a significant portion shipped by truck from Maryland's Eastern Shore and the Delmarva Peninsula. Broader flows originate from Pennsylvania or the Midwest by truck or rail, and low-to-moderate future growth is anticipated, with more significant increases for inbound flows.
- **Live Animals, Fish, Meat, Poultry, and Seafood:** This group includes more than 5.8 million tons (2020 FAF5) of resources spanning livestock (e.g., chickens, dairy cows, pigs); meat and poultry products; and a vibrant fishing and aquaculture industry. With its notoriety in the poultry industry, chickens and related products are transported not just domestically by truck, but also to international markets through the Port of Baltimore, Port of Virginia (Norfolk), and the Port of New York and New Jersey.
- **Fertilizer:** This group includes 2.4 million tons (2020 FAF5) of fertilizer with more than 88% of that amount produced within Maryland and three-quarters of that production shipped locally throughout the state for direct usage by Maryland's agricultural producers. The high levels of in-state manure transportation illustrate agency-level partnerships via Maryland's Manure Transport Program that helps local agricultural producers comply with nutrient management plans. Through the program, cost-share grants are used to help move manure within a farm's operations, to other farms, or to alternative-use facilities.²⁷

- **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.
- **Ag Tourism:** Maryland promotes ag tourism and the craft beverage industry (breweries, wineries, distilleries). Sustaining these industries requires a focus on both freight and non-freight transportation networks to move farm products while also bringing people to farms.

Agriculture Sector Needs and Challenges

Important freight transportation needs and challenges for the agriculture industry include the following:






- Freight transportation networks must operate efficiently and reliably to meet demands for locally sourced fresh foods and timely arrivals to market.
- Multimodal highway, rail, and port systems are critical to serving both domestic and overseas markets, both inbound and outbound, for a variety of products from feed to fertilizer to poultry.
- Conflicts between passenger and freight rail operations often limit freight travel to late night or slow speed operations, impacting timely and efficient goods movement opportunities.
- Driver shortages and federal constraints that influence weight limit variations between states, stringent control of food product movements per the Food Safety Modernization Act (FSMA), and truck operator requirements can complicate interstate or food processing movements.
- The transportation networks that serve farmland along the shores of the Chesapeake Bay and river system may be vulnerable to sea level rise.



3.3.2 MINING

MINING FREIGHT ACTIVITY IN MARYLAND ²⁸	
ECONOMIC IMPACTS	2,900 Jobs (2019) (25% decrease since 2009)
	\$380M GDP (2019) (91% increase since 2009)
TYPICAL COMMODITIES	SCTG 10-15: Building Stone; Natural Sands; Gravel; Nonmetallic Minerals; Metallic Ores; Coal
DOMESTIC FREIGHT	2020: 78,996 kTons (28.1% MD); \$3.3 billion (0.9% MD)
	2050: 101,780 kTons (23.7% MD); \$4.0 billion (0.5% MD); Growth ~ 29% kTons; 19% value
DOMESTIC TRADE PATTERNS	33% inbound; 9% outbound; 58% intrastate (2020 tonnage-based)
	94% from: MD (86%); VA (4%); PA (4%)
	99% to: MD (87%); WV (3%); PA (3%); DE (3%); VA (3%)
FOREIGN TRADE PATTERNS	2020 Imports: 918.9 kTons, including Nonmetallic Minerals (94%) and Metallic Ores (5%); with key trade partners in Canada (71%), Europe (11%) and Mexico (9%)
	2020 Exports: 1,047.9 kTons, including Coal (47%) and Metallic Ores (40%); with key trade partners in Europe (49%), Rest of Americas (21%), Eastern Asia (16%), and Canada (12%)

TRANSPORTATION MODES

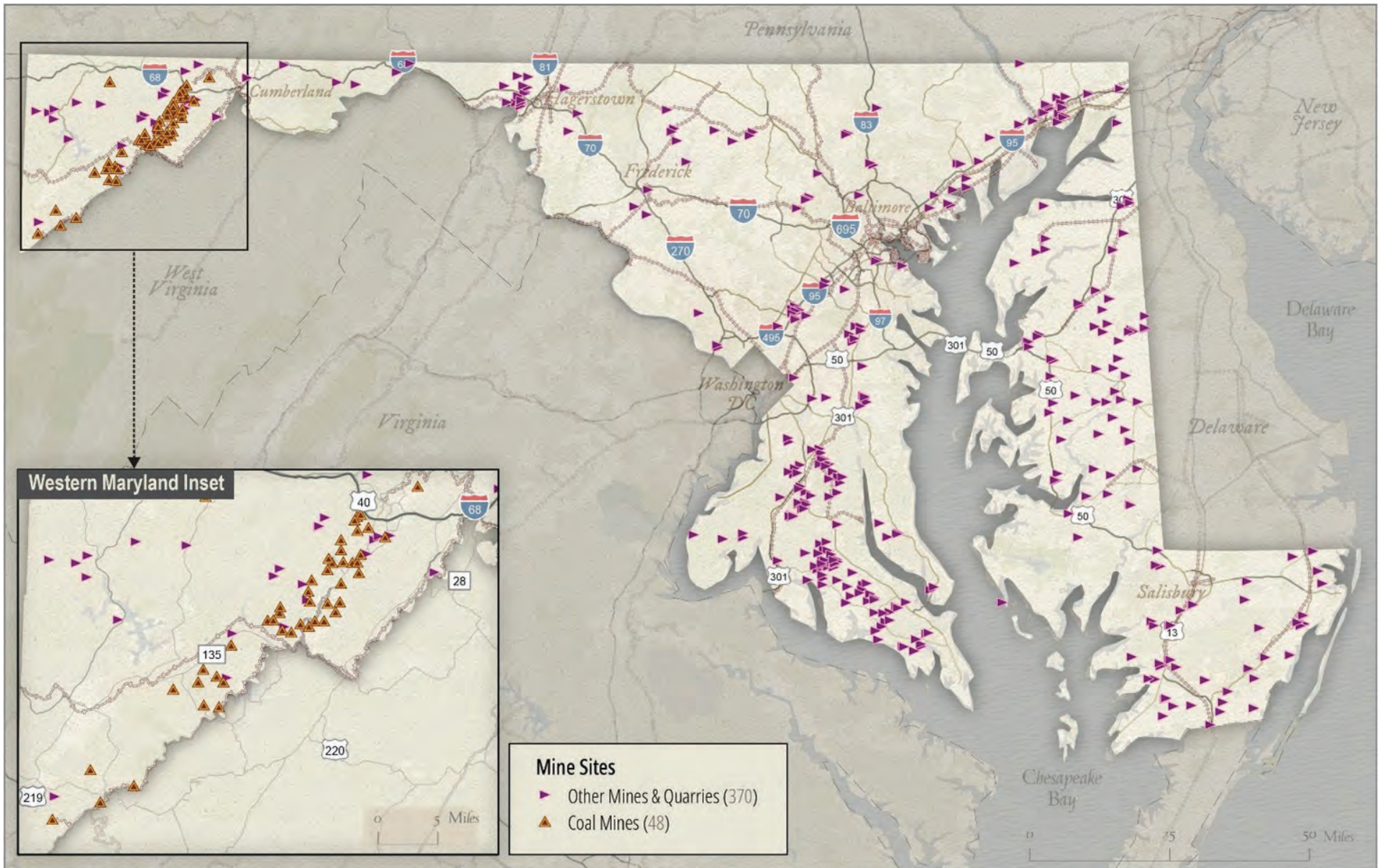
- CLASS I RAIL 
- SHORT LINE RAIL 
- BARGE 
- CONTAINER VESSELS 
- TRUCK 

Mines and quarries are an important element of Maryland’s economic history, and operations continue today with more than 300 active mines statewide. Mining locations include coal field regions in Allegany and Garrett counties in western Maryland and, as of 2020, 285 non-coal mines that are mostly located in Charles, Prince George’s, and St. Mary’s counties in southern Maryland.²⁹ While the typical mining commodity groups listed above reflect more than \$3.3 billion of materials, this reflects less than 1% of Maryland’s total freight value due to their relatively low value-to-weight ratios. However, as extremely heavyweight materials, they account for more than 28% of Maryland’s domestic tonnage.

Concentrations of activity based on the locations of coal mines, other mines, and quarries are shown in **Exhibit 3.19**.



EXHIBIT 3.19: MARYLAND MINE AND QUARRY SITES (2018-2019)³⁰



Mining Sector Highlights

Maryland's freight transportation system carries goods related to and supporting the state's mining sector, including:

- **Stone, Sand, Gravel, Nonmetallic Ores, and Metallic Ores:** These types of raw materials are used extensively for construction, industrial processes, or as ingredients to manufacture finished goods. They account for more than 56 million tons (2020 FAF5), more than 80% of which is mined/produced and consumed directly within Maryland. Gravel alone, given its extensive use in asphalt, concrete, and general road or infrastructure construction, accounts for 69% of these types of raw materials. Significant growth in tonnage is expected, but with only a limited increase in future value.
- **Coal:** In 2019, mines in Allegany and Garrett counties produced 1.68 million tons of coal, of which 816,944 tons were drawn from surface coal or strip mining, and 864,200 tons came from deep coal mining.³¹ Coal from western Maryland is transported to destinations throughout the world via truck, rail, and by water through the Port of Baltimore. Substantial coal tonnage mined in other states also passes through Maryland on its way to other destinations. Coal shipments, however, are expected to stagnate and decline in the future, including overall decreases of more than 30% for state totals and more significant declines of 73% less tonnage and 64% less value for coal that specifically originates in Maryland (2020-2050 FAF5).

Mining Sector Needs and Challenges

Important freight transportation needs and challenges for the mining industry include the following:







- Efficient multimodal access to international shipping ports will continue to be a critical component of serving coal export markets.
- Increasing competition from other fuel sources, such as Marcellus shale and renewable energy sources, could continue to decrease the use of coal and limit the need for rail shipments of coal. This could potentially affect rail demand, efficiency, and cost.
- Most quarries and mines in Maryland extract materials that serve the state's construction industry. Therefore, the mining industry is exceptionally sensitive to fluctuations in construction and infrastructure development.
- Infrastructure maintenance, especially bridges, is a priority due to the heavy weight of mined materials.



3.3.3 CONSTRUCTION AND UTILITIES

CONSTRUCTION AND UTILITIES FREIGHT ACTIVITY IN MARYLAND ³²	
ECONOMIC IMPACTS	245,500 Jobs (2019) (15% increase since 2009)
	\$19.1B GDP (2019) (36% increase since 2009)
TYPICAL COMMODITIES	SCTG 11; 12; 26; 31; 41: Natural Sands; Gravel; Wood Products; Nonmetal Minerals Products; Waste/Scrap
DOMESTIC FREIGHT	2020: 101,431 kTons (36.1% MD); \$15.9 billion (4.2% MD)
	2050: 157,635 kTons (36.8% MD); \$27.3 billion (3.5% MD); Growth ~ 55% kTons; 72% value
DOMESTIC TRADE PATTERNS	12% inbound; 19% outbound; 69% intrastate (2020 tonnage-based)
	94% from: MD (86%); VA (6%); PA (2%)
	93% to: MD (79%); VA (7%); PA (5%); DE (3%)
FOREIGN TRADE PATTERNS	2020 Imports: 1,893.6 kTons, including Wood Products (87%); with key trade partners in Canada (46%), Rest of Americas (23%) and Europe (21%)
	2020 Exports: 1,297.2 kTons, including Waste/Scrap (90%); with key trade partners in Southwest and Central Asia (51%), Canada (14%), and Eastern Asia (13%)

TRANSPORTATION MODES

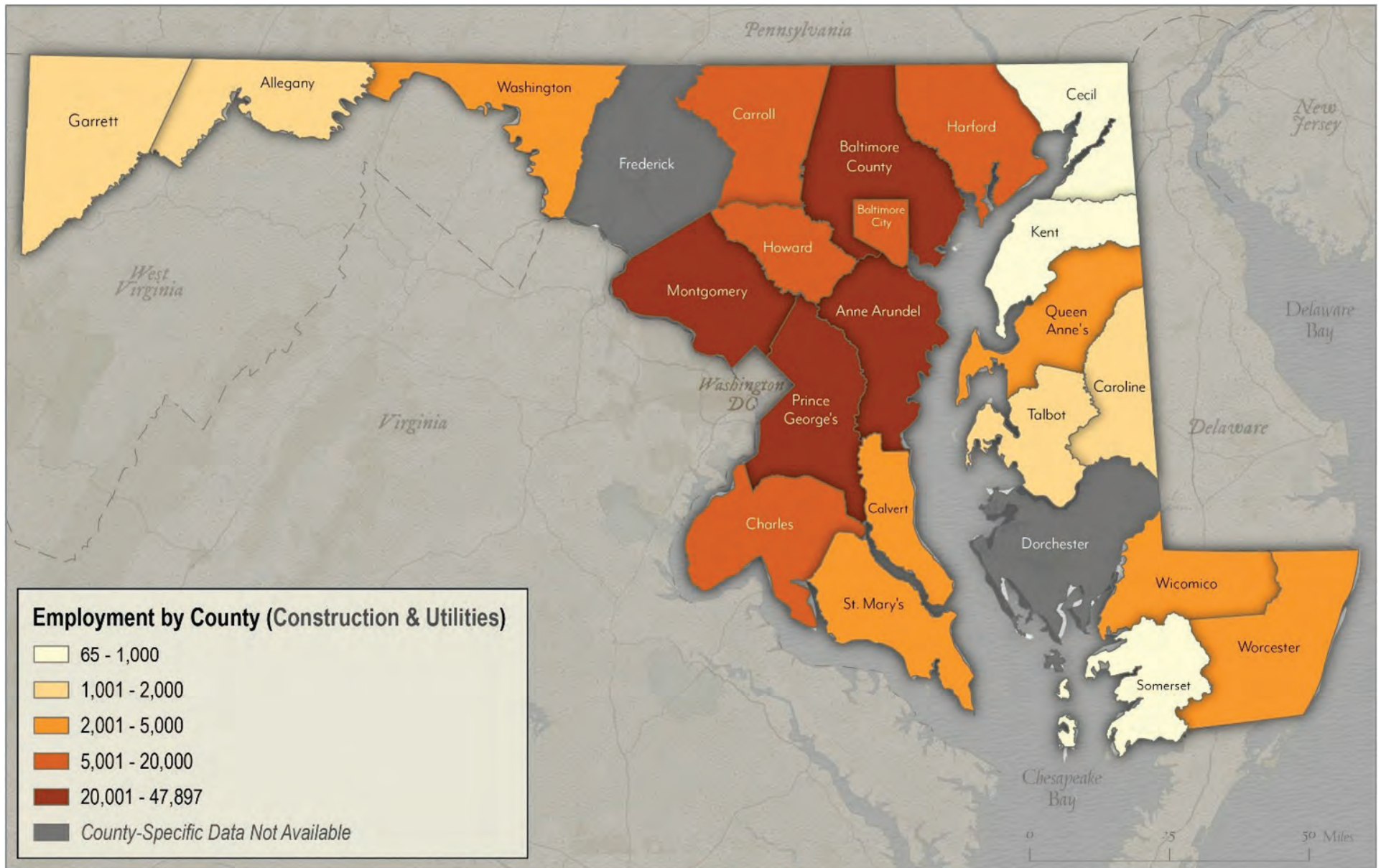
- CLASS I RAIL 
- SHORT LINE RAIL 
- BARGE 
- TANKER VESSELS 
- TRUCK 
- PIPELINE 

The construction and utilities sector is directly influenced by the type and pace of infrastructure and residential, commercial, or industrial development throughout Maryland. Typical commodity groups in the construction sector overlap materials that may be captured in other sectors (e.g., raw materials such as sand or gravel), plus miscellaneous building products (e.g., wood, stone, or block) and waste or scrap elements. This collective sample accounts for just over 36% of Maryland’s total domestic freight tonnage, and approximately 4% of total freight value. Demand through 2050 is expected to increase steadily; though, as noted previously, the pace of growth will be directly tied to broader development activities and related factors.

Concentrations of activity based on construction and utilities sector employees by county are shown in **Exhibit 3.20**.



EXHIBIT 3.20: MARYLAND EMPLOYMENT BY COUNTY – 2019 CONSTRUCTION AND UTILITIES³³



Construction Sector Highlights

Maryland's freight transportation system carries goods related to and supporting the state's construction and utilities sector, including:

- **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/ship transfers. Shipments both from within and from outside of Maryland are projected to grow moderately in both weight and value. Final delivery to sites throughout Maryland for both intra- and interstate shipments occurs on local truck routes and roads throughout the state.
- **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. Primary destinations include movements within Maryland plus external destinations in Virginia, Pennsylvania, the Carolinas, and New Jersey. Significant increases are expected for waste/scrap within Maryland, as well as export shipments of waste/scrap through Maryland.

Construction Sector Needs and Challenges

Important freight transportation needs and challenges for the construction industry include the following:

- New construction is needed to keep up with growing demand for residential and commercial development. Thus, there will be ongoing freight needs for this sector.
- With substantial freight movements via truck to construction and development sites throughout Maryland – including shipments of heavy raw materials, bulk or oversize loads, and large machinery – highway and bridge maintenance and congestion management are critical for timely and efficient construction freight deliveries.
- Conflicts between passenger and freight rail operations often limit freight travel to late night or slow speed operations, impacting timely and efficient goods movement opportunities.
- Energy development and/or production activities may generate more construction activity, including increases in specialty, oversize, or overweight material delivery needs and challenges.



3.3.4 ENERGY

ENERGY FREIGHT ACTIVITY IN MARYLAND ³⁴

ECONOMIC IMPACTS	10,300 Jobs (2019) (3% decrease since 2009)
	\$7.7B GDP (2019) (35% increase since 2009)
TYPICAL COMMODITIES	SCTG 15; 17-19: Coal; Gasoline; Fuel Oils; Other Coal and Petroleum Products
DOMESTIC FREIGHT	2020: 74,401 kTons (26.5% MD); \$18.9 billion (5.0% MD)
	2050: 83,221 kTons (19.4% MD); \$20.6 billion (2.6% MD); Growth ~ 12% kTons; 9% value
DOMESTIC TRADE PATTERNS	52% inbound; 20% outbound; 28% intrastate (2020 tonnage-based)
	92% from: MD (50%); PA (30%); VA (10%); WV (3%)
	98% to: MD (58%); VA (35%); WV (5%)
FOREIGN TRADE PATTERNS	2020 Imports: 204.8 kTons, including Fuel Oils (81%); with key trade partners in Rest of Americas (58%) and Canada (31%)
	2020 Exports: 617.1 kTons, including Coal (80%) and Fuel Oils (19%); with key trade partners in Rest of Americas (49%), Eastern Asia (25%), and Europe (21%)



TRANSPORTATION MODES

- CLASS I RAIL 
- SHORT LINE RAIL 
- BARGE 
- TANKER VESSELS 
- TRUCK 
- PIPELINE 

While Maryland ranks among the 10 lowest states in the U.S. in per capita energy consumption, it also consumes more than five times as much energy as it produces.³⁵ The energy industry in Maryland encompasses power generation; distribution networks for natural gas, oil, and electricity; and renewable energy sources including hydropower, solar, wind, and biomass. Typical commodity groups may include coal, gasoline, fuel oils, and other coal and petroleum products (captured by SCTG 19 or coal-n.e.c. [not elsewhere classified], which includes liquefied natural gas, propane, and coke). Such materials comprise more than 26% of Maryland's total domestic freight tonnage, but only 5% of total freight value. Changes through 2050 show significant tonnage growth specifically in the coal and petroleum products category (coal-n.e.c.), but overall growth for the group of typical commodities listed above is otherwise offset by notable declines in coal, gasoline, and fuel oils. Such declines are likely based on anticipated shifts in future energy sources, such as switchovers from coal to gas-fired power plants, expanded use of electric or fuel-efficient vehicle technologies, or other increased reliance on alternative energy sources.

Potential concentrations of energy activities overlap the illustration of construction and utilities sector employees by county shown previously in **Exhibit 3.20**.

Energy Sector Highlights

Maryland's freight transportation system carries goods related to and supporting the state's energy sector, including:

- **Petroleum:** Petroleum products arrive in Maryland by pipeline from other states and by ship through the Port of Baltimore; no production occurs in-state. Almost 90% of petroleum in Maryland is consumed by the transportation sector, while the remainder consists of fuel oil, propane, and kerosene for heating about 1 in 9 households in the state.³⁶
- **Natural Gas:** Most of Maryland's natural gas needs are supplied by pipelines from the Gulf Coast, Southwest, and (with increasing shale gas production) Pennsylvania.³⁷ Liquefied natural gas (LNG) imports and exports also funnel through the Cove Point LNG terminal in Lusby, MD.
- **Coal:** Coal mines in western Maryland produced approximately 1.68 million tons of coal in 2019.³⁸ However, almost three-fourths of the domestic coal consumed in Maryland's coal-fired power plants arrives by rail and river from Pennsylvania, with the rest predominately by rail from West Virginia, and a small amount from as far away as Colorado.³⁹ Additionally, in 2019, the Port of Baltimore was the nation's second-largest coal-exporting port after Norfolk, VA, with slightly more than one-fifth of U.S. coal exports leaving through its terminals.
- **Electricity:** Nuclear and natural gas-fired power plants supplied about 75% of Maryland's electricity generation in 2019, while coal's share dropped to only 14% as natural gas-fired generation increased.⁴⁰ As of mid-2021, only six conventional steam coal generators remained in Maryland, with two of those slated for retirement by mid-2022.⁴¹
- **Renewable Energy:** Maryland increased its Renewable Portfolio Standard in 2019 to require that 50% of the state's electricity sales be generated from renewable sources by 2030, compared to about 11% from renewables in 2019. Renewable electricity generation sources included half from hydropower, one-third from solar, more than one-tenth from wind energy, and almost one-tenth from biomass. Two major offshore wind projects off the Atlantic coastline were approved with conditions in 2017, and additional (Round 2) projects were submitted for review in mid-2021.⁴²

Energy Sector Needs and Challenges

Important freight transportation needs and challenges for the energy industry include the following:

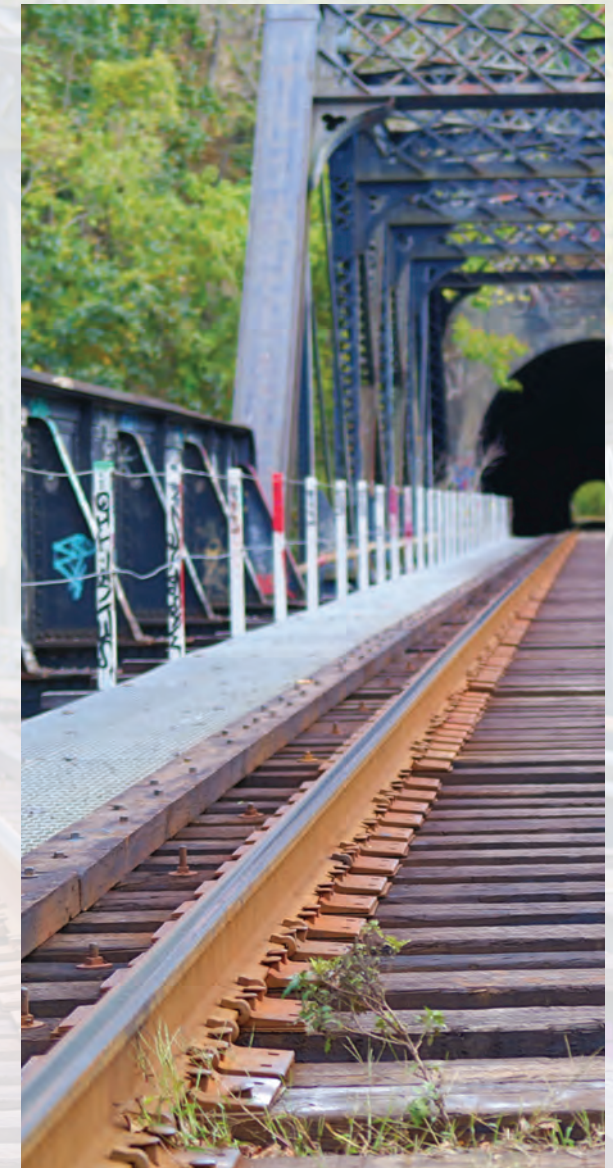
- Increased reliance on renewable sources could decrease the use of fossil fuels, limiting the need for rail shipments of coal and oil. This may affect rail demand, efficiency, and cost.
- Growing demand for renewable energy resources may create an increase in specialized freight shipments, including wind turbine blades, solar cells, or plant retrofit equipment. Such components may require oversize/overweight permitting, special hauling considerations, or other details that may introduce challenges or complications to logistics chains or permitting processes.
- The increasing demand for energy consumption leads to the need for more production facilities, which generates more construction.
- Transportation networks that serve energy production facilities along the shores of the Chesapeake Bay and river system may be vulnerable to sea level change.



3.3.5 MANUFACTURING

MANUFACTURING FREIGHT ACTIVITY IN MARYLAND ⁴³

ECONOMIC IMPACTS	122,900 Jobs (2019) (3% decrease since 2009)
	\$24.9B GDP (2019) (32% increase since 2009)
TYPICAL COMMODITIES	SCTG 20; 23; 32-34; 38; 40: Basic Chemicals; Chemical Products; Base Metals; Articles of Base Metals; Machinery; Precision Instruments; Miscellaneous Manufactured Products
DOMESTIC FREIGHT	2020: 17,252 kTons (6.1% MD); \$86.2 billion (22.9% MD)
	2050: 37,089 kTons (8.7% MD); \$188.7 billion (24.2% MD); Growth ~ 115% kTons; 119% value
DOMESTIC TRADE PATTERNS	36% inbound; 35% outbound; 29% intrastate (2020 tonnage-based)
	74% from: MD (37%); PA (16%); VA (6%); OH (5%); NJ (4%); IA (4%); CA (3%)
	80% to: MD (42%); PA (16%); VA (10%); NJ (4%); IL (3%); DE (3%); OH (3%)
FOREIGN TRADE PATTERNS	2020 Imports: 2,171.8 kTons, including Base Metals (50%), Machinery (14%), and Basic Chemicals (12%); with key trade partners in Eastern Asia (21%), Europe (17%), Southwest and Central Asia (15%), Southeast Asia/Oceania (15%), and Canada (15%)
	2020 Exports: 415.5 kTons, including Chemical Products (31%), Base Metals (24%), and Basic Chemicals (21%); with key trade partners in Canada (36%), Eastern Asia (19%), and Europe (15%)



TRANSPORTATION MODES

CLASS I RAIL
SHORT LINE RAIL



CONTAINER VESSELS
RORO VESSELS



TRUCK



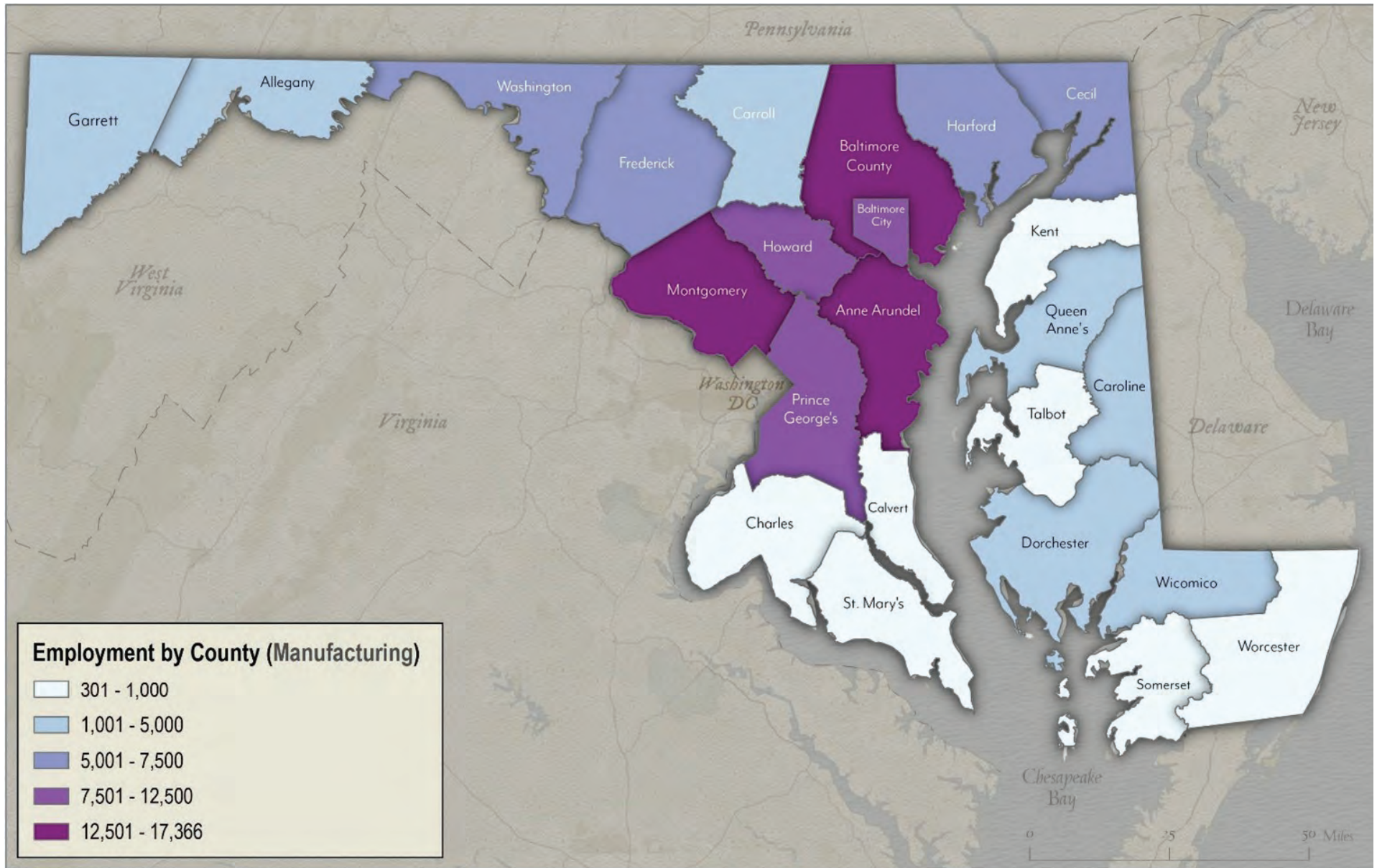
AIR



The manufacturing sector in Maryland reflects diverse elements ranging from traditional manufacturing (e.g., plastics, paper mills, or engine construction) to technology manufacturing (e.g., search, detection, and navigation instruments). Maryland has 4,000 manufacturing companies across the state, and the University of Maryland ranks 14th in the nation in undergraduate supply chain management/ logistics.⁴⁴ Sample commodity groups in the manufacturing sector account for just more than 6% of Maryland's total domestic freight tonnage, but almost 23% of total freight value.

Concentrations of activity based on manufacturing employees by county are reflected in Exhibit 3.21.

EXHIBIT 3. 21: MARYLAND EMPLOYMENT BY COUNTY – 2019 MANUFACTURING ⁴⁵



Manufacturing Sector Highlights

Maryland's freight transportation system carries goods related to and supporting the state's manufacturing sector, including:

- **Basic Chemicals, Chemical Products, and Base Metals:** Beyond Maryland sources (40%), the raw materials used in manufacturing processes arrive from Pennsylvania (19%), Iowa (5%), Virginia (5%), and a wide variety of other locations nationwide. These goods move on trucks, Class I rail, and short line rail. Shipments are expected to grow substantially through 2050 as manufacturing demand continues. On a percentage basis for tonnage alone, this growth anticipates upwards of a 180% increase in basic chemicals, 127% in chemical products, and 71% in base metals (2020-2050 FAF5).
- **Finished Goods:** Manufacturing outputs include a variety of goods used by other manufacturing facilities, businesses, and consumers. Finished goods range from metal products, to tools and machinery, to precision instruments. They may be transported by truck, Class I rail, and short line rail directly to the end user or to distribution centers. Precision instruments may also ship to international markets via air. Larger finished goods, such as machinery, may ship to domestic locations or abroad via rail and Roll-on/Roll-off (RoRo) cargo vessels. Shipments of machinery and precision instruments alone are expected to increase substantially by approximately 100% to 136% by weight or value through 2050 (2020-2050 FAF5).
- **Expanding Opportunities:** Existing and projected activities within Maryland create a unique environment in which manufacturing activities can continue to expand. For example, the Port of Baltimore ranks first in the nation in handling cars and trucks, and in RoRo cargo.⁴⁶ Additionally, as an outgrowth of energy-related opportunities in the offshore wind markets, Tradepoint Atlantic has partnered to develop Sparrows Point Steel as a new manufacturing facility that will produce the structural pilings, or monopiles, needed for wind turbine foundations.⁴⁷ Maryland advantages in terms of transportation access, logistics, and a tech-savvy workforce have also been noted as contributing factors for expansion opportunities, including the recent decision to locate a \$70 million Hitachi Rail manufacturing facility in Hagerstown, Washington County.⁴⁸

Manufacturing Sector Needs and Challenges

Important freight transportation needs and challenges for the manufacturing industry include the following:







- Truck travel times and reliability are important components of just-in-time deliveries that serve manufacturing operations. Congestion, incidents, or weather can severely hamper efficient goods movement. Therefore, overall improvements to the highway system, including infrastructure conditions, operations efficiencies, truck parking opportunities, incident management, supporting technologies, or related elements, may be exceptionally important to this industry sector and many others that rely heavily on time-sensitive truck deliveries.
- Manufacturing processes often rely on the transportation of heavyweight or hazardous material products, which increases potential needs, challenges, and permitting requirements for specialty, oversize, or overweight material deliveries.
- Bridge infrastructure conditions are critical components to the transportation of heavyweight or hazardous material products related to many manufacturing processes. The movement of hazardous materials, specifically, can conflict with community safety/security concerns.
- Truck driver shortages can significantly impact manufacturing-related supply chains, deliveries, and related deadlines or costs nationwide.
- Qualified freight and logistics support staff are needed by manufacturers to plan for efficient transportation specific to their individual businesses and supply chains. This need is particularly acute in light of truck driver shortages, as well as major supply chain disruptions, such as those caused by the COVID-19 pandemic or by major weather events and emergencies.
- Multimodal connectivity and effective planning, routing, and/or permitting will continue to be critical aspects of manufacturing-related transportation. This is particularly relevant considering the growth in specialized cargo related to other industries, such as wind turbine blades or other potential oversize/overweight goods.

3.3.6 WHOLESALE TRADE, TRANSPORTATION AND WAREHOUSING, AND RETAIL TRADE

WHOLESALE TRADE, TRANSPORTATION AND WAREHOUSING, AND RETAIL TRADE FREIGHT ACTIVITY IN MARYLAND ⁴⁹	
ECONOMIC IMPACTS	609,700 Jobs (2019) (17% increase since 2009)
	\$48.4B GDP (2019) (41% increase since 2009)
TYPICAL COMMODITIES	SCTG 06-09; 24; 27-30; 35-37; 39; 43: Milled Grain Products; Other Prepared Foodstuffs; Alcoholic Beverages; Tobacco Products; Plastics/Rubber; Newsprint/Paper; Paper Articles; Printed Products; Textiles/Leather; Electronics; Motorized Vehicles; Transportation Equipment; Furniture; Mixed Freight
DOMESTIC FREIGHT	2020: 49,804 kTons (17.7% MD); \$199.0 billion (52.9% MD) 2050: 90,888 kTons (21.2% MD); \$396.8 billion (50.8% MD); Growth ~ 82% kTons; 99% value
DOMESTIC TRADE PATTERNS	34% inbound; 36% outbound; 30% intrastate (2020 tonnage-based)
	76% from: MD (44%); PA (14%); VA (9%); NJ (7%); CA (3%)
	79% to: MD (43%); VA (18%); PA (8%); DC (4%); NJ (3%); NY (3%)
FOREIGN TRADE PATTERNS	2020 Imports: 3,171.3 kTons, including Newsprint/Paper (24%), Motorized Vehicles (23%), and Other Foodstuffs (22%); with key trade partners in Europe (43%), Eastern Asia (17%), and Rest of Americas (17%)
	2020 Exports: 578.1 kTons, including Motorized Vehicles (21%), Other Foodstuffs (19%), and Newsprint/ Paper (16%); with key trade partners in Canada (40%), Africa (16%), and Europe (11%)



TRANSPORTATION MODES

- CLASS I RAIL 
- SHORT LINE RAIL 
- CONTAINER VESSELS 
- RORO VESSELS 
- TRUCK 
- AIR 

Though they represent distinctly separate industries, the wholesale trade, transportation and warehousing, and retail trade sectors together encompass a broad array of resources, products, and interrelated supply chain interests. These interests include materials for manufacturing processes, the output of those processes, and all manner of products from foodstuffs to manufactured goods to paper and publishing materials. Their supply chains cover wholesale markets and warehousing/distribution activities, retail goods to stock in-store shelves, and e-commerce deliveries directly to consumers.

Materials and products in these sectors contribute significantly to Maryland's economy, with typical commodity groups comprising more than 17% of Maryland's total domestic freight tonnage, but almost 53% of total freight value. Demands are expected to increase steadily with growth of 82% in tonnage and almost a doubling in value through 2050 (2020-2050 FAF5).

Concentrations of activity based on employment by county are shown in **Exhibit 3.22** and **Exhibit 3.23**.

EXHIBIT 3.22: MARYLAND EMPLOYMENT BY COUNTY – 2019 WHOLESALE TRADE AND TRANSPORTATION⁵⁰

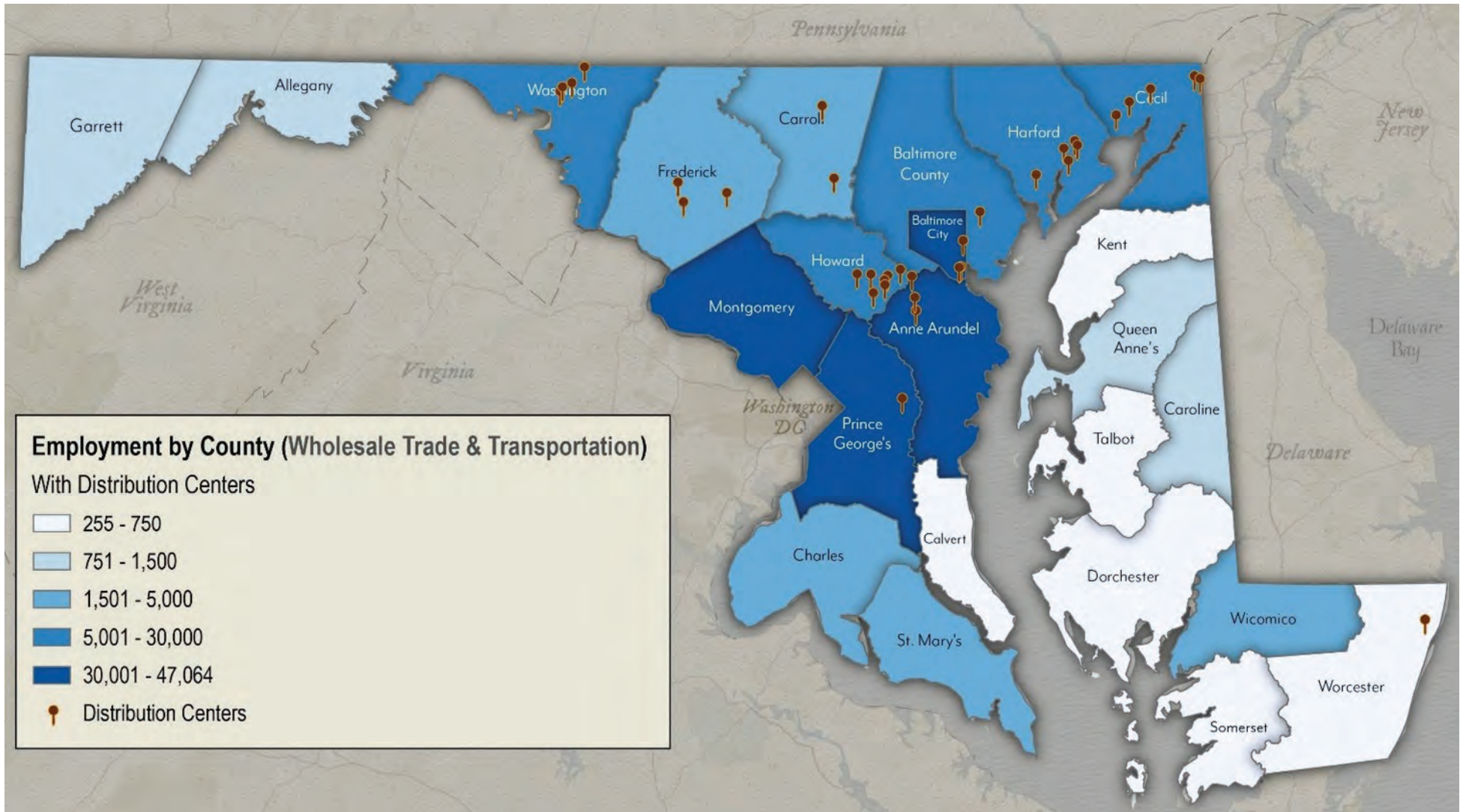
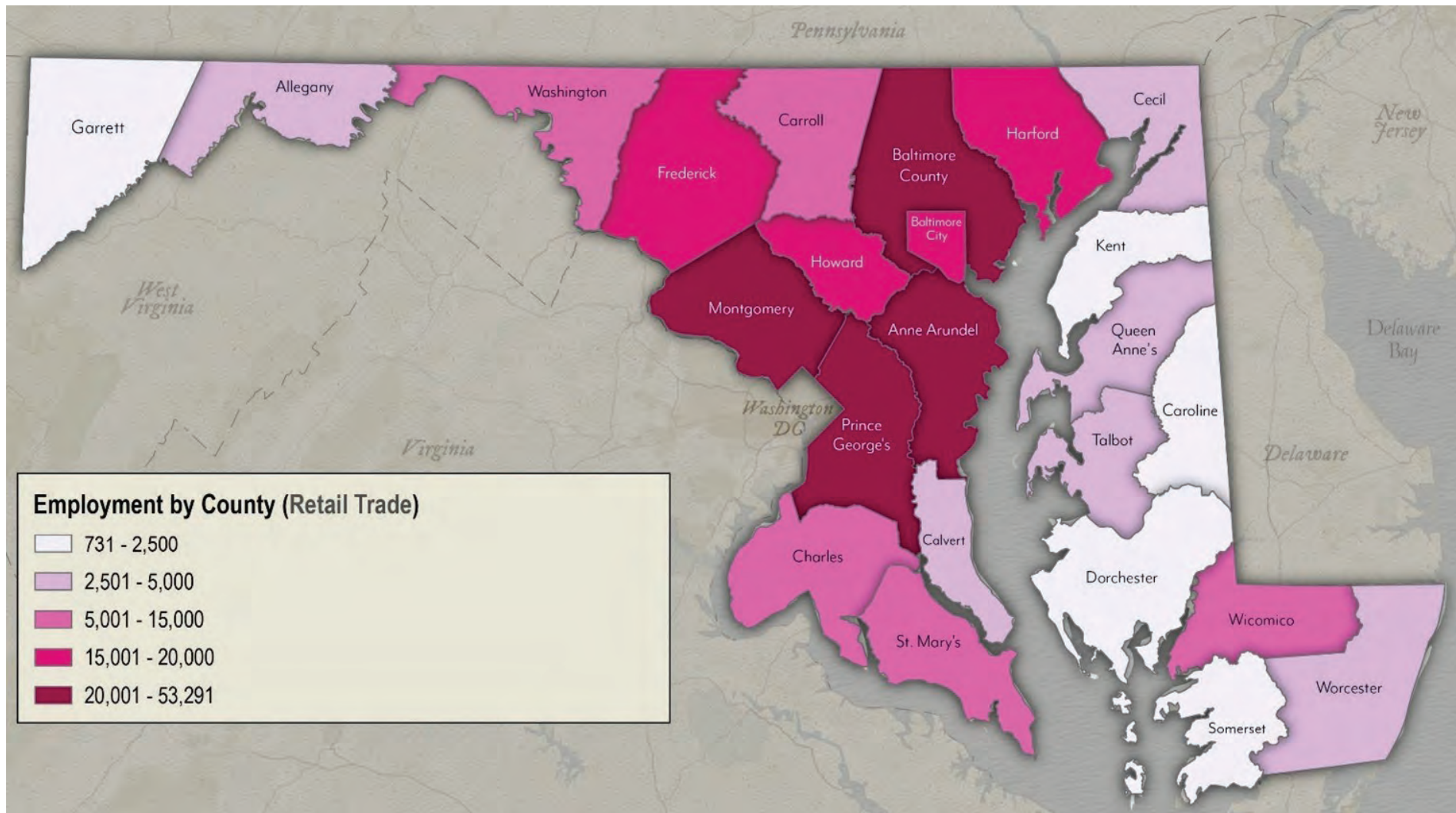


EXHIBIT 3.23: MARYLAND EMPLOYMENT BY COUNTY – 2019 RETAIL TRADE⁵¹

Wholesale/Retail Sector Highlights

Maryland's wholesale trade, transportation and warehousing, and retail trade sector activity is influenced by the following trends:

- **Distribution and Logistics Growth:** Relative to geographic location, logistics workforce concentration, available transportation infrastructure, and the overall business and development climate, Maryland continues to see notable growth and expansion of major distribution and warehousing activities, including the following⁵² in 2020 alone:
 - Kroger (the nation's largest grocery retailer) and Ocado (one of the world's largest online grocery retailers) partnered to construct a high-tech robotic fulfillment center in Frederick County.⁵³
 - Pompeian Olive Oil expanded by 400,000 square feet at the Tradeport Atlantic Industrial Park in Baltimore.
 - McCormick constructed a 1.8 million square foot distribution center (its largest site in the world) at Tradeport Atlantic.
 - Amazon added a second distribution center (its fourth in Maryland) at Tradeport Atlantic.
 - FedEx, Restoration Hardware, Lidl and Smithfield Foods, and numerous logistics companies experienced growth.
- **Multimodal Import/Export Connections:** Import and export goods move through Maryland by way of numerous multimodal connections. These include long-haul truck or Class I rail shipments from West Coast ports; regional trucking from the Midwest, South, and Northeast; shipping activity through the Port of Baltimore; and connections to final destinations via local/regional trucking, Class I rail, or short line rail. International movement of low-weight, high-value goods, such as pharmaceuticals, electronics, perishable foodstuffs, or precision instruments also relies on access to air travel.

Many shipments travel to/from distribution centers, and it is notable that products in Maryland are within an overnight drive of one-third of the U.S. population, including major hubs of activity in Boston, Atlanta, and Chicago.⁵⁴ Connections to/from the Port of Baltimore are exceptionally critical with the Port ranking first in the nation in 2019 for handling automobiles, light trucks, farm and construction machinery, as well as imported sugar and gypsum.⁵⁵
- **E-Commerce and Fulfillment Centers:** While already part of a growing logistics chain, the role and criticality of e-commerce activities and fulfillment centers that move retail products directly to consumers has been vastly accelerated as a result of the COVID-19 pandemic. Market research in early 2021, for example, noted that "Eighty percent of U.S. consumers are still changing the way they shop...60% are currently visiting brick-and-mortar stores less, and 43% will shop

more often online for products they previously bought in stores."⁵⁶ Future events that will likely continue this trend include the following:

- Omni-channel retailing strategies to facilitate consumer-retail interactions seamlessly across online, mobile platform, in-store, television, or catalog-based activities.
- Fulfillment center expansion to process customer orders and prepare deliveries.
- High demand for final mile package deliveries by truck or local delivery vehicles, as well as up-and-coming technologies that expand into unmanned aerial vehicles (UAVs or drones) or personal delivery devices (PDD or autonomous robots).
- **Reverse Logistics:** Reverse logistics describes the process of moving product returns from the consumer back to a wholesale fulfillment center or warehouse. Demands for product returns, particularly with the increased reliance on e-commerce and direct-to-consumer deliveries, further add to the truck/delivery traffic that travels along local streets and highways.

Maryland's freight transportation system also carries goods related to and supporting the state's wholesale trade, transportation and warehousing, and retail trade sectors, including:

- **Retail 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 their journey. Consumer goods are the dominant inbound deliveries to retail establishments and arrive from distribution centers via truck and Class I railroads.
- **Material Waste:** Discarded packaging accounts for most of the material waste produced by retail establishments or e-commerce activities. Trucks move material waste along local truck routes to reach consolidation centers, while bulk material waste can be transported to recycling facilities or landfills via truck and Class I railroads. Waste production across all uses – businesses, retail, residential, etc. – generated 14.3 million tons of solid waste in Maryland in 2018.⁵⁷

Wholesale/Retail Sector Needs and Challenges

Important freight transportation needs and challenges for these industry sectors include the following:

- These industry sectors utilize a complex logistics network that relies heavily on qualified freight and logistics support staff to manage supply chain flows. Multimodal freight transportation options, interconnectedness, system efficiency, and reliability are crucial.

- Final mile truck service is vital to warehousing, re-stocking, and delivery activities for wholesale/retail operations. Therefore, overall improvements to the highway system, including infrastructure conditions, operations efficiencies, truck parking opportunities, incident management, supporting technologies, or related elements, may be exceptionally important to time-sensitive truck deliveries.
- Delays due to congestion, bottlenecks, and reliability on the road network also create additional costs for shippers, transporters, and customers; affect retail/consumer satisfaction; and can limit growth or constrain multimodal connections, such as delayed truck drayage trips to the Port of Baltimore that spillover to delays in warehouse sorting for final delivery.
- Wholesale/retail activities may be especially sensitive to trends related to truck driver shortages, e-commerce expansion, or supply chain disruptions (e.g., due to the COVID-19 pandemic, weather, events).
- Double-stacking capability is needed for Class I rail connections between the Port of Baltimore and the national rail network, and ongoing efforts to resolve the existing constraints are underway on the Howard Street Tunnel Project.⁵⁸ Conflicts between passenger and freight rail operations also often limit freight travel to late night or slow speed operations, impacting timely and efficient goods movement opportunities.
- E-commerce expansion and related final mile truck deliveries impact all segments of the highway network, which can further increase congestion, roadway degradation, and potential conflicts between trucks, passenger vehicles, or truck usage of local streets. Thus, truck clearance issues, conflicts with traffic calming or pedestrian/bicycle facilities, truck parking needs, urban planning considerations, or other urban freight delivery issues may become increasingly widespread.
- New package delivery technologies such as UAVs/drones or personal delivery devices may create new opportunities, but also new challenges in terms of responding to necessary policy or regulation revisions, public education or acceptance, or other unforeseen impacts.
- **Healthcare:** Hospitals, clinics, and other healthcare services are found throughout Maryland, with major clusters throughout the Baltimore and Washington, D.C. metropolitan regions (**Exhibit 3.24**). These facilities require regular supplies to operate, arriving by truck from distribution centers or from longer-haul supply chain connections via truck, rail, air, or through the Port of Baltimore. Medical supplies vary widely, including linens, gowns, bandages, instruments, food, office supplies, specialty medical equipment, and specialty items, such as blood or plasma. Some materials may require special considerations for critical time-sensitive supplies or documents (as recently seen during the COVID-19 pandemic), or special routing for bio-hazardous medical waste shipments. Pharmaceuticals also play a large role in Maryland's healthcare economy with \$34.7 billion of commodities (2020 FAF5) representing more than 9% of the state's total freight value; the highest projected value increase (+220%, 2020-2050 FAF5) of all Maryland commodities; and key trade partners in Europe, parts of Asia, and Canada.
- **Government and Professional, Scientific, and Technical (PST) Services:** These sectors reflect major components of Maryland's economy with clusters around Baltimore, Washington, D.C., and major government/military installations (**Exhibit 3.25**). Combined, they comprise approximately 25% of the state's workforce and more than \$160 billion in GDP (U.S. BEA, 2019). Both sectors rely on final mile truck deliveries of office products, office equipment or furnishings, and – in an expanding sector – construction materials related to new/refurbished buildings or support facilities. Both sectors also contribute to general waste/scrap generation across the state.
- **Waste/Scrap Shipments:** All industry sectors across Maryland contribute to solid waste generated in the state, amounting to approximately 14.3 million tons in 2018.⁵⁹ Waste shipments move by truck to local consolidation centers, in-state or out-of-state recycling facilities, and landfill sites. Outside of Maryland, waste/scrap movements by truck or rail include primary destinations in Virginia, Pennsylvania, the Carolinas, New Jersey, Illinois, and Ohio (2020 FAF5).

Important freight transportation needs and challenges for these industry sectors overlap many of those detailed in the prior sections. Concerns include:

- The impact of congestion and delay on truck travel times, reliability, final mile operations, truck parking/staging, and delivery costs, especially those related to time-sensitive or specialty product deliveries.
- Potential conflicts between truck/freight deliveries and passenger vehicle, community, or complete street interests, particularly in urbanized areas.
- The impact of truck driver shortages, particularly in a government or professional, scientific, and technical services realm where site-specific deliveries may demand additional driver requirements or security clearances that may further restrict the available driver pool.

3.3.7 OTHER INDUSTRY SECTOR INFLUENCES

Beyond the more freight-intensive industry sectors discussed in the prior sections, it is also important to note that freight and goods movement are an inherent part of essentially all other industry sectors throughout Maryland to various degrees. In many of these remaining sectors, the freight focus typically shifts away from heavy resources or raw materials to a demand for high-value/low-weight products, miscellaneous business supplies, and parcel/package deliveries, as well as any waste/scrap that is generated by any business or commerce. Notable examples include the following:

EXHIBIT 3.24: MARYLAND EMPLOYMENT BY COUNTY – 2019 HEALTHCARE⁶⁰

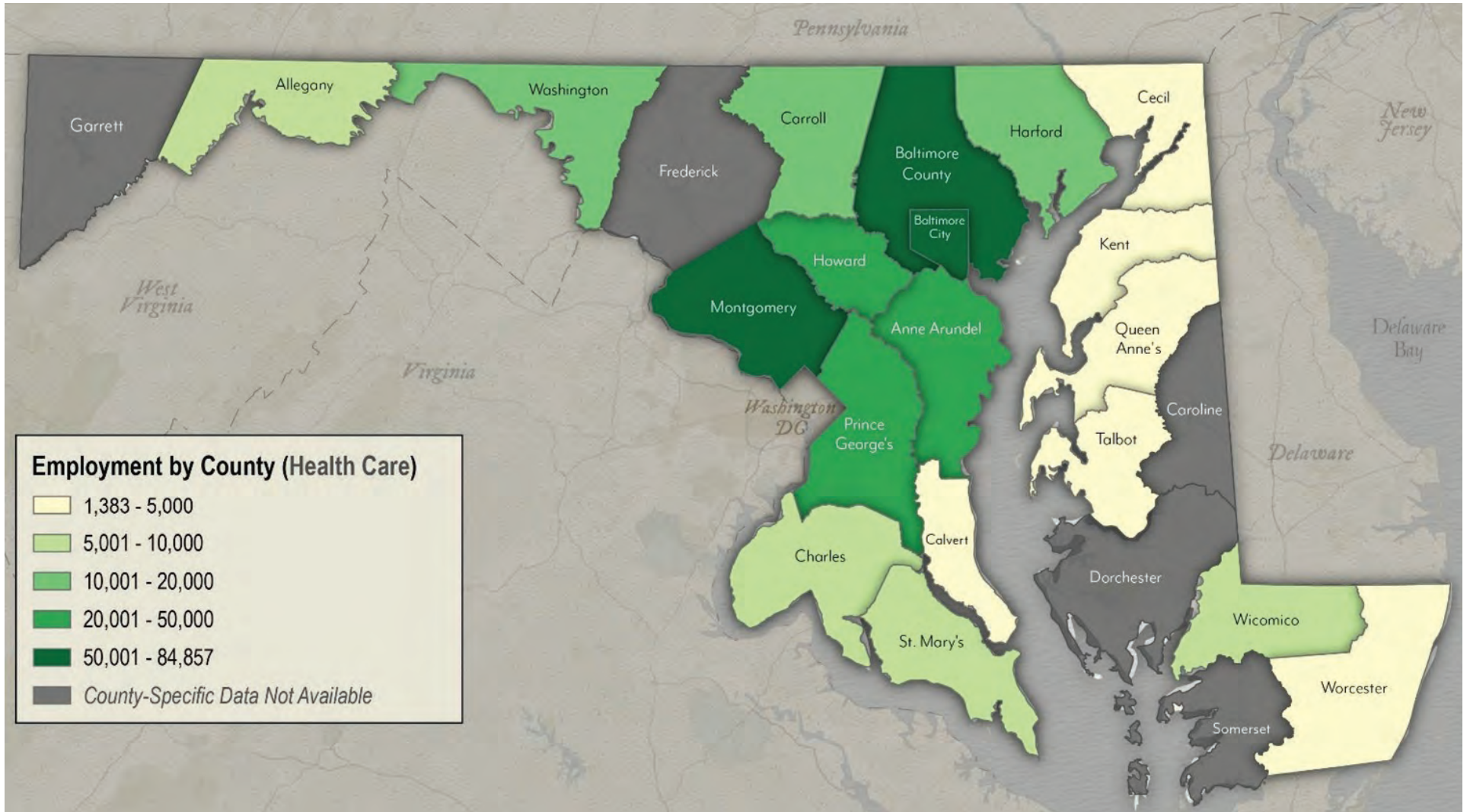
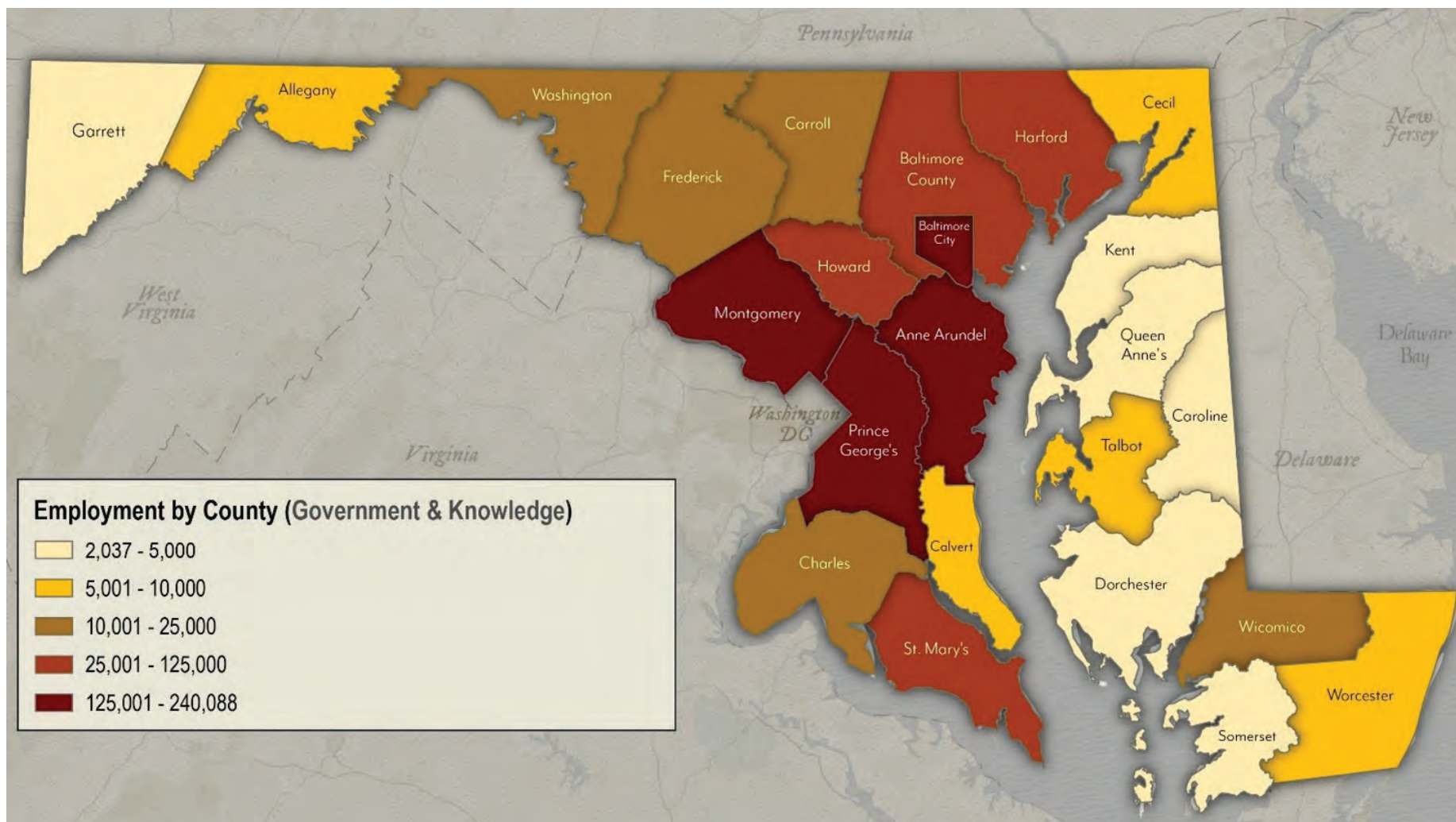


EXHIBIT 3.25: MARYLAND EMPLOYMENT BY COUNTY – 2019 GOVERNMENT AND KNOWLEDGE SECTOR⁶¹

ENDNOTES

- 1 Oak Ridge National Laboratory, Freight Analysis Framework Version 5 – User’s Guide for Release 5.0, January 20, 2021, <https://www.bts.gov/sites/bts.dot.gov/files/2021-02/FAF5-User-Guide.pdf>.
- 2 Ibid.
- 3 U.S. Bureau of Transportation Statistics, 2017 Commodity Flow Survey Standard Classification of Transported Goods (SCTG) – SCTG Commodity Codes, CFS-1200, October 4, 2016, available at <https://www.bts.gov/surveys/commodity-flow-survey/2017-cfs-commodity-code-sctg-manual>.
- 4 As of January 2022, the available online resources through MDOT SHA’s Maryland Freight Economy Dashboard were still sourced from historic (FAF4) data. Future updates to reflect the latest (FAF5) dataset may be considered as resources are made available. Refer to <https://maryland.maps.arcgis.com/apps/MapSeries/index.html?appid=cc2c5487486941c1be260de4654a84e8>.
- 5 See Endnote 1.
- 6 Based on assessments of Maryland state totals for tonnage (kTons) and value (\$M in 2017 dollars) using FHWA Freight Analysis Framework Version 5 (FAF5) data from <https://faf.ornl.gov/faf5/SummaryTable.aspx>.
7. Ibid.
8. Ibid.
9. Ibid.
10. Ibid.
11. Ibid.
12. Ibid.
13. Ibid.
14. Ibid.
15. Ibid.
16. Ibid.
17. Ibid.
18. Maryland Department of Planning, 2020 Census Data for Maryland Released by U.S. Census Bureau, Press Release, August 12, 2021, <https://content.govdelivery.com/accounts/MDMDP/bulletins/2ec7fb4>.
19. Maryland Department of Planning, Projections and State Data Center, December 2020, available from: https://planning.maryland.gov/MSDC/Pages/s3_projection.aspx.
20. U.S. Census Bureau, Historical Population Density Data (1910-2020), available from: <https://www.census.gov/data/tables/time-series/dec/density-data-text.html>.
21. Based on 2019 SUSB Annual Data Tables by Establishment Industry, <https://www.census.gov/data/tables/2019/econ/susb/2019-susb-annual.html>.
22. Based on assessments of data from multiple sources including:
 - Maryland Motor Fuel Tax and Motor Carrier Tax IFTA (International Fuel Tax Agreement) Annual Report, <https://www.marylandtaxes.gov/reports/static-files/revenue/motorfuel/annualreport/FuelAnnualReportFY2020.pdf>;
 - Spotlight on Maryland – Current Maryland Revenue, <https://www.marylandtaxes.gov/finances/revenue/revenue.aspx>;
 - MDTA 2019 Comprehensive Annual Financial Report, including p. 83, Schedule of Toll Revenue for the Fiscal Year Ended June 30, 2019, <https://www.marylandtaxes.gov/reports/static-files/revenue/motorfuel/annualreport/FuelAnnualReportFY2020.pdf>; and
 - Maryland Sales Tax Receipts FY 2019, https://marylandtaxes.gov/reports/static-files/revenue/salesandusereceipts/Sales_Tax_Receipts_FY_2019.pdf.
23. Based on assessment of Maryland state GDP data from U.S. Bureau of Economic Analysis, 2019.
24. Based on assessments of data from multiple sources including (1) Maryland employment and GDP data from U.S. Bureau of Economic Analysis; (2) pivot table analysis of 2020 Maryland state commodity data from FHWA Freight Analysis Framework Version 5 (FAF5) resources; and (3) growth projections (2020-2050) for selected commodity groups by SCTG code from FHWA Freight Analysis Framework Version 5 (FAF5) resources.
25. Maryland Marketing Partnership, Maryland Agribusiness, accessed September 17, 2021, <https://open.maryland.gov/industries/agribusiness/>.
26. MDOT mapping based on assessments of Maryland state data for Total Full-Time and Part-Time Employment by NAICS Industry (by county) from U.S. Bureau of Economic Analysis, 2019.
27. Maryland Department of Agriculture, Maryland’s Manure Transport Program (brochure), https://mda.maryland.gov/resource_conservation/documents/mdatransportrepr305-2.pdf.
28. See Endnote 24.
29. Maryland State Archives, Maryland at a Glance: Mines & Quarries, accessed September 17, 2021, <http://msa.maryland.gov/msa/mdmanual/01glance/html/mines.html>.
30. Maryland Department of the Environment, Non-Coal Surface Mine Location Maps (2019), and Coal Mine Location Maps (2018), based on KMZ data downloaded from <https://mde.maryland.gov/programs/LAND/mining/Pages/mapping.aspx>.
31. See Endnote 29.
32. See Endnote 24.
33. See Endnote 26.

34. See Endnote 24.
35. U.S. EIA, Maryland State Energy Profile, October 15, 2020, <https://www.eia.gov/state/print.php?sid=MD>.
36. Ibid.
37. Ibid.
38. See Endnote 29.
39. See Endnote 35.
40. See Endnote 35.
41. U.S. EIA, Form EIA-860M – Monthly Update to Annual Electric Generator Report, June 2021, <https://www.eia.gov/electricity/data/eia860m/>.
42. Maryland Energy Administration, Offshore Wind Energy in Maryland, accessed September 17, 2021, <https://energy.maryland.gov/Pages/Info/renewable/offshorewind.aspx>.
43. See Endnote 24.
44. Maryland Marketing Partnership, Maryland Advanced Manufacturing, accessed September 17, 2021 <https://open.maryland.gov/industries/advanced-manufacturing/>.
45. See Endnote 26.
46. See Endnote 44.
47. Winters, Amanda, Offshore wind efforts expand in Maryland with thousands of new jobs, Maryland Marketing Partnership, August 3, 2021, <https://open.maryland.gov/blog/offshore-wind-efforts-expand-maryland-thousands-new-jobs/>.
48. Maryland Governor's Office (Maryland.gov), "Governor Hogan Welcomes Hitachi Rail Announcement to Locate \$70 Million Manufacturing Operations in Washington County", Press Release, March 21, 2022, <https://governor.maryland.gov/2022/03/21/governor-hogan-welcomes-hitachi-rail-announcement-to-locate-70-million-manufacturing-operations-in-washington-county/>.
49. See Endnote 24.
50. See Endnote 26.
51. See Endnote 26.
52. Maryland Marketing Partnership, Distribution & Logistics, accessed September 17, 2021, <https://open.maryland.gov/industries/distribution-logistics/>.
53. Winters, Amanda, "Kroger brings robotic customer fulfillment center to Maryland", Maryland Marketing Partnership, January 23, 2020, <https://open.maryland.gov/blog/kroger-brings-robotic-customer-fulfillment-center-maryland/>.
54. See Endnote 52.
55. Maryland State Archives, Maryland at a Glance: Waterways, accessed September 17, 2021, <https://msa.maryland.gov/msa/mdmanual/01glance/html/port.html>.
56. Gramling, Kathy, Future Consumer Index Cycle 6: How a year of pandemic changed consumers, Ernst & Young Global Limited (EY) online, March 17, 2021, https://www.ey.com/en_us/consumer-products-retail/future-consumer-index-cycle-6-how-a-year-of-pandemic-changed-consumers.
57. Maryland Department of the Environment, Maryland Solid Waste Management and Diversion Report, 2019, <https://mde.maryland.gov/programs/LAND/AnalyticsReports/MSWMDR-%202019.pdf>.
58. Maryland Port Administration, Howard Street Tunnel Project, accessed September 17, 2021, <https://mpa.maryland.gov/pages/hst.aspx>.
59. Maryland Department of the Environment, Maryland Solid Waste Management and Diversion Report, 2019, <https://mde.maryland.gov/programs/LAND/AnalyticsReports/MSWMDR-%2019.pdf>.
60. See Endnote 26.
61. See Endnote 26.

SECTION 4 FREIGHT NETWORK AND INFRASTRUCTURE

SECTION TABLE OF EXHIBITS

SECTION TABLE OF CONTENTS

4 FREIGHT NETWORK AND INFRASTRUCTURE	4-2
4.1 Roadways	4-2
4.1.1 National Highway Freight Network	4-3
4.1.2 Highway Freight Route Redesignation Opportunities	4-7
4.1.3 Other Significant Maryland Freight Routes	4-8
4.2 Railroads	4-9
4.2.1 Rail Network Overview	4-9
4.2.2 Class I and II Freight Rail Operators	4-11
4.2.3 Class III Short Line Rail Operators	4-11
4.2.4 Rail Weight Capacities	4-12
4.2.5 Rail Vertical Clearances	4-13
4.2.6 Rail Transfer Facilities	4-14
4.3 Ports and Waterways	4-15
4.3.1 Port of Baltimore	4-15
4.3.2 Marine Terminal Throughput	4-17
4.3.3 Dredging for Safe Passage	4-19
4.3.4 Port Education and Outreach	4-19
4.3.5 Inland Waterways	4-20
4.4 Air Cargo	4-22
4.5 Energy Infrastructure	4-24
4.6 Multimodal Freight Network	4-30

Exhibit 4.1: Maryland Highway Mileage by Functional Classification	4-2
Exhibit 4.2: National Highway Freight Network in Maryland	4-4
Exhibit 4.3: Maryland PHFS Routes	4-5
Exhibit 4.4: Maryland Non-PHFS Interstate Routes	4-5
Exhibit 4.5: Maryland PHFS Intermodal Connectors	4-6
Exhibit 4.6: Maryland Highway Freight Routes	4-8
Exhibit 4.7: Maryland Rail System – Rail Operators	4-9
Exhibit 4.8: Maryland Freight Mode Share by Rail by Distance	4-10
Exhibit 4.9: Maryland Rail System – 286k Capability	4-12
Exhibit 4.10: Maryland Rail System – Double Stack Clearance Restrictions	4-13
Exhibit 4.11: Maryland Rail Transfer Facilities	4-14
Exhibit 4.12: Port of Baltimore Tonnage Estimates (2019)	4-15
Exhibit 4.13: Port of Baltimore Marine Terminals	4-16
Exhibit 4.14: Port of Baltimore Import/Export Loaded Twenty-foot Equivalent Units (TEUs)	4-17
Exhibit 4.15: Seagirt Marine Terminal ICTF Activity	4-18
Exhibit 4.16: Port of Baltimore Dredging Demand vs. Capacity (as of June 30, 2021)	4-19
Exhibit 4.17: Maryland Key Inland Waterways for Freight Movements	4-20
Exhibit 4.18: Maryland Air Cargo Airports	4-22
Exhibit 4.19: Annual Cargo (Freight & Mail) at BWI Marshall Airport (2016-2021)	4-23
Exhibit 4.20: Top 10 Freight Carriers at BWI Marshall Airport (2021)	4-23
Exhibit 4.21: Maryland Power Generation Sites	4-24
Exhibit 4.22: Maryland Net Electricity Generation by Source, June 2021 (Thousand MWh)	4-25
Exhibit 4.23: Maryland Pipeline Networks	4-26
Exhibit 4.24: Maryland Energy Storage and Terminal Sites	4-27
Exhibit 4.25: Maryland Energy Rankings (2019)	4-28
Exhibit 4.26: Maryland Energy Consumption by End-Use Sector, 2018 (Trillion BTU)	4-28
Exhibit 4.27: Maryland Energy Consumption by Source, 2019 (Trillion BTU)	4-29
Exhibit 4.28: Maryland Multimodal Freight Network	4-32
Exhibit 4.29: Multimodal Critical Rural Freight Facilities	4-32

4 FREIGHT NETWORK AND INFRASTRUCTURE

Domestic and international goods move to, from, or through Maryland by way of truck, Class I and short line rail, via coastal ports and inland waterways, by air, and by pipeline.¹ The broader freight transportation systems also include logistics networks that often span thousands of miles over land, sea, and air with critical multimodal connections through hubs such as the Port of Baltimore, BWI Marshall Airport, or other domestic seaports and airports. At a state level, Maryland’s logistics network encompasses freight shippers and receivers, freight handling facilities, waterborne freight terminals, and air cargo facilities. The collective multimodal networks provide vital connections between freight generating, receiving, and handling facilities.

Maryland’s overall goods movement transportation network is composed of the state’s highway network, freight rail network, waterways, seaports, air cargo airports, and energy-related infrastructure, as well as supporting elements such as intelligent transportation systems (ITS). Components are summarized below.

4.1 Roadways

Maryland’s overall roadway system consists of 31,343 total centerline miles with 2.6% represented as interstates or freeways/expressways, approximately 29% as arterials or collectors, and just under 69% as local roads (**Exhibit 4.1**). This system also includes more than 5,000 bridges across the state, including 2,569 bridges on the Maryland State Highway System.² Maryland roadways collectively handled approximately 78% of the total freight tonnage and 76% of the total freight value moving to, from, or within the state, amounting to approximately 218 million tons worth approximately \$286 billion (2020 FAF5).³

MARYLAND FREIGHT NETWORK






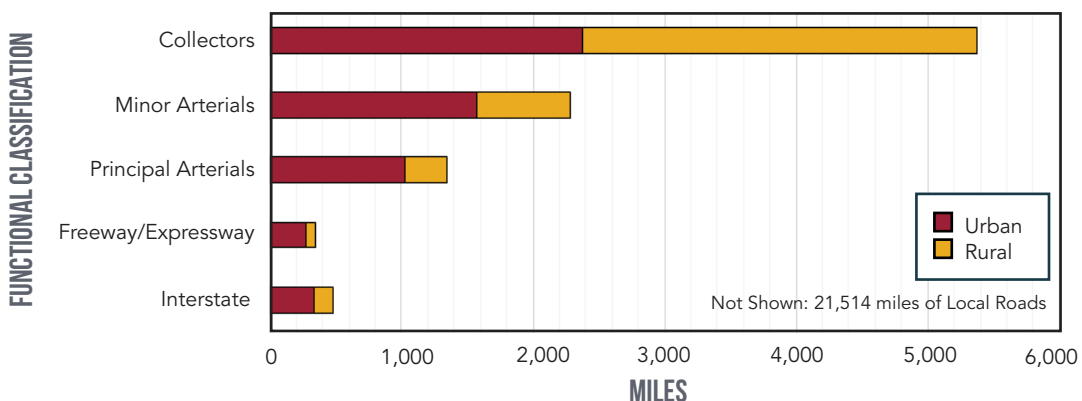
- 31,343 Public Road Miles 
- 1,152 Track Miles 
- 530 Inland Waterway Miles 
- 52,568 Cargo Runway Feet 
- 16,478 Pipeline Miles 

EXHIBIT 4.1: MARYLAND HIGHWAY MILEAGE BY FUNCTIONAL CLASSIFICATION⁴ (AS OF JANUARY 1, 2020)



4.1.1 NATIONAL HIGHWAY FREIGHT NETWORK

While goods generally move along the entire roadway network, the majority of freight utilizes portions of the NHFN or other significant freight routes throughout Maryland (**Exhibit 4.2**). The NHFN is a federally designated network initially set forth by the FAST Act in 2017 and consists of the following four components:

1. **Primary Highway Freight System (PHFS):** a mileage limited network designated by FHWA using measurable and objective national data to identify the most critical highway portions of the U.S. freight transportation system. Maryland PHFS route sections and mileage are listed in **Exhibit 4.3**.
2. **Non-PHFS Interstate Routes:** remaining portions of Interstate routes that are not included on the PHFS to support route continuity and access to freight transportation facilities. Maryland non-PHFS Interstate sections and mileage are listed in **Exhibit 4.4**.
3. **Critical Urban Freight Corridors (CUFC):** public roads in urbanized areas that provide freight access, connectivity, or redundancy between the PHFS, Interstate routes, an intermodal freight facility, or a major freight generator, logistics center, or manufacturing and warehouse industrial land.

Under Maryland's 2017 Strategic Goods Movement Plan, CUFC routes were determined by a joint effort between MDOT SHA and the state's MPOs based on methodology developed by the Metropolitan Washington Council of Governments (MWCOG). The FAST Act initially allowed for 75 CUFC miles in Maryland, which were allocated such that 25 miles of the CUFCs occur in both the MWCOG and the BMC MPO areas, and the remaining 25 miles are split between the five other MPOs in Maryland.

4. **Critical Rural Freight Corridors (CRFC):** public roads in non-urbanized areas that provide freight access and connectivity to key air, rail, water, or other freight facilities or activities that are vital to the state's freight economy, including the energy, agriculture, mining, and forestry industry sectors or significant freight intermodal transfer facilities.

Under Maryland's 2017 Strategic Goods Movement Plan, CRFC routes were selected based on criteria developed by MDOT SHA. The criteria considered FHWA guidance and additional freight data developed during the state freight planning process to identify the most critical corridors for the 150 CRFC miles that were initially allowed under the FAST Act.

In addition to the major route segments included on the PHFS, a sub-component of the PHFS also includes designated Intermodal Connectors that link major freight intermodal terminals with the National Highway System (NHS) and the broader highway network (**Exhibit 4.5**).

CUFC and CRFC Mileage Allotments

Based on **FAST Act** provisions, initial CUFC/CRFC mileage allotments in Maryland included **75** total CUFC miles and **150** total CRFC miles, which were allocated as detailed in the 2017 Maryland Strategic Goods Movement Plan.

Newer provisions in the **2021 IIJA** double the state's mileage caps to **150** total CUFC miles and **300** total CRFC miles. As such, future network expansion (beyond the CUFC/CRFC networks currently mapped on page 4-4) will occur as MDOT and MPO resources become available to coordinate and designate additional CUFCs and CRFCs for the newly allotted mileage.

It is anticipated that MDOT SHA and the state's MPOs will coordinate the new mileage allocations as a priority implementation step independent of this 2022 update to the state freight plan.

EXHIBIT 4.2: NATIONAL HIGHWAY FREIGHT NETWORK IN MARYLAND

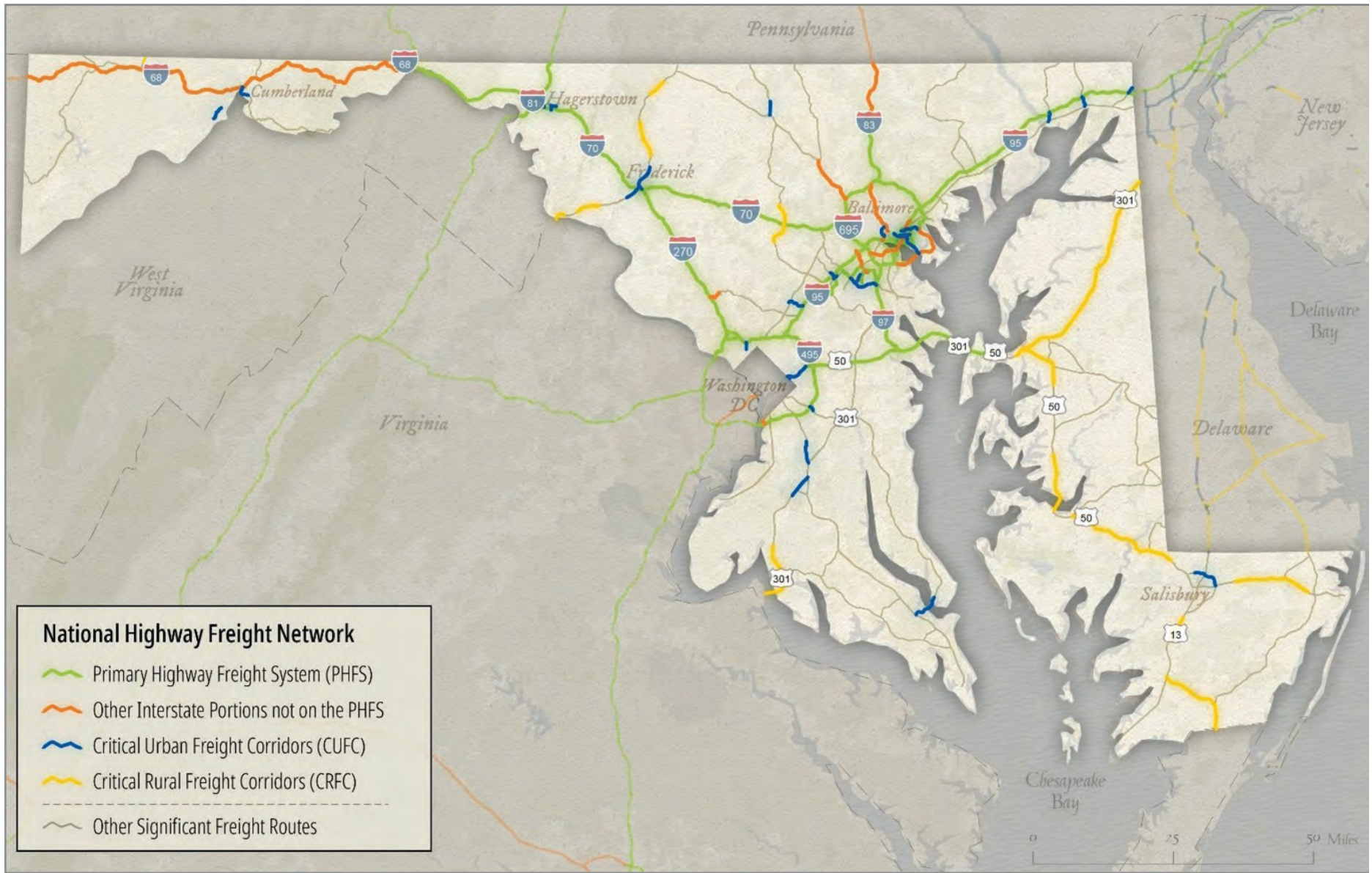


EXHIBIT 4.3: MARYLAND PHFS ROUTES⁵

ROUTE NUMBER	START POINT	END POINT	LENGTH (MILES)
I-195	MD 50A	MD 295	1.08
I-270	I-70	I-495	34.45
I-495	VA/MD Line	MD/DC Line	41.46
I-595	I-495	MD 70	19.39
I-695	MD 40L	MD 150 (From the North)	38.99
I-70	PA/MD Line	I-695	91.57
I-81	WV/MD Line	MD/PA Line	11.98
I-83	I-695	0.33 mile north of S138	13.36
I-95	I-495	MD/DE Line	83.07
I-97	I-595	I-695	16.53
MD 100	I-95	MD 295	2.71
MD 295	MD 100	I-195	3.00
US 301	I-595	16.32 east of I-595	16.32
US 50	MD 410	I-495	1.29
Total Length of PHFS Routes in MD (miles)			375.20
Total Length of PHFS Intermodal Connectors in MD (miles) (See Exhibit 4.5)			29.23
TOTAL PHFS MILES IN MARYLAND			404.43

EXHIBIT 4.4: MARYLAND NON-PHFS INTERSTATE ROUTES⁶

ROUTE NUMBER	START POINT	END POINT	LENGTH (MILES)
I-195	MD 166	MD 295	3.02
I-195	MD 170	.89 miles south of MD 170	0.89
I-295	DC/MD Line	MD 210	1.84
I-370	I-270	0.37 mile east of Mid County Hwy	2.82
I-395	I-95	W Conway St	1.17
I-68	WV/MD Line	I-70	80.10
I-695	MD 173	MD 150	12.26
I-170	I-695	MD 122	1.83
I-795	I-695	MD 140	9.01
I-83	E Fayette St	I-695	19.43
I-895	I-695	I-95 (North)	11.08
TOTAL LENGTH OF NON-PHFS INTERSTATE ROUTES IN MARYLAND (MILES)			143.46

EXHIBIT 4.5: MARYLAND PHFS INTERMODAL CONNECTORS⁷

FACILITY ID	FACILITY NAME	FACILITY DESCRIPTION	LENGTH (MILES)
MD38R	CSX Intermodal Container Facility	Vail St (Keith to CSX Gate), New Vail St (Keith to Newgate), Keith Ave (MU 5857) (Broening to Clinton)	1.79
MD39R	Norfolk Southern Bayview Intermodal Container Transfer Facility	Eastern Ave (I-95 to Ponca), Ponca St (Eastern to Lombard), Lombard St (Kane to Haven), Kane St (Northpoint to Dundalk), Northpoint Blvd (I-695 to Kane), Haven/Kresson Streets (Lombard to Pulaski)	2.27
MD3M	BWI Marshall Airport MARC/AMTRAK	Mileage on MD 50A	0.44
MD40L	Shell/Motiva Facility	E. Patapsco Ave (Pennington to Fairfield), Fairfield Rd (Patapsco to Northbridge), Northbridge Ave (Fairfield to Asiatic), Asiatic Ave (Northbridge to Shell Oil), Pennington/ Curtis Ave (Birch to Patapsco), Birch St (Pennington to Curtis)	5.08
MD42P	Dundalk/Seagirt Marine Terminal	Dundalk Ave (Holabird to Eastern), Holabird Ave (Ponca to Dundalk)	4.02
MD43P	Locust Point Terminals	McComas St (MU 4320) (Hanover to end of street)	2.26
MD46P	Rukert/Hale Intermodal Terminal	Clinton St (Boston to Keith); access to this terminal is provided by Keith Ave, listed under MD38R; Newkirk St (Newgate to Boston), Newgate St (New Vail to end)	0.14
MD47P	Fairfield Auto Terminals	Frankfurt Ave (Hanover to Vera), Vera St (Frankfurt to Chesapeake), Chesapeake Ave (Vera to Fairfield), Childs St (Frankfurt to Terminal)	2.49
MD48P	Hawkins Point Marine Terminal	Pennington Ave/Hawkins Point Rd (Birch to Anne Arundel County), Quarantine Rd (Hawkins Pt to Terminal)	1.41
MD50A	BWI Marshall Airport	Camp Meade Rd (Dorsey to Aviation), Aviation Blvd (Camp Meade to I-97)	5.45
MD60R	Jessup Auto Distribution Facility	Dorsey Run Rd (MD 175 to MD 32), MD 175 (I-95 to Dorsey Run Rd)	3.89
TOTAL LENGTH OF PHFS INTERMODAL CONNECTORS IN MARYLAND (MILES)			29.23



4.1.2 HIGHWAY FREIGHT ROUTE REDESIGNATION OPPORTUNITIES

Per FAST Act requirements, the PHFS undergoes its first required five-year update by the U.S. Department of Transportation (USDOT) through 2022. In coordination with the USDOT's update of the PHFS, or as part of the expanded CUFC/CRFC mileage allotments under the IIJA, opportunities may exist to expand or redesignate portions of Maryland's freight network. Based on a review of the current freight network and in coordination with feedback from the Maryland SFAC (September 2021 meeting), potential candidates include the following:

- **US 301 (Eastern Shore)** – currently designated as CRFC (39.4 total miles), this route connects with existing PHFS on US 50 just east of the Bay Bridge and runs northeast through Queen Anne's, Kent, and Cecil counties into Delaware.
- **US 50 (Eastern Shore)** – currently designated with intermittent sections of CRFC (55.4 total miles) and CUFC (6.0 miles), this route connects with existing PHFS on US 50 just east of the Bay Bridge and runs southeast across Maryland's Eastern Shore as a vital freight link supporting agriculture, tourism, and extractive industries.
- **US 15 (Emmitsburg to Virginia)** – currently designated with intermittent sections of CRFC (9.2 total miles) and CUFC (6.7 total miles), this route carries significant truck traffic, supports rural industries with freight flow connections across three states, as well as connections for major growth areas through the Washington metropolitan region.
- **MD 5 (D.C. to Patuxent River)** – currently designated with limited sections of CUFC (3.5 miles), the route spans 57 miles and provides important connectivity between major military establishments southeast of Washington, D.C., and in the Patuxent River area.
- **MD 4 (D.C. to Patuxent River)** – currently designated with only limited sections of CUFC (5.9 total miles), the route spans more than 66 miles and provides important connectivity between major military establishments southeast of Washington, D.C., and in the Patuxent River area.
- **US 301 (Waldorf to Virginia)** – currently designated with intermittent sections of CRFC (11.6 miles) and CUFC (4.0 miles), this route provides redundancy to I-95 for truck traffic and has been proposed by MDOT SHA for truck alternative routing as part of TSMO solutions.
- **US 40 (Baltimore to Perryville)** – currently not included on the NHFN, this route spans approximately 25 miles, provides redundancy to I-95 and crossings of the Susquehanna River and supports connectivity to major military establishments, industry areas, and intermodal rail connections.

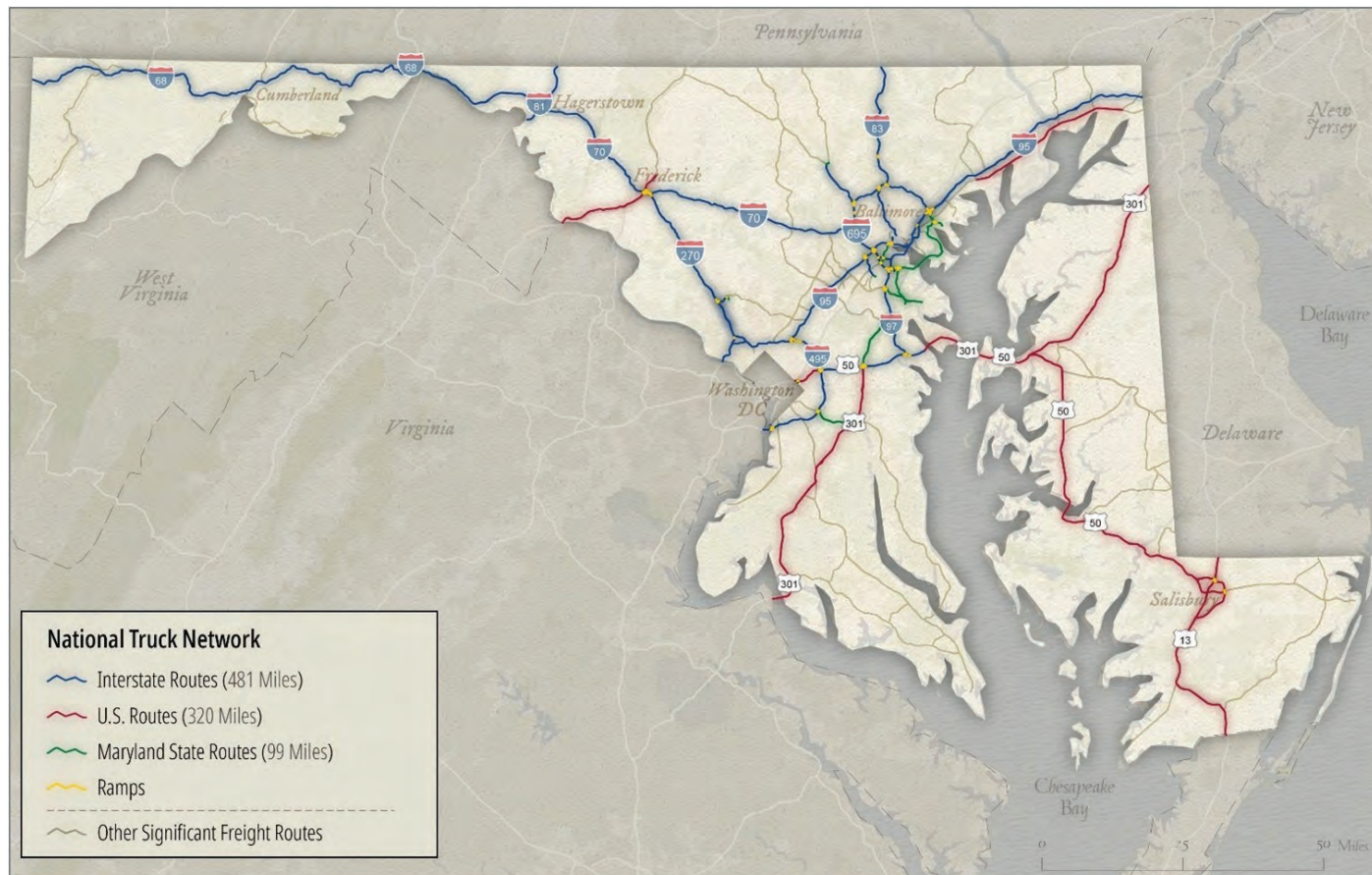
Of the above routes, sections of the US 301 corridor in particular may provide a significantly useful truck alternative route that supports multistate connections through Maryland from Delaware to Virginia. Sections of US 40 would also provide redundancy (relative to I-95) coupled with connections to major freight generators and military establishments.



4.1.3 OTHER SIGNIFICANT MARYLAND FREIGHT ROUTES

While the network discussions on prior pages cover the formally designated and mileage limited networks of the PHFS, Non-PHFS Interstate Routes, CUFC, and CRFC, freight also travels along other significant routes throughout Maryland, as well as local first/last mile connections to freight origins and destinations. Such routes encompass the remainder of significant freight corridors identified by MDOT SHA and MDTA as part of the state's broader highway network (**Exhibit 4.6**). These "other significant freight routes" include portions of the U.S. highway system and the Maryland State Highway network that were designated as part of the National Truck Network authorized under the Surface Transportation Assistance Act (STAA) of 1982. Beyond these routes, trucks may also travel on any road in Maryland – except where expressly prohibited – for local deliveries and pick-up.

EXHIBIT 4.6: MARYLAND HIGHWAY FREIGHT ROUTES

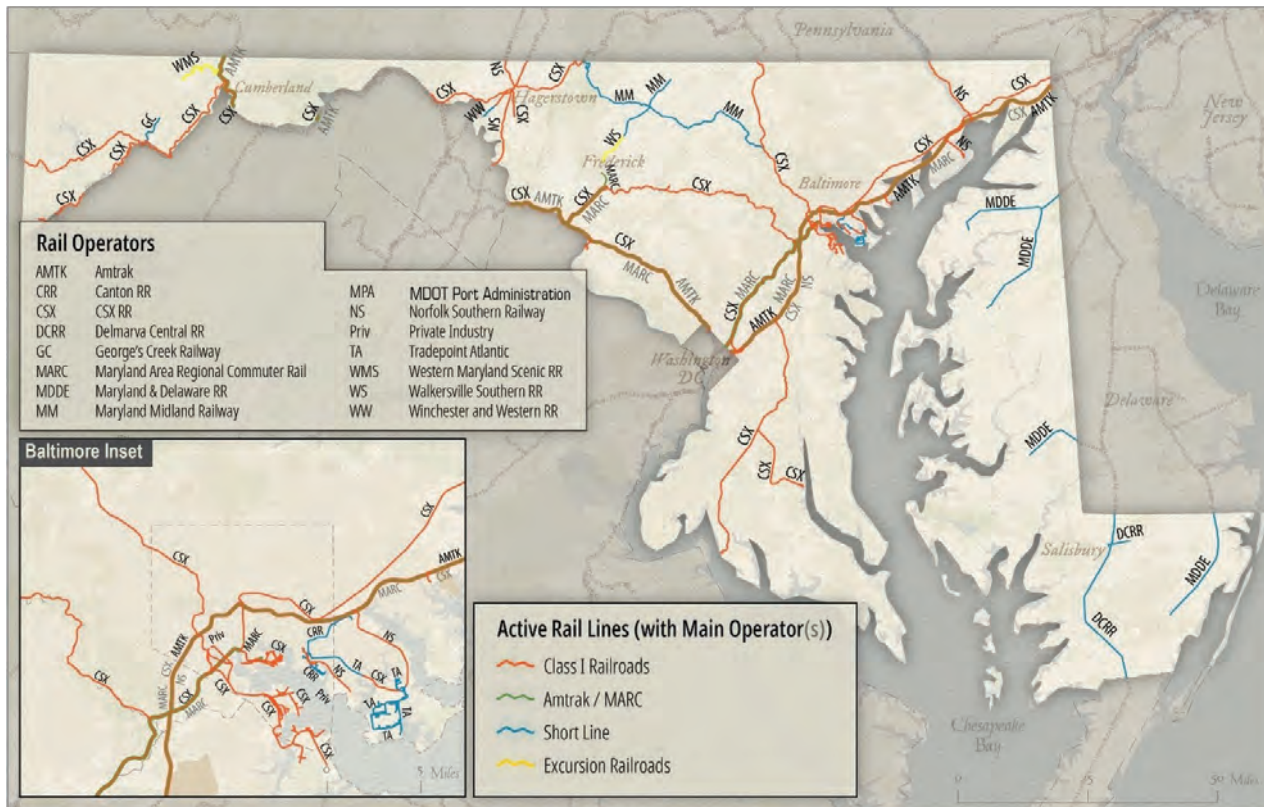


4.2 Railroads

4.2.1 RAIL NETWORK OVERVIEW

Maryland's rail network includes about 886 miles of active rail lines and more than 15 different rail operators of various types (Exhibit 4.7). Freight operations include two Class I, one Class II, and seven Class III (or short line) freight rail operators.⁸ The overall network also includes intercity passenger rail services under the National Passenger Railroad Corporation (Amtrak), regional/commuter operations under MDOT MTA's MARC Train Commuter service, and two tourist/excursion services that are operated by Western Maryland Scenic Railroad (WMS) and Walkersville Southern Railroad (WSRR).

EXHIBIT 4.7: MARYLAND RAIL SYSTEM – RAIL OPERATORS



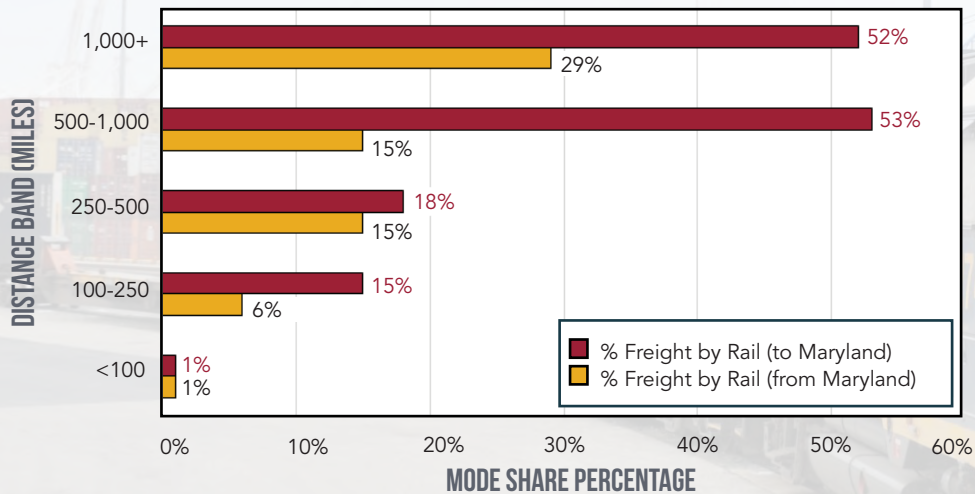
Concurrent with the development of the Maryland Freight Plan, MDOT is also updating the Maryland State Rail Plan, which provides additional emphasis on both passenger and freight rail system trends, needs, and related planning efforts. For details, refer to: <https://mdot.maryland.gov/railplan>.



Freight rail transportation plays an important role in Maryland with major rail flows along the Class I lines, as well as critical first/last-mile connectivity and rural area access provided by the state's Class III operators. Maryland railroads collectively handled approximately 9% of total freight tonnage and 4% of total freight value moving to, from, or within the state, amounting to more than 25 million tons and more than \$13 billion in 2017.⁹

As noted in **Section 3**, movement by truck is the dominant mode for freight flows in Maryland, carrying approximately 78% of the state's overall tonnage and 76% of its overall value (2020 FAF5). However, for long-distance movement of many higher-weight/lower-value commodities (e.g., coal, metallic ores, plastics/rubber), as well as high-value motorized vehicle imports/exports that transfer through the Port of Baltimore, the efficiencies of rail transport become increasingly apparent in the higher percentages of freight that move by rail at longer distances. In fact, for trip distances greater than 1,000 miles, almost one-third (29%) of the freight tonnage originating in Maryland and more than half (52%) of the freight tonnage destined for Maryland moves by rail (**Exhibit 4.8**).

EXHIBIT 4.8: MARYLAND FREIGHT MODE SHARE BY RAIL BY DISTANCE¹⁰



4.2.2 CLASS I AND II FREIGHT RAIL OPERATORS

Class I freight rail operations in Maryland include service by **CSX Transportation (CSX)** and **Norfolk Southern Railway (NS)**. These operators serve customers across the eastern half of the United States and interchange with western and Canadian railroads to connect Maryland with all North American rail markets. Portions of the CSX and NS freight rail networks include trackage rights along Amtrak's heavily trafficked Northeast Corridor that carries intercity passenger service between Washington, D.C., and Boston. Overall, CSX has the broader presence in Maryland, operating 516 total miles (including 87 miles under trackage rights) in the state at the end of 2020, compared to 259 total miles (including 200 miles under trackage rights) operated by NS.¹¹



While no Class II railroad owns or leases rail lines in Maryland, the **Wheeling & Lake Erie Railway (W&LE)** operates on trackage rights over CSX, providing connections between Connellsville, PA and Hagerstown, MD.

4.2.3 CLASS III SHORT LINE RAIL OPERATORS

Class III freight rail services in Maryland include short line freight carriers that provide first/last-mile access to the rail network as well as sorting or switching/terminal operations. Seven Class III railroads operate 247 miles (excluding trackage rights) in Maryland, including:

- **Canton Railroad (CRR)** – provides switching service between the Port of Baltimore and Class I operators CSX and NS, transload services through the CRR Boston Street Bulk Terminal (BSBT), and warehousing/distribution support for palletized freight via local logistics providers along the CRR rail lines.¹²



- **Delmarva Central Railroad Company (DCRR)** – is a subsidiary of Carload Express Inc. that operates 188 miles of track between Porter, DE to Hallwood, VA, including 42 miles in Wicomico, Somerset, and Worcester counties on Maryland's Eastern Shore. The DCRR interchanges with NS in northern Delaware, and with The Maryland and Delaware Railroad Company (MDDE) at Townsend, Seaford, and Frankford, DE.¹³



- **Georges Creek Railway (GC)** – historically provided localized switching operations in Allegany County. However, coordination between Allegany County, MD Department of Natural Resources (DNR), and the Eighteen Thirty Group, LLC, are actively negotiating abandonment proceedings (recently extended through February 2023) to railbank the line for interim trail use.¹⁸

- **The Maryland and Delaware Railroad Company (MDDE)** – provides short line rail services to several counties on Maryland's rural Eastern Shore, supporting the Delmarva agriculture and poultry industries and the movement of chemical and industrial products. The MDDE operates on 96 miles of track in Maryland and Delaware and interchanges with DCRR in Townsend, Seaford, and Frankford, DE, which subsequently links with NS in northern Delaware.¹⁴



- **Maryland Midland Railway (MM)** – is a subsidiary of Genesee & Wyoming Inc. that operates 65 miles of track, transloading, and warehousing/industrial site access through Frederick and Carroll counties in central Maryland, interchanging with CSX at Emory Grove and Highfield.¹⁵



- **Tradepoint Rail LLC (TA)** – is a privately-owned short line operation that connects tenants at the multimodal Tradepoint Atlantic site (on the former Sparrows Point industrial property) in Baltimore, MD with NS and CSX. TA capabilities include transloading for dry bulk, liquid and hazardous material, food grade, or other commodities, as well as car storage, maintenance/repair, cleaning, sorting/assembling, rail scale, and scrapping services.¹⁶



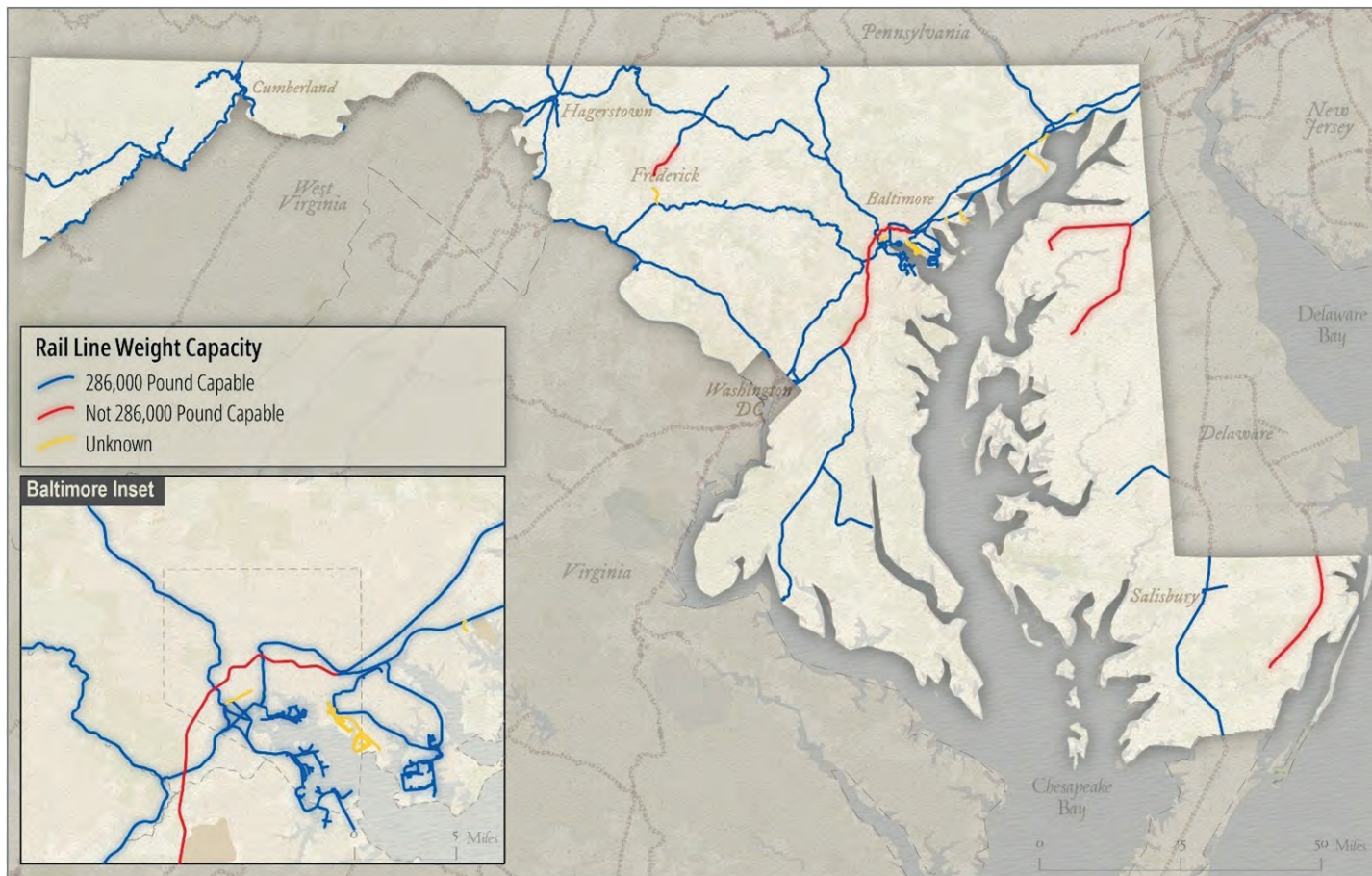
- **Winchester & Western Railway (WW)** – is a subsidiary of OmniTRAX that operates 53 miles of line and transloading services along the Shenandoah Valley. The WW interchanges with NS near Hagerstown, while the route also links with CSX in Martinsburg, WV and Winchester, VA.¹⁷



4.2.4 RAIL WEIGHT CAPACITIES

The current industry standard railcar weight is 286,000 gross pounds, including the weight of the railcar and the payload. This standard reflects an increase from the prior (pre-1990's) standard of 263,000 gross pounds. Trackage rated for loads less than 286,000 gross pounds place railroads and shippers on those lines at a disadvantage, as the 263,000-pound cars are more costly to handle on a per ton basis. Rates do not often vary according to weight, so that the rate to ship a 286,000-pound car carrying 10 percent more payload would be the same as a 263,000-pound car. A review of "286k capability" in Maryland identifies 97 miles that cannot accommodate 286,000-pound railcars, including 61 miles operated by the MDDE on the Eastern Shore, 29 miles on the Amtrak Northeast Corridor between Bowie and Bayview (north and southwest of Baltimore), and 7 miles of the Walkersville Southern Railroad (**Exhibit 4.9**).¹⁹

EXHIBIT 4.9: MARYLAND RAIL SYSTEM 286K CAPABILITY



4.2.5 RAIL VERTICAL CLEARANCES

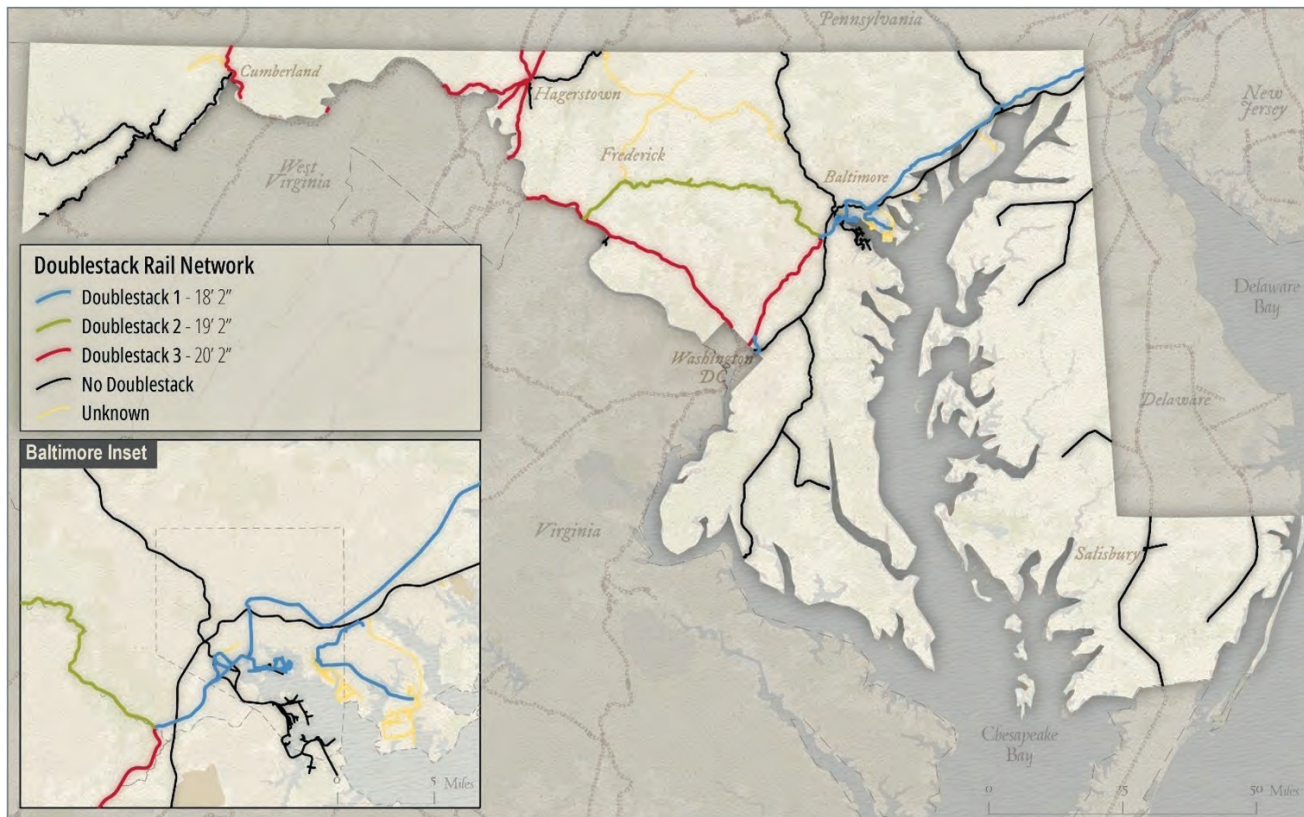
Limited vertical clearance over rail lines can constrain intermodal capacities by limiting the ability to efficiently “double stack” containers on top of each other, which allows more containers to be carried by each train. Double-stack trains require between 18’8” and 20’8” of vertical clearance from top of rail, depending on the type of container, including “Hi cube” containers used for oversized shipments in North America that require 10’ of vertical clearance.²⁰ A review of double-stack clearance restrictions in Maryland is summarized below (**Exhibit 4.10**).

Notable constraints for CSX are caused by existing clearances through the Howard Street Tunnel in Baltimore that prohibit double stack CSX train access to the Port of Baltimore. However, the ongoing Howard Street Tunnel (HST) project, expected to be

completed in 2024, will clear the tunnel and 21 other clearance obstructions along CSX’s I-95 Rail Corridor to allow double stack operations to the Port of Baltimore and between Baltimore and Philadelphia.²¹

Notable constraints for NS are caused by overhead catenary lines that power passenger trains on Amtrak’s Northeast Corridor (NEC), which are generally too low to allow double stack trains to pass underneath. Considering NS relies on trackage rights and usage of the NEC to access Baltimore, NS is also unable to operate double stack trains to/from the Port of Baltimore.

EXHIBIT 4.10: MARYLAND RAIL SYSTEM – DOUBLE STACK CLEARANCE RESTRICTIONS



The **CSX National Gateway Initiative** improved clearances on corridors in Maryland during the last decade. National Gateway projects within Maryland included raising a pedestrian bridge in Germantown, raising highway bridges in Gaithersburg and Jessup, and lowering track within tunnels at Point of Rocks and Catoctin. The National Gateway Initiative was concluded in 2018 with the completion of the Virginia Avenue Tunnel project in Washington, D.C.

4.2.6 RAIL TRANSFER FACILITIES

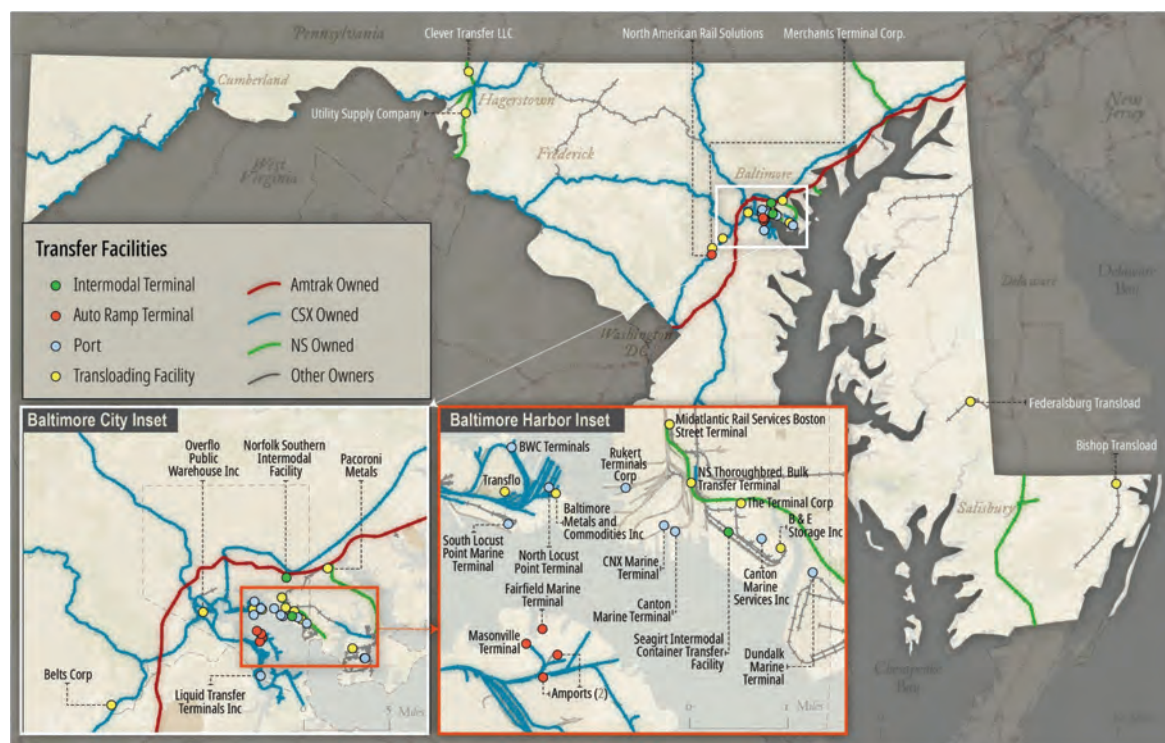
Major multimodal freight transfer facilities are located in Maryland, particularly clustering in the Baltimore area (**Exhibit 4.11**). These facilities include:

- **Intermodal Terminals** – facilitate the transfer of intermodal containers between truck and rail. Two terminals are located in Maryland, both in Baltimore. These include the Intermodal Container Transfer Facility (ICTF) at Seagirt Marine Terminal, operated by Ports America and served by CSX; and the NS terminal at Bayview Yard. CSX provides international and domestic container services at Baltimore, while NS provides domestic service. Smaller, heavier containers (20, 40 and 45 feet long) used in international service move primarily between vessels and railcars on-dock. Larger containers (53 feet long) in domestic service are trucked to and from Baltimore for movement by rail to other points in North America.
- **Auto Ramps** – facilitate the loading and unloading of finished vehicles onto or off of railcars. Many of these ramps are associated with international movements

of vehicles through the Port of Baltimore. They also support regional distribution of automobiles that arrive by train from North American assembly plants to be unloaded and distributed by truck throughout the Mid-Atlantic and Northeast.

- **Port Facilities** – facilitate the transfer of other types of freight between marine vessels and rail, including bulk commodities such as coal, petroleum products, gypsum, and chemicals; as well as break bulk commodities, such as steel, lumber, or paper.
- **Transload Facilities** – facilitate other types of non-containerized freight transfers between truck and rail (separate from the facilities noted above). Transload facilities are not dedicated to a single shipper's operation and provide flexibility to accommodate bulk commodities or break bulk traffic, operating as standalone public facilities or associated with private sites such as warehouses. Most transload facilities in Maryland are located in the Baltimore area, but others may be found throughout the state to provide access to rail transportation for customers outside the metropolitan region.

EXHIBIT 4.11: MARYLAND RAIL TRANSFER FACILITIES



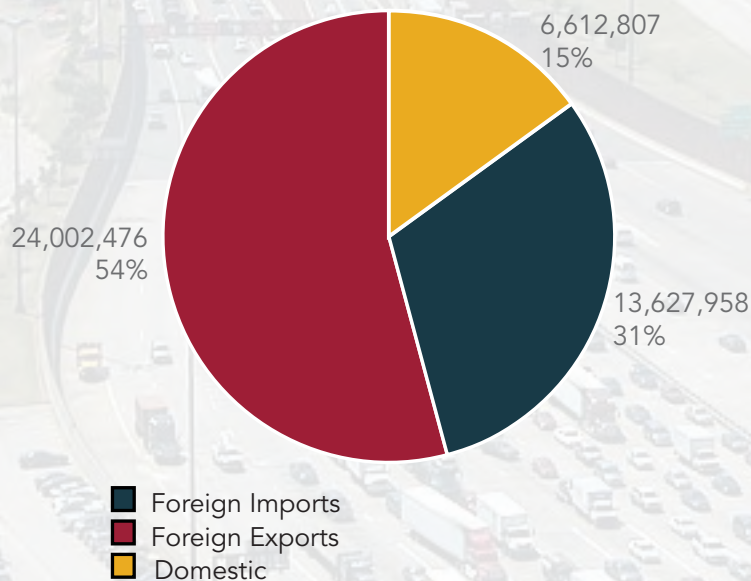
4.3 Ports and Waterways

4.3.1 PORT OF BALTIMORE

Cargo is the lifeblood of the Port of Baltimore, which handled more than 44.2 million tons of freight in CY 2019 (**Exhibit 4.12**). 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. Key commodities handled at the Port's state-owned marine terminals include autos, roll-on/roll-off, containers, forest products, and specialized cargo that includes a wide variety of machinery or other components for complex construction projects (e.g., manufacturing plants, power plants, transit systems, airports, wind farms). 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 marine terminals managed by MDOT MPA plus many privately-owned terminals (**Exhibit 4.13**). It is a vital link for raw materials and manufactured goods moving into and out of Maryland, the Mid-Atlantic region, and into the Midwest United States. The Port of Baltimore ranks at or near the top of all U.S. ports in several categories, including handling farm and construction machinery, automobiles, imported forest products, imported sugar, imported gypsum, and exported coal. Total general cargo at the MDOT MPA state-owned terminals reached 10.3 million tons in FY 2020. ²²

EXHIBIT 4.12: PORT OF BALTIMORE TONNAGE ESTIMATES (2019)²³



PORT OF BALTIMORE MARINE TERMINALS*

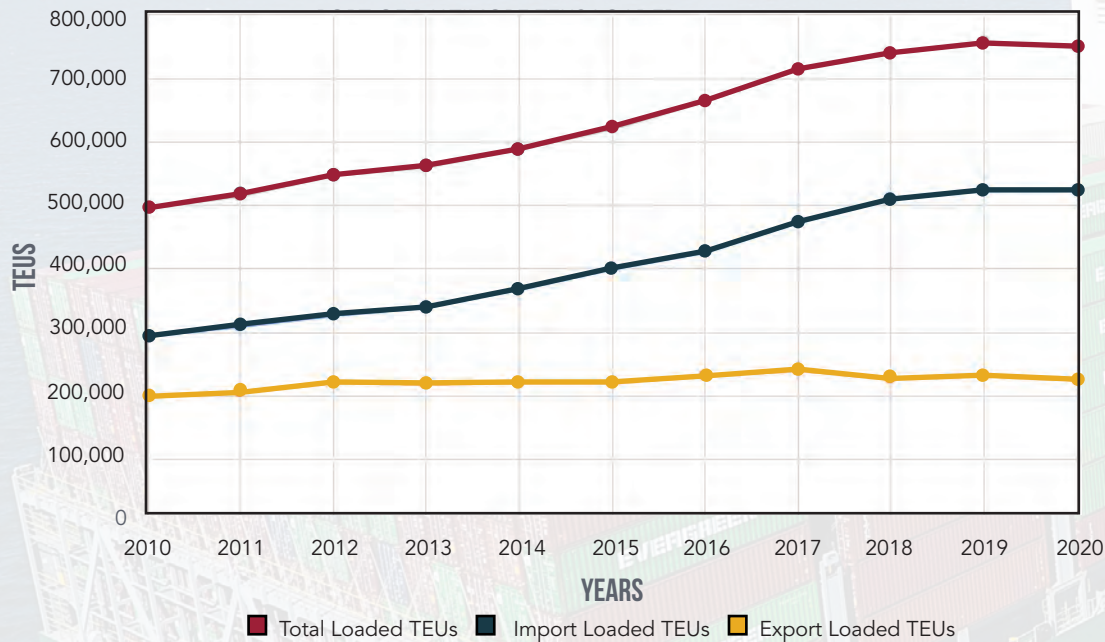
1. Tradepoint Atlantic
2. Dundalk Marine Terminal (MPA)
3. Seagirt Marine Terminal (MPA/Ports America)
4. Gold Bond Building Products
5. Canton Marine Terminal Pier 13
6. Canton Pier 10/11
7. Consol Energy/CNX Marine Terminal
8. Point Breeze Business Center
9. Intermodal Container Transfer Facility (ICTF)/(MPA/Ports America)
10. Port America Chesapeake Grain Operation
11. Fort Holabird Industrial Park
12. Chesapeake Commerce Center (Amazon)
13. MTC Logistics (Cold Storage)
14. Canton Railroad (Penn-Mary Yard)
15. Belt's Business Center (U.S. Customs Station)
16. Norfolk Southern (Bayview Intermodal Yard)
17. Rukert Terminals Corp. (Clinton Street Offices)
18. Lehigh Portland Cement
19. Petroleum Fuel & Terminals Co. (Apex)
20. General Ship Repair
21. American Sugar Refining (ARS)/Domino Sugar
22. North Locust Point Marine Terminal (MPA)
23. C. Steinweg (Baltimore)
24. South Locust Point Marine Terminal (MPA)
25. Cruise Maryland/Cruise Terminal
26. SubCom
27. Vulcan Materials Company
28. Masonville Terminal (MPA)/(Mercedes-Benz Auto Facility)
29. Fairfield Marine Terminal (MPA)/(Auto Warehousing Corp.)
30. Atlantic Terminals (Amports)
31. NuStar Energy LP
32. Vane Brothers
33. Chesapeake Terminal (Amports)
34. Baltimore Asphalt Refinery Dock (Chevron USA)
35. SASOL North America
36. Citgo/Tosco
37. CSXT Chesapeake Bay Piers (Coal)
38. CSXT Chesapeake Bay Shiploader Pier 2 (Coal)
39. Mid States Oil Terminal
40. Bitumar USA
41. Liquid Transfer Terminal, Inc.
42. Amerada Hess Dock
43. BP/Amoco Oil Co. (Curtis Bay Terminal)
44. ARGOS Cement
45. W.R. Grace & Company
46. U.S. Gypsum Dock
47. Hawkins Point Marine Terminal (MPA)/(Eastalco/Yara North America)
48. U.S. Coast Guard Yard

*see map in Exhibit 4.13 for locations listed above

4.3.2 MARINE TERMINAL THROUGHPUT

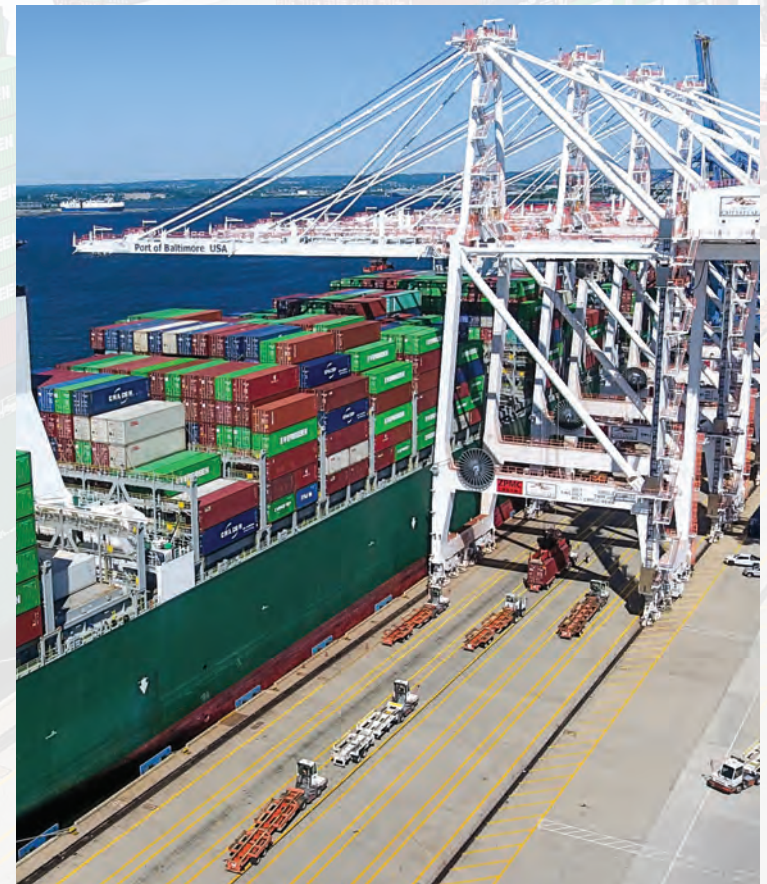
The Port of Baltimore is the top-ranked port in the U.S. by volume of automobiles and roll on/roll off heavy equipment, such as farm, construction, and transportation equipment. The Port imports foreign automobiles and equipment for consumption in the U.S. and exports American-made automobiles and equipment to consumers throughout the world. The Port of Baltimore is able to handle larger vessels traveling through the expanded Panama Canal, including increasing volumes of containerized import/export freight (**Exhibit 4.14**).

EXHIBIT 4.14: PORT OF BALTIMORE IMPORT/ EXPORT LOADED TWENTY-FOOT EQUIVALENT UNITS (TEUs)²⁵



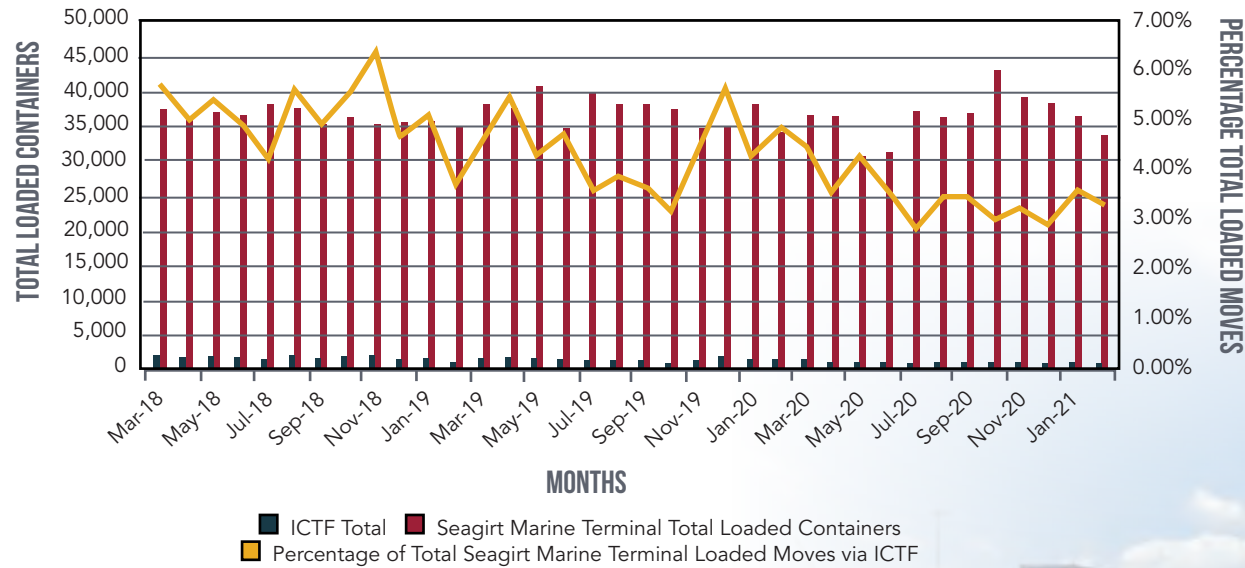
Containerized Freight Opportunities:

Opportunities at the Port will continue to grow with significant expansion efforts such as the 2021 arrival of four additional Neo-Panamax cranes at Seagirt Marine Terminal and the 2021 ground-breaking for the Howard Street Tunnel project that, upon completion, will facilitate double-stacked container trains to and from the Port.



The ICTF at the Port of Baltimore, adjacent to Seagirt Marine Terminal, moves containers to and from Baltimore via the CSX railroad (**Exhibit 4.15**). CSX has four trains daily offering direct service to the Southeast and Midwest, and connections to the rest of the continental U.S. and Canada. Operating since 1988, the ICTF has never reached its full capacity due to CSX's inability to double stack containers in and out of Baltimore.

EXHIBIT 4.15: SEAGIRT MARINE TERMINAL ICTF ACTIVITY²⁶



4.3.3 DREDGING FOR SAFE PASSAGE

To maintain 50-foot-deep shipping channels needed for large Post-Panamax vessels, approximately 4.8 million cubic yards (MCY) of material must be dredged from the Baltimore Harbor annually. Maryland's Dredged Material Management Program (DMMP) strives to provide adequate dredged material placement capacity for harbor and bay dredging through preferred management options. The MDOT MPA 20-year dredge material plan (**Exhibit 4.16**) estimates that the capacity to support planned maintenance and some new work dredging will be met.

Implementation of the 2014 Innovative and Beneficial Use Strategy continues to be an MDOT MPA priority in planning for sustainable dredged material management solutions. "Beneficial use" means using dredged material for aquatic ecosystem benefits, such as creating wetland habitat and restoring eroded islands. Beneficial use projects exist at Poplar Island and Hart-Miller Island.

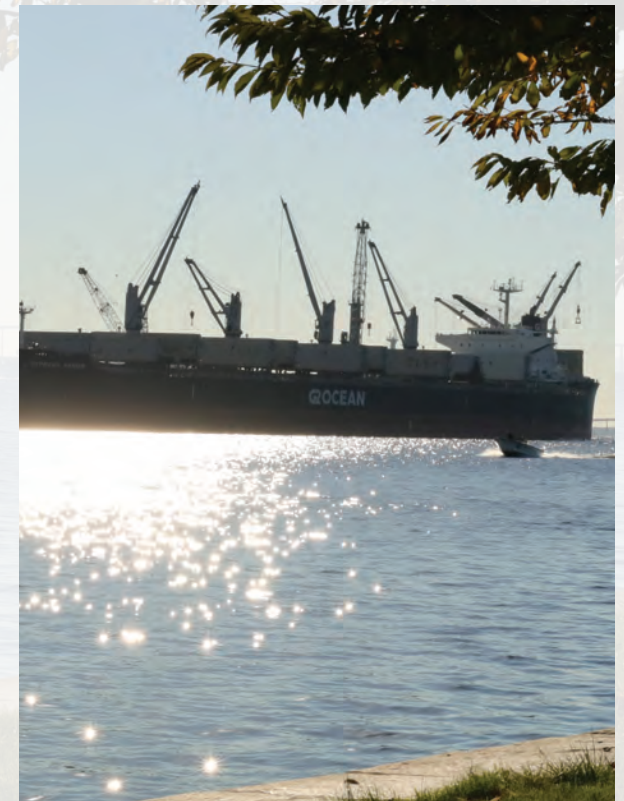
"Innovative Reuse" transforms dredged material into usable products for construction restoration, and agriculture. The MDOT MPA has demonstration projects underway to test the feasibility of using Harbor material to produce a lightweight aggregate, construction fill, and soil amendments.

4.3.4 PORT EDUCATION AND OUTREACH

The MDOT MPA continues efforts to increase its visibility and the public's knowledge of the Port of Baltimore, its operations and projects, and their importance to the state of Maryland. As part of its continuing efforts to improve collaboration, inclusiveness, and transparency with its partners, as well as to improve outreach, port education, communications, and visibility of port programs, MDOT MPA has increased its use of and promotion through social media. In 2019, more than 18,000 people learned about the Port of Baltimore through an outreach effort, obtained more than 1,000 social media followers, and increased 5% in GreenPort eNewsletter.²⁸

EXHIBIT 4.16: PORT OF BALTIMORE DREDGING DEMAND VS. CAPACITY (AS OF JUNE 30, 2021)²⁷

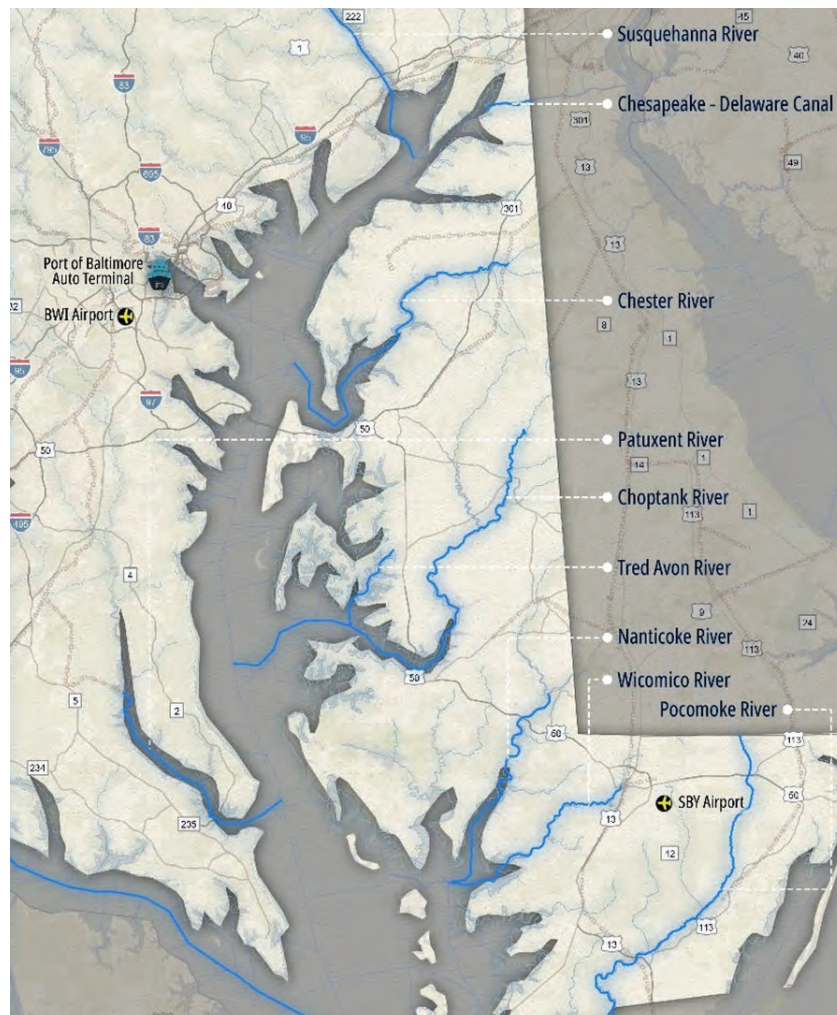
CHANNEL SEGMENT	AVERAGE ANNUAL DEMAND (MCY)	20-YEAR DEMAND (MCY)	AVAILABLE/PLANNED CAPACITY (MCY)	20 YEAR CAPACITY DEFICIT (-) OR SURPLUS (+)
BALTIMORE HARBOR	1.33	26.6	27.3	+0.7
MARYLAND BAY	1.9	38.3	120.2	+81.9
CHESAPEAKE AND DELAWARE APPROACHES	0.6	12.0	16.6	+4.6
VIRGINIA BAY	0.9	17.9	>157	+ >139.3
TOTAL	4.83	96.8	>320.9	+ >224.3



4.3.5 INLAND WATERWAYS

Beyond the Port of Baltimore, various inland waterways also provide vital goods movement corridors that support Maryland industries. These corridors include the Chesapeake and Delaware Canal, numerous rivers on Maryland's Eastern Shore, and other locations such as the Susquehanna, Patuxent, and Potomac rivers (**Exhibit 4.17**).

EXHIBIT 4.17: MARYLAND KEY INLAND WATERWAYS FOR FREIGHT MOVEMENTS



Chesapeake and Delaware Canal

The busiest of Maryland's inland waterways, the Chesapeake and Delaware Canal (C&D Canal) directly supports vital shipping access to/from the Port of Baltimore. The waterway is maintained by the U.S. Army Corps of Engineers (USACE) Philadelphia District and consists of a channel 35 feet deep and 450 feet wide that connects from Reedy Point on the Delaware River, about 41 miles below Philadelphia, to the Chesapeake Bay.²⁹ Canal access saves ships traversing between Baltimore and Wilmington or Philadelphia about 300 miles, serves about 40% of all ship traffic from the Port of Baltimore, and is one of the nation's most state-of-the-art, high-tech canals with shipping traffic monitored by maritime traffic controllers.³⁰

The C&D Canal traffic varies year-to-year, typically showing 4,500 to more than 11,000 trips annually carrying 8-13 million tons per year. The diversity of commodities moving through the canal are related to the diversity of traffic to/from the Port of Baltimore. Approximately one-third (38%) of canal tonnage consists of heavyweight materials, such as sand and gravel, slag, gypsum, or iron and steel scrap; and one-third (33%) consists of petroleum and petroleum products, including gasoline, kerosene, fuel oils, or asphalt. The remainder consists of various chemicals and related products (15%), manufactured products (7%), coal and lignite (3%), and other miscellaneous products or waste materials.³¹



Eastern Shore Rivers

At least five rivers on Maryland's Eastern Shore actively provide important goods movement connections including, from north to south, the Tred Avon, Choptank, Nanticoke, Wicomico, and Pocomoke rivers. A sixth location along the Chester River may also see intermittent freight traffic, such as the transport of waterway improvement materials, but based on USACE data appears to have had little to no reported freight tonnage in several years. Key issues confronting waterborne commerce on Maryland's Eastern Shore include dredging to maintain adequate channel depths, securing appropriate dredge materials disposal sites, winter icing, the need for truck and rail access improvements, and encroachment of residential development near waterborne industrial facilities. Freight conditions on each river (all based on USACE data³²) include:

- **Tred Avon River (MD)** – Limited river freight averages approximately 150 trips annually carrying more than 72-180 thousand tons per year (2015-2019), hauling almost exclusively sand and gravel. The section includes approximately 2.5 miles from Peachblossom Creek to Easton Point with a channel depth of about 12 feet.
- **Choptank River (MD)** – Since 2015, limited river freight has dropped to approximately 120 trips annually carrying 72-120 thousand tons per year, hauling mostly sand and gravel or coal and lignite. The section includes from the river's mouth to Greensboro with controlling depths of 6 feet to Denton and 3.5 feet to Greensboro.
- **Nanticoke River (MD and DE)** – One of the two busiest rivers on the Eastern Shore, Nanticoke River freight averages more than 700 trips annually carrying more than one million tons per year. Most of the tonnage consists of sand and gravel, but also includes a substantial variety of products for the agriculture and poultry industries including corn, soybeans, wheat, animal feed, and fertilizers. The section includes from the river's mouth to Seaford, DE, and a Northwest Fork to Federalsburg, MD. Maintained depths range from 10.5 to 11.5 feet along the main river, and 3 feet for the Northwest Fork; but are authorized up to 12 feet to Seaford and 6 feet to one-half mile below Federalsburg.
- **Wicomico River (MD)** – One of the two busiest rivers on the Eastern Shore, Wicomico River freight averages more than 1,100 trips annually carrying more than one million tons per year. Most of the tonnage consists of gasoline and fuel oils or sand and gravel, but also includes various alcohols, corn, soybeans, and other miscellaneous materials. The Wicomico River provides a 150-foot-wide channel and access for the Port of Salisbury, MD's second-largest port and the subject of a recent port expansion/feasibility study (see **Section 6.7.6**). The section includes from the river's mouth to Salisbury, MD. Maintained depth of the main river channel is 12 feet, but is authorized up to 14 feet to the Main Street Bridge and in prongs at Salisbury, while various branch channels or basins range from 2 to 10 feet.

- **Pocomoke River (MD)** – The third busiest river on the Eastern Shore, Pocomoke River freight has dropped steadily since 2016 and saw only 167 trips carrying just more than 112 thousand tons in 2019, almost exclusively consisting of sand and gravel. The section includes from the river's mouth to Snow Hill, Maryland with a controlling depth of 8 feet to Snow Hill; 7 feet through the Muds (Pocomoke Sound to Pocomoke River), and 3.4 feet above bridge in Snow Hill.

Other Maryland Rivers

Three additional river corridors in Maryland that are not located on the Eastern Shore include specific connections via the Susquehanna, Patuxent, or Potomac rivers as follows³³:

- **Susquehanna River (above and below Havre De Grace, MD)** – The Susquehanna River freight averages more than 2,500 trips annually carrying 2-3 million tons per year, hauling almost exclusively sand and gravel. The section includes from the river's mouth to Spesutie Narrows, MD with a controlling depth of 15 feet from Chesapeake Bay to Spesutie Narrows, and a project depth of 8 feet above Havre de Grace.
- **Patuxent River (MD)** – Nominal tonnage periodically moves along the Patuxent River, ranging from kerosene to various iron, steel, construction, or waste materials.
- **Potomac River (MD/VA)** – For sections below Washington, D.C., Potomac River freight ranges from approximately 1,800 to more than 3,500 trips annually carrying between 805,000 and more than 1.2 million tons per year. This freight traffic serves both Maryland on the river's northeastern shore and Virginia on the river's opposite shore. The majority of tonnage consists of sand and gravel, distillate fuel oil, and kerosene. However, notable amounts of several other products range from asphalt or coal, to agricultural products, such as soybeans, corn, and wheat, to miscellaneous machinery, aircraft parts, and waste or scrap. The section includes 108 miles from the river's mouth to Giesboro Point at Washington, D.C., with controlling depths from 18.5 feet to 24 feet.



4.4 Air Cargo

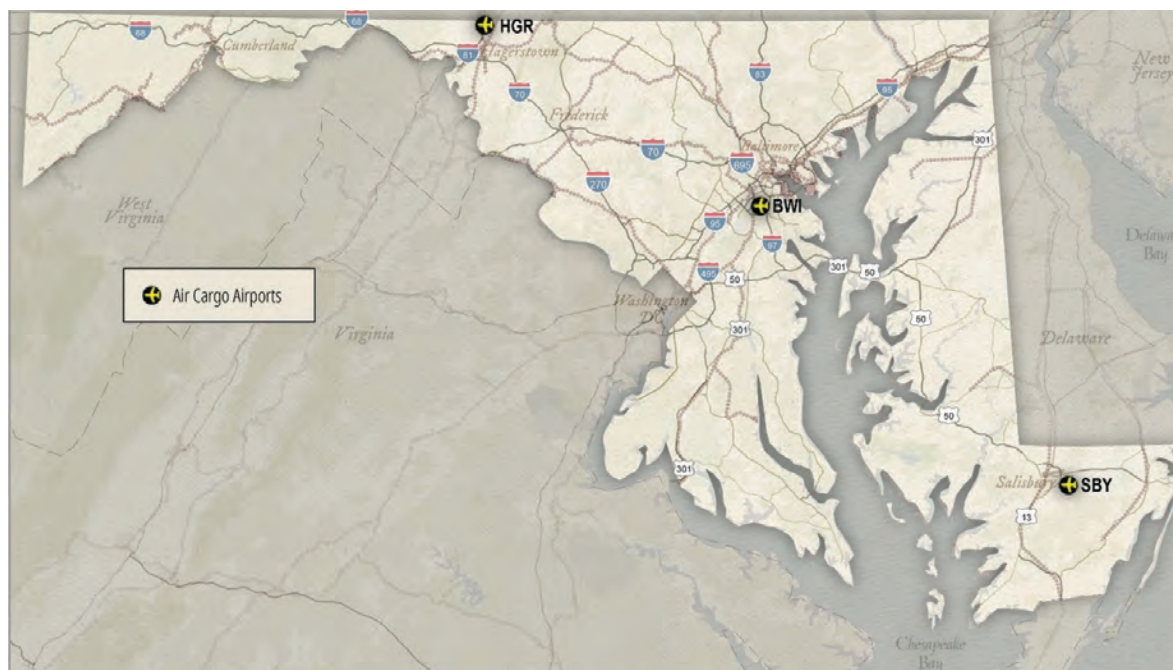
MDOT MAA is responsible for airport regulation in the state and owns and operates two airports: Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall Airport) and Martin State Airport (MTN). There are 35 public-use airports in Maryland; three are capable of cargo shipments including BWI Marshall Airport, Hagerstown (HGR), and Salisbury (SBY) (**Exhibit 4.18**).³⁴ On a much smaller scale, Martin State Airport also periodically handles charter and corporate flights that deliver supplies and materials (e.g., medical supplies) to local businesses.

BWI Marshall Airport is the state's largest cargo airport with a Foreign Trade Zone and two air cargo complexes. The North Cargo Complex includes 395,000 square feet of cargo buildings and a 17-acre air cargo ramp with parking for 17 aircraft with direct nose-in access for 8 freighters.³⁵ The Midfield Cargo Complex includes 260,000 square feet of building space and a 17-acre ramp with 12 aircraft parking positions. The airport serves as a hub within Maryland's extensive transportation network, connecting the state with the nation and strategic world hubs. Advantageously located at the center of a

large metropolitan region, BWI Marshall Airport is linked by MDOT's transportation infrastructure, including interstate highway connections and passenger rail, with easy access to the Port of Baltimore.

Air cargo (including freight and mail) is important in moving high value, time-sensitive shipments. Primary freight commodities shipped from BWI Marshall Airport include machine parts, electrical machinery, aircraft/spacecraft components, seafood, chemicals, and pharmaceutical/biological products. With the expansive growth of e-commerce and online shopping, BWI Marshall Airport has become a significant hub for small package sorting and distribution to last-mile delivery service. The airport is regularly served by several cargo airlines, chartered air cargo service, and passenger airline "belly cargo"; although just the top 10 carriers accounted for almost 99% of the freight transported through BWI Marshall Airport in 2021 (**Exhibit 4.20**).

EXHIBIT 4.18: MARYLAND AIR CARGO AIRPORTS



In 2021, BWI Marshall Airport set its annual cargo record by transporting almost 619 million pounds (**Exhibit 4.19**), which accounted for more than 55% of the freight transported in the U.S. Capital Region.



EXHIBIT 4.19: ANNUAL CARGO (FREIGHT & MAIL) AT BWI MARSHALL AIRPORT (2016-2021)³⁶

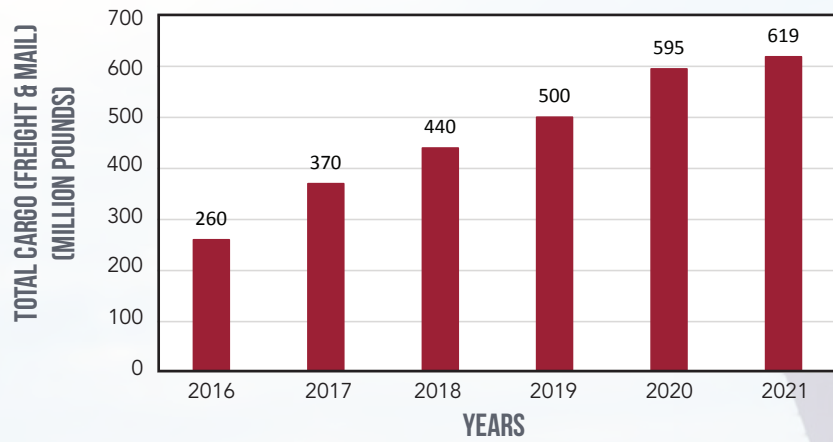


EXHIBIT 4.20: TOP 10 FREIGHT CARRIERS AT BWI MARSHALL AIRPORT (2021)³⁷

TOP 10 FREIGHT CARRIERS	2021 FREIGHT (MILLION POUNDS)	2021 FREIGHT (% OF ANNUAL TOTAL)
AMAZON - ATI	252.7	41.5%
FEDEX	119.6	19.6%
UPS	53.6	8.8%
DHL - SOUTHERN	43.2	7.1%
SOUTHWEST	41.8	6.9%
AMAZON - ABX AIR	32.9	5.4%
AMAZON - ATLAS AIR	21.9	3.6%
ATLAS AIR	15.7	2.6%
DHL - AMERIJET	15.0	2.5%
DHL - ATLAS AIR	5.5	0.9%
ALL OTHER	7.7	1.3%



4.5 Energy Infrastructure

The energy industry in Maryland encompasses power generation, distribution networks for natural gas, oil, and electricity, and renewable energy sources including hydropower, solar, wind, and biomass. The location of energy infrastructure varies across the state with clusters of activity based on resources, plant locations, and transportation links as follows:

- Fossil fuel resources are limited to coalfields in western Maryland. However, the broader movement of coal to Maryland from Pennsylvania, West Virginia, and more distant western states includes substantial coal export activity through the Port of Baltimore.
- Power generation sources in Maryland (**Exhibit 4.21**) include more than 270 operating generators as of June 2021.³⁸ Maryland's only nuclear power plant – the Calvert Cliffs power station in Calvert County – accounts for 38% of the state's utility-scale electricity net generation (**Exhibit 4.22**). By comparison, natural gas-fired generators located mostly through the state's southern and metro regions provide 34%; the state's few remaining coal-fired generators provide 20%; and various renewable sources provide approximately 7%.

- Renewable energy is a focus area for Maryland and sources are more widely distributed. Maryland has 1,300 energy and sustainability businesses across the state, and in 2020 earned the number 6 spot on the State Energy Efficiency Scorecard from the American Council for an Energy-Efficient Economy.³⁹ Renewables include:

- **Biomass** – Almost all of Maryland's currently used biomass resources, primarily landfill gas and municipal solid wastes, are found in the state's most densely populated areas. Other biomass resources come from agriculture, fishing, aquaculture, and forestry.
- **Wind** – The state's greatest wind resources are located in the western mountains through Garrett County, as well as offshore wind project opportunities off Maryland's eastern Atlantic Ocean and southern Chesapeake Bay shorelines.
- **Solar** – Most of Maryland's solar resources are located throughout the eastern two-thirds of the state.
- **Hydropower** – Most of the state's hydropower generation occurs in Harford County via the Susquehanna River, although a small amount is generated in Garrett County in the Deep Creek area.

EXHIBIT 4.21: MARYLAND POWER GENERATION SITES

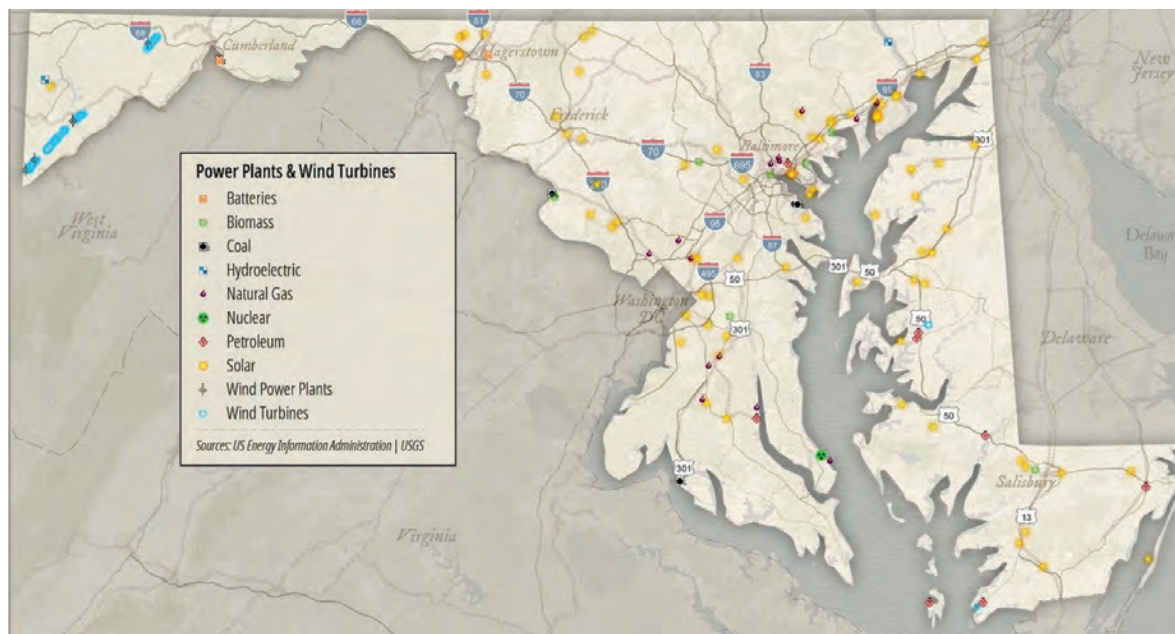
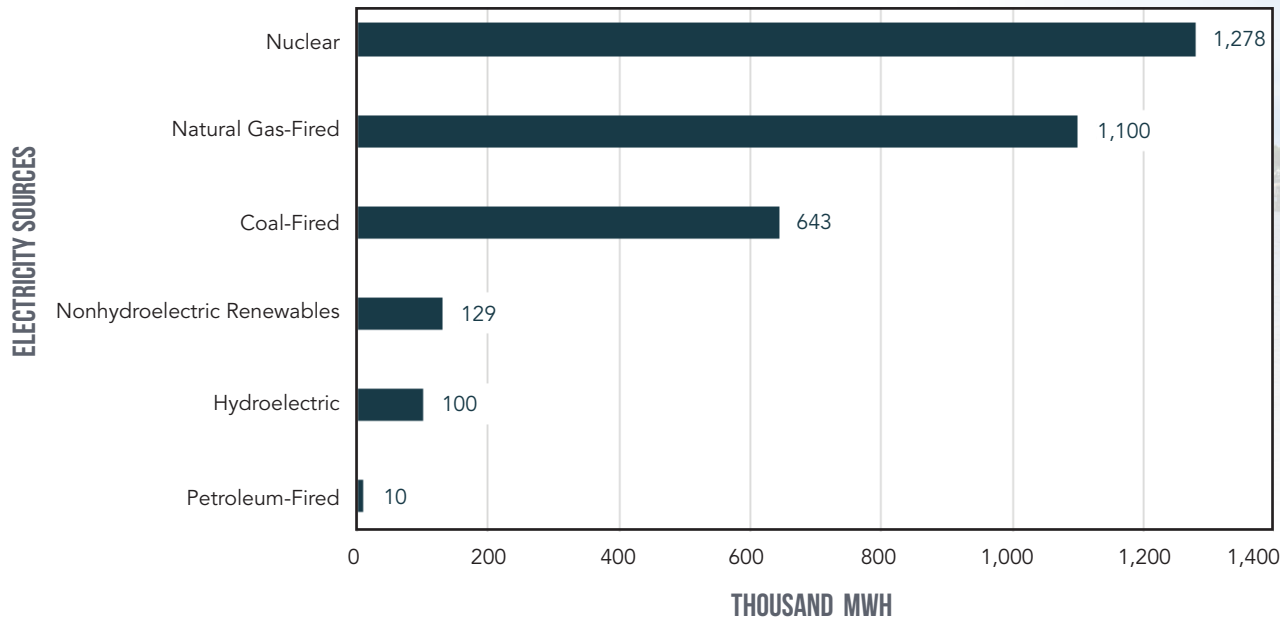


EXHIBIT 4.22: MARYLAND NET ELECTRICITY GENERATION BY SOURCE, JUNE 2021 (THOUSAND MWH)⁴⁰



- No in-state oil/gas refining and processing occurs in Maryland; however, approximately 320 miles of refined product pipelines (**Exhibit 4.23**) pass through the state.⁴¹ These lines include the Colonial Pipeline Company's interstate petroleum product pipeline that crosses northeast through the Washington, D.C. and Baltimore metro regions.
- Natural gas usage in Maryland relies on approximately 996 miles of natural gas transmission pipelines and 15,162 miles of natural gas distribution pipelines.⁴² These lines (**Exhibit 4.23**) fall under multiple operating jurisdictions including:
 - Texas Eastern Transmission Company in Garrett County
 - Columbia Gas Transmission Company through the Cumberland area
 - Dominion Transmission Company through the Hagerstown area
 - Transcontinental Gas Pipeline and Columbia Gas Transmission Company running northeast through the Washington, D.C. and Baltimore metro regions
- Cove Point Pipeline running from the Washington, D.C. area toward Dominion Energy's Cove Point LNG import/export terminal in Calvert County
- Eastern Shore Natural Gas Company into Caroline, Talbot, Dorchester, Wicomico, and Worcester counties on Maryland's Eastern Shore
- Key transportation and storage links (**Exhibit 4.24**) include crude oil rail terminals and petroleum product terminals in Baltimore and throughout the Port of Baltimore, as well as petroleum product terminals at Piney Point in St. Mary's County, and in Salisbury in Wicomico County on Maryland's Eastern Shore. LNG imports and exports also funnel through the Cove Point LNG terminal in Lusby in Calvert County.

EXHIBIT 4.23: MARYLAND PIPELINE NETWORKS

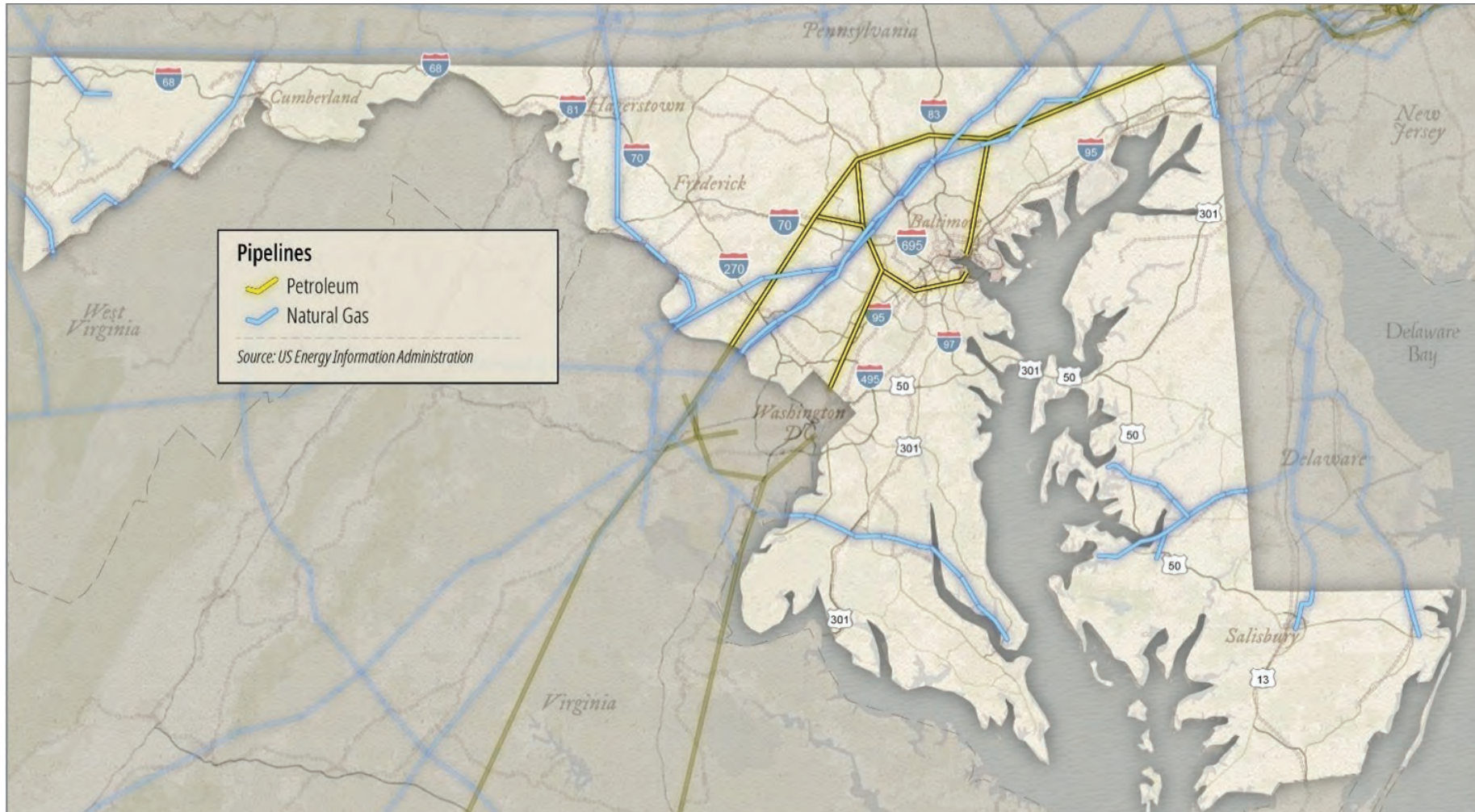
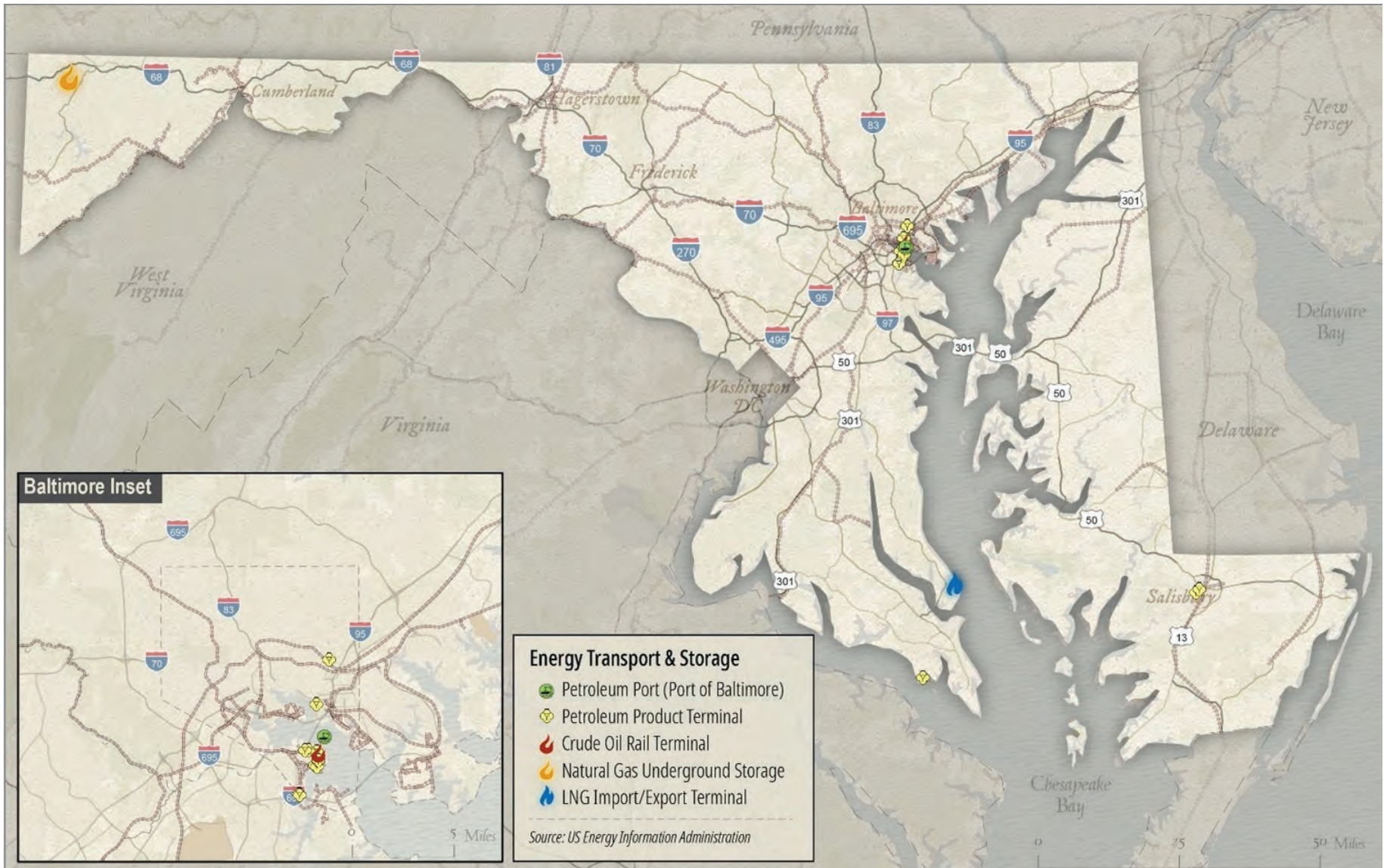


EXHIBIT 4.24: MARYLAND ENERGY STORAGE AND TERMINAL SITES

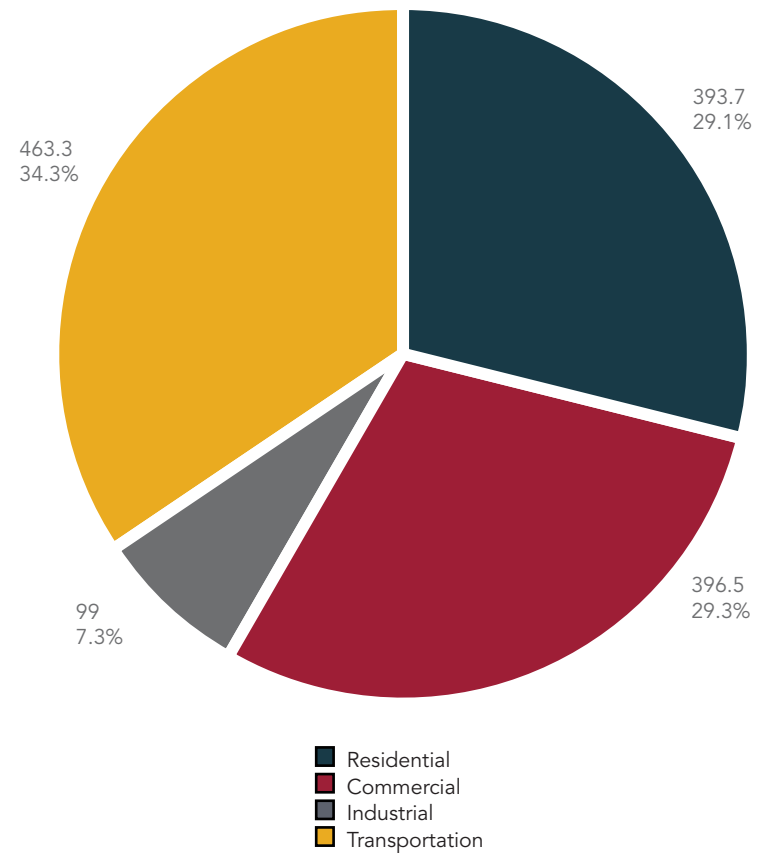


Overall, Maryland's per capita energy consumption and expenditure rank among the lowest in the nation at 42nd and 47th, respectively (**Exhibit 4.25**). About one-third (each) of Maryland's energy is consumed by the transportation (34%), residential (29%), and commercial (29%) sectors, with the remainder (7%) in the industrial sector (**Exhibit 4.26**).⁴³

EXHIBIT 4.25: MARYLAND ENERGY RANKINGS (2019)⁴⁴

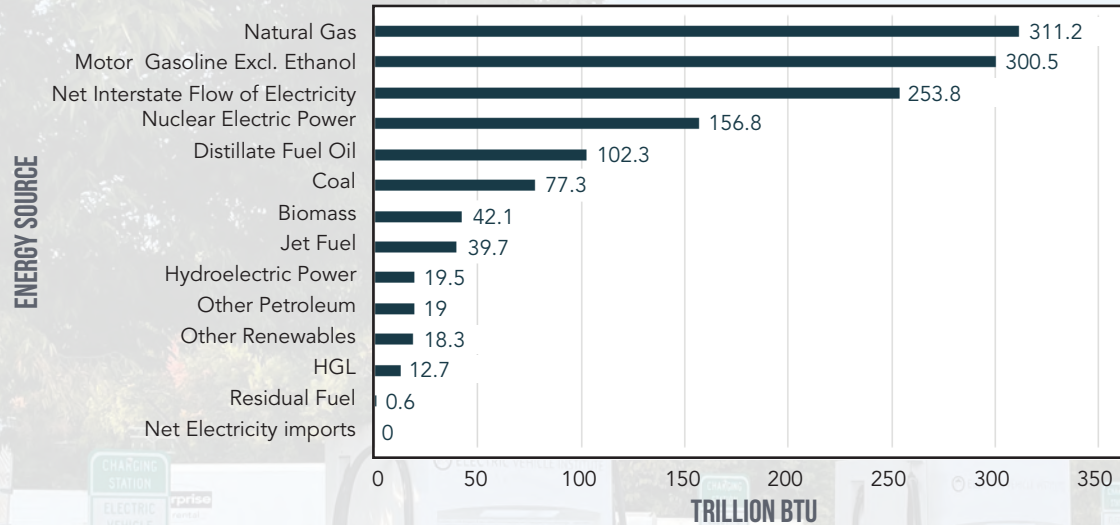
CATEGORY	U.S. RANKING	VALUE
PER CAPITA ENERGY RANKINGS		
TOTAL ENERGY CONSUMED PER CAPITA	42 nd	223 million BTU
TOTAL ENERGY EXPENDITURES PER CAPITA	47 th	\$3,211
MARYLAND ENERGY PRODUCTION		
TOTAL ENERGY PRODUCTION	39 th	247 trillion BTU
FROM CRUDE OIL	n/a	0.0 barrels per day
FROM NATURAL GAS	31 st	10 million cubic feet
FROM COAL	19 th	1,471 thousand short tons
FROM ELECTRICITY	38 th	3,295 thousand MWh

EXHIBIT 4.26: MARYLAND ENERGY CONSUMPTION BY END-USE SECTOR, 2018 (TRILLION BTU)⁴⁵



Among these sectors, the consumption by source in transportation is dominated by motor gasoline, while other sectors largely encompass natural gas, interstate electric flows, nuclear electric power, and other power sources (**Exhibit 4.27**). However, relative to the transportation sector, it is worth noting that Electric Vehicle (EV) usage and supporting infrastructure in Maryland are growing considerably (see text box below).

EXHIBIT 4.27: MARYLAND ENERGY CONSUMPTION BY SOURCE, 2019 (TRILLION BTU)⁴⁶



Maryland EV Infrastructure

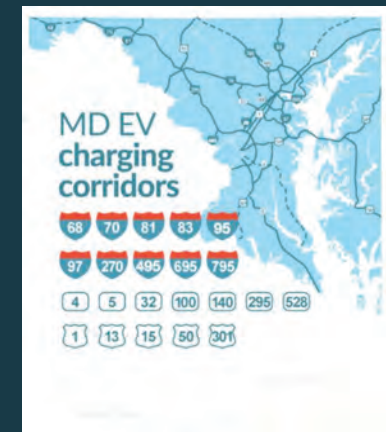
MDOT is actively collaborating on and sharing information and research that support EV technologies and infrastructure to improve safety, mobility, community prosperity, connectivity, and quality of life. As of November 2021, Maryland has 22 EV charging corridors with 1,101 charging stations, 2,908 charging outlets, and almost 40,600 registered EVs. Additional details and resources are available online at:

MDOT Electric Vehicles: www.mdot.maryland.gov/EV

Maryland EV: <https://marylandev.org/>

Maryland Zero Emission Vehicle Infrastructure Plan: evplan.mdot.maryland.gov/

Maryland Zero Emission EV Infrastructure Council (ZEEVIC): <https://mdot.maryland.gov/zeevic>



4.6 Multimodal Freight Network

The FAST Act required the USDOT to establish a National Multimodal Freight Network (NMFN) that identifies significant transportation assets for freight movement.⁴⁷ Initial public comment periods related to the Interim NMFN identified two key areas for the USDOT to address including:

1. Increasing the highway component of the NMFN, and
2. Clarity on the purpose of the NMFN and the relevance of having routes/facilities on the network.

The USDOT has indicated that “Following the release of the [2020] NFSP, the Department intends to designate the final NMFN, incorporating comments received from stakeholders on the Interim NFMN.”⁴⁸ As such, ongoing refinements or revisions to potential formal multimodal network designations, including applicable facilities throughout Maryland, should be anticipated. Until the clarification and release of a final federally designated NMFN, a broader overview of Maryland’s multimodal freight network can provide connectivity insights based on a combination of the Interim NMFN and by overlaying the individual roadway, railroad, port/waterway, air cargo, and key freight junctions summarized in the prior sections.

Multimodal freight network perspectives align with key MDOT strategies to deliver transportation programs and services that support freight logistics and multimodal transportation options. Freight transportation via all modes must support Maryland’s key industry sectors as well as international cargo flows through the supply chain via critical hubs such as the Port of Baltimore and BWI Marshall Airport. Beyond state-specific interests, multimodal freight perspectives also support broader USDOT guiding principles and National Freight Policy goals that include a focus on prioritizing projects that improve freight intermodal connectivity and enhance freight flows on first/last-mile connections and at major trade gateways.⁴⁹ These perspectives also influence the state’s designation of multimodal critical rural freight facilities per State Freight Plan Requirements outlined by the FAST Act and IJA.

National Multimodal Freight Network

Per **49 USC §70103**, the USDOT published an Interim NMFN on June 6, 2016 that included:

- The **National Highway Freight Network**;
- **Class I freight rail** systems;
- **Public ports** with total foreign and domestic trade of more than **2 million short tons**;
- The **inland and intracoastal waterways** of the United States, the Great Lakes, St. Lawrence Seaway, coastal, and open-ocean waterways;
- The **top 50 airports** with the highest annual landed weight; and
- **Other strategic assets**, initially defined to include approximately 9,000 miles of Class II and III railroads, three ports designated as commercially strategic by the Department of Defense, and six additional airports.

With these perspectives in mind, Maryland's multimodal freight network is summarized in **Exhibit 4.28**. This network includes the NMFN and other significant highway freight routes throughout Maryland, the state's railroad network, key freight airports, the Port of Baltimore, and the inland waterway systems as detailed in prior sections. It also includes a listing of multimodal critical rural freight facilities (**Exhibit 4.29**) based on FAST Act and IIJA criteria (see sidebar). These facilities were identified in conjunction with the prior iteration of Maryland's state freight plan based on an overlay and review of key freight routes and facilities in comparison to USDOT's initial Interim NMFN.

Viewing Maryland's overall freight network from a multimodal perspective will help to support the subsequent consideration and development of multimodal improvement strategies; partnership or collaboration opportunities; and local, regional, or megaregional connectivity needs and opportunities. Such perspectives will help to serve growing regions throughout Maryland as markets shift or expand, as freight demands increase, and as overall multimodal freight connectivity and accessibility needs evolve, particularly in light of future bottlenecks or congestion that may influence freight mobility issues.

Multimodal perspectives are also a critical element of multijurisdictional freight planning such as may be involved with broader transportation coalitions including the *I-81 Corridor Coalition*⁵⁰ or *The Eastern Transportation Coalition*⁵¹ (TETC). These coalitions can help to coordinate and collaborate on studies affecting intermodal congestion, bottlenecks, or other freight-related concerns along major multistate corridors including I-81 and I-95. Examples include TETC's M-95 Marine Highway Corridor sponsorship that aims to advance the utilization of coastal and inland waterways within the I-95 Corridor region all along the Atlantic coast.⁵²

Multimodal Critical Rural Freight Facilities

Following requirements in **49 USC §70103(c)(4)**, a state may propose additional designations for the NMFN by designating a freight facility or corridor within the borders of the state as a critical rural freight facility or corridor if it meets the following:

- is a **rural principal arterial**;
- provides access or service to **energy** exploration, development, installation, or production areas;
- provides access or service to a **grain** elevator, **agricultural** facility, **mining** facility, **forestry** facility, or **intermodal** facility;
- connects to an **international port** of entry;
- provides **access** to a significant air, rail, water, or other freight facility in the state; or
- has been determined by the state to be vital to improving the efficient movement of freight of importance to the **economy** of the state.

EXHIBIT 4.28: MARYLAND MULTIMODAL FREIGHT NETWORK

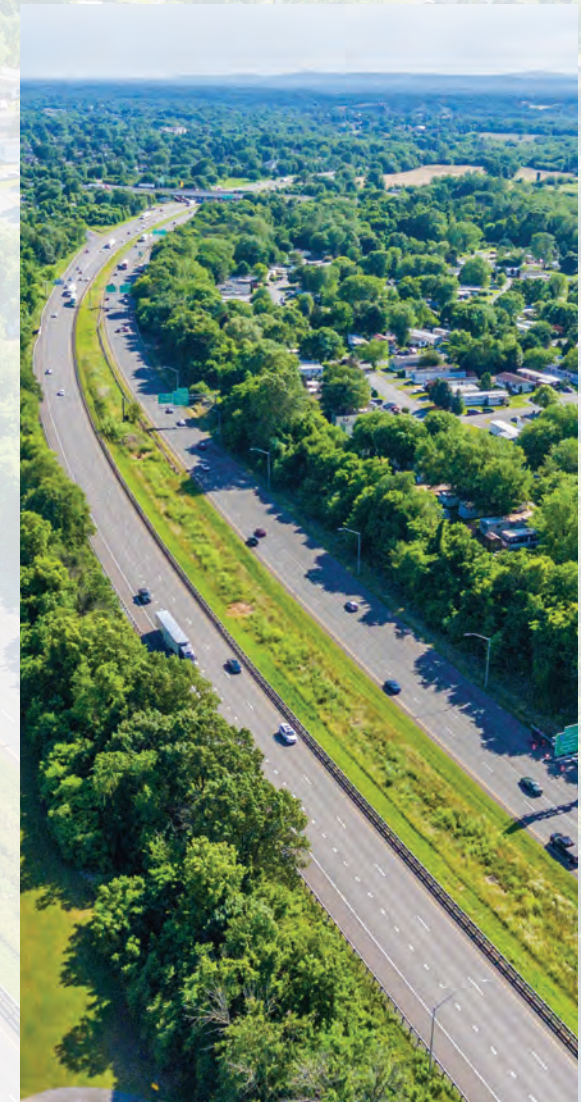
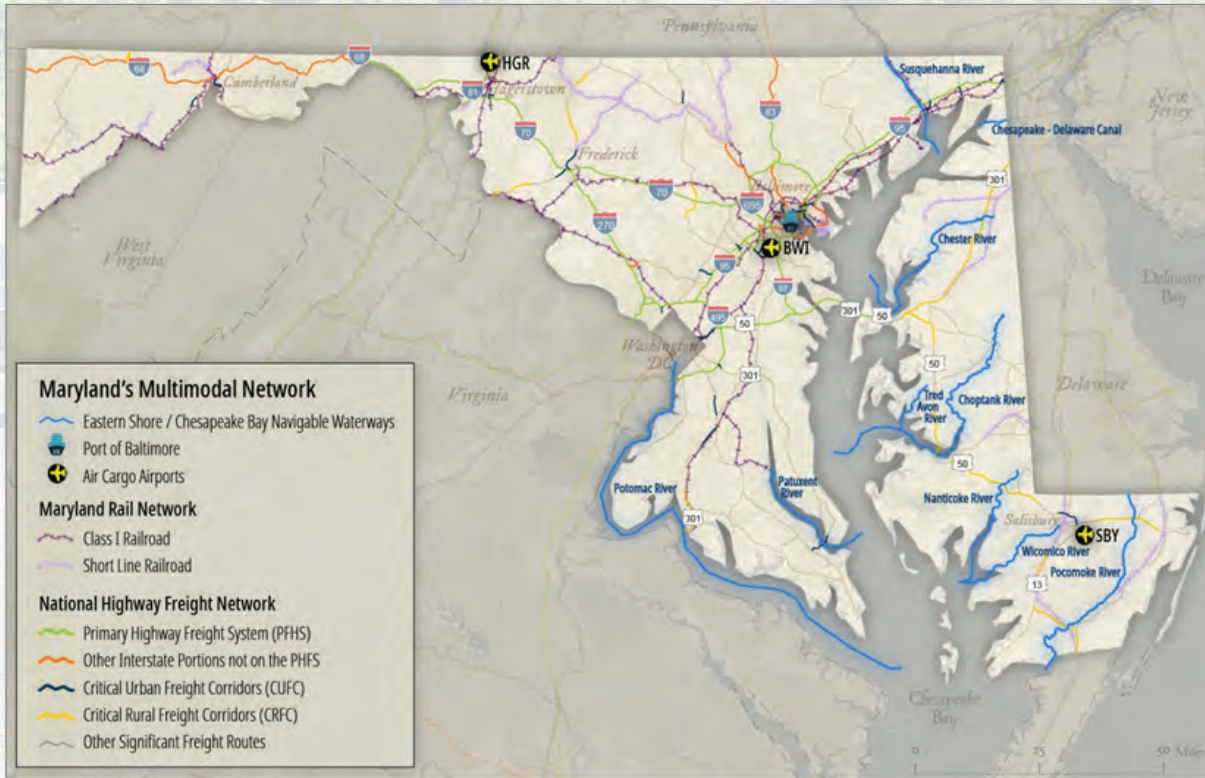


EXHIBIT 4.29: MULTIMODAL CRITICAL RURAL FREIGHT FACILITIES

REGION	FREIGHT FACILITY	ROADWAY
WESTERN MARYLAND (CUMBERLAND AREA)	Greater Cumberland Regional (CBE) CSX Other Railroads	I-68
CENTRAL MARYLAND (HAGERSTOWN AREA)	Hagerstown Regional (HGR) Norfolk Southern CSX Other Railroads BWI Marshall Airport	I-81, I-70, US 340, US 40, I-270, I-695
EASTERN SHORE	Port of Salisbury Salisbury-Ocean City Wicomico Regional Norfolk Southern	US 13, US 50, US 301

ENDNOTES

1. Includes 996 miles of natural gas transmission pipelines, 15,162 miles of natural gas distribution pipelines, and 320 miles of refined product pipelines per the U.S. Department of Energy, State of Maryland Energy Sector Risk Profile, March 2021, <https://www.energy.gov/ceser/state-and-regional-energy-risk-profiles>.
2. MDOT SHA, Structurally Deficient Bridges on the Maryland State Highway System, March 15, 2018, https://www.roads.maryland.gov/OBD/SHA_Structurally_Deficient_Bridges.pdf.
3. Based on FHWA Freight Analysis Framework (FAF5) data and excluding through-freight; see details per previous Chapter 3.1.
4. Data sourced from MDOT SHA, 2019 Mileage Reports, https://www.roads.maryland.gov/OPPEN/2019_Mileage_Reports.pdf.
5. Data sourced from FHWA, National Highway Freight Network Map and Tables for Maryland, last modified February 1, 2017, https://ops.fhwa.dot.gov/freight/infrastructure/ismt/state_maps/states/maryland.htm
6. Ibid.
7. Ibid.
8. Railroad classifications are based on annual operating revenues, adjusted for inflation, with thresholds and factors outlined by the Surface Transportation Board (<https://stb.gov/reports-data/economic-data/>) with reference to 49 C.F.R. §1201.
9. Based on FHWA Freight Analysis Framework (FAF5) data and excluding through-freight; see details per previous Chapter 3.1.
10. Data Sourced from MDOT, Maryland State Rail Plan, 2022, based on FHWA FAF4 data compilations.
11. Surface Transportation Board, Annual Report Financial Data 2020, R-1 Reports (Schedule 702) for CSX and NS Railroads, accessed October 7, 2021, <https://stb.gov/reports-data/economic-data/annual-report-financial-data/>.
12. Canton Railroad Company, <http://cantonrr.com/>.
13. Carload Express, Delmarva Central Railroad, <https://www.carloadexpress.com/railroads/delmarva-central-railroad/>.
14. Maryland & Delaware Railroad, <http://mdde.com/>.
15. Maryland Midland Railway, <https://www.gwrr.com/mmid/>.
16. Tradepoint Rail, <https://www.tradepointatlantic.com/rail/>.
17. OminTRAX, Winchester and Western Railroad Company, <https://omnitrax.com/our-company/our-railroads/winchester-and-western-railroad-company/>.
18. Larry, Greg, "County moving forward on trail project", Cumberland Times-News, November 27, 2020, https://www.times-news.com/news/local_news/county-moving-forward-on-trail-project/article_1dad4e22-2f58-11eb-8c94-7366c470c3a2.html.
19. MDOT, Maryland State Rail Plan, 2022.
20. Ibid.
21. Maryland Port Administration, Howard Street Tunnel Project, accessed October 7, 2021, <https://mpa.maryland.gov/pages/hst.aspx>. Funding data as given by MDOT TSO on November 5, 2021.
22. Maryland Port Administration.
23. Data sourced from USACE Waterborne Tonnage for Principal U.S. Ports (2019), <https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/6753>.
24. Maryland Port Administration, Port of Baltimore Map of Terminals, provided December 10, 2021.
25. Data sourced from Maryland Port Administration.
26. Ibid.
27. Port of Baltimore Dredging data as given by MDOT MPA, June 30, 2021. See also Port of Baltimore, Dredged Material Management Program (DMMP) website, <https://maryland-dmmp.com/>, and related MDOT MPA DMMP Annual Report, 2021, <https://maryland-dmmp.com/wp-content/uploads/2021/12/DMMP-Annual-Report-2021-12.3.21.pdf>.
28. Maryland Port Administration, 2019 Dredged Material Management Program Annual Report. Social media data as given by MDOT MPA on November 16, 2021.
29. USACE, <https://www.nap.usace.army.mil/Missions/Civil-Works/Chesapeake-Delaware-Canal/>.
30. MacArthur, Ron, "C&D Canal among busiest in nation", Cape Gazette, July 22, 2020, <https://www.capegazette.com/blog-entry/cd-canal-among-busiest-nation/205536>.
31. USACE, Waterborne Commerce of the United States (WCUS) Ports and Waterways Web Tool, based on 2015-2019 data accessed October 8, 2021, <https://www.iwr.usace.army.mil/About/Technical-Centers/WCSC-Waterborne-Commerce-Statistics-Center-2/WCSC-Waterborne-Commerce/>.
32. Ibid.
33. Ibid.
34. Airport Data as given by MDOT MAA on November 5, 2021.
35. Ibid.

36. BWI Marshall Airport, Statistics, based on calendar year performance comparisons from December Monthly Statistical Report Summaries, **2016-2021**, <https://www.bwiairport.com/flying-with-us/about-bwi/statistics>.
37. Ibid.
38. U.S. EIA, Form EIA-860M – Monthly Update to Annual Electric Generator Report, June 2021, <https://www.eia.gov/electricity/data/eia860m/>.
39. Maryland Marketing Partnership, Maryland Energy & Sustainability, accessed September 17, 2021, <https://open.maryland.gov/industries/energy-sustainability/>.
40. Data sourced from U.S. EIA, Maryland State Profile and Energy Estimates, 2019, <https://www.eia.gov/state/?sid=MD>.
41. U.S. Department of Energy, State of Maryland Energy Sector Risk Profile, March 2021, <https://www.energy.gov/ceser/state-and-regional-energy-risk-profiles>.
42. Ibid.
43. U.S. EIA, Maryland State Energy Profile, October 15, 2020, <https://www.eia.gov/state/print.php?sid=MD>.
44. See Endnote 40.
45. Ibid.
46. Ibid.
47. USDOT, National Freight Strategic Plan, 2020, p. 12, <https://www.transportation.gov/freight/NFSP>.
48. Ibid.
49. USDOT, National Freight Strategic Plan, 2020, pp. 84-85, <https://www.transportation.gov/freight/NFSP>.
50. I-81 Corridor Coalition, <https://www.i-81coalition.org/>.
51. The Eastern Transportation Coalition, <https://tetcoalition.org/>.
52. The Eastern Transportation Coalition, M-95 Marine Highway Corridor, <https://tetcoalition.org/projects/m-95-marine-highway-corridor/>.

SECTION 5 FREIGHT SYSTEM PERFORMANCE, TRENDS, AND NEEDS

SECTION TABLE OF EXHIBITS

Exhibit 5.1: Maryland Freight Performance Measures (Summary List and General Sources) _____	5-2
Exhibit 5.2: Maryland Freight Performance Measures (Safety, Security, and Resilience) _____	5-5
Exhibit 5.3: Maryland Freight Performance Measures (Economic Opportunity and Efficiency) _____	5-7
Exhibit 5.4: Maryland Freight Performance Measures (System Preservation and Modernization) _____	5-9
Exhibit 5.5: Maryland Freight Performance Measures (Quality of Service, Efficiency, and Customer Experience) _____	5-11
Exhibit 5.6: Maryland Freight Performance Measures (Environmental Protection and Sensitivity) _____	5-13
Exhibit 5.7: Maryland Freight Performance Measures (Fiscal Responsibility) _____	5-15
Exhibit 5.8: Maryland Freight Performance Measures (Transportation Choices and Connections) _____	5-16
Exhibit 5.9: Maryland Regional Freight Needs Summary _____	5-18
Exhibit 5.10: Maryland Summary Freight Needs by Goal _____	5-20

SECTION TABLE OF CONTENTS

5 FREIGHT SYSTEM PERFORMANCE, TRENDS, AND NEEDS _____	5-2
5.1 Freight Performance Measures _____	5-2
5.1.1 Safety, Security, and Resilience _____	5-5
5.1.2 Economic Opportunity and Efficiency _____	5-7
5.1.3 System Preservation and Modernization _____	5-9
5.1.4 Quality of Service, Efficiency, and Customer Experience _____	5-11
5.1.5 Environmental Protection and Sensitivity _____	5-13
5.1.6 Fiscal Responsibility _____	5-15
5.1.7 Transportation Choices and Connections _____	5-16
5.2 Agency and Stakeholder Perspectives _____	5-17
5.3 Summary Freight Needs – Regional Perspectives _____	5-18
5.4 Summary Freight Needs – Statewide Perspectives _____	5-20



5 FREIGHT SYSTEM PERFORMANCE, TRENDS, AND NEEDS

Maryland is a nationally and regionally significant crossroads for freight movement, so addressing performance trends, needs, and issues is vital to keeping its freight system efficient and reliable. This section of the freight plan summarizes statewide freight performance using data, outreach perspectives, and regional freight insights to help identify notable trends, needs, or issues. The specific data and outreach driven findings here in **Section 5** are supplemented by broader exploration of freight focus areas and programs in **Section 6** to collectively support an overall assessment of Maryland's freight system. These assessments, in turn, help to inform the project and strategy-related action plans in **Section 7** and **Section 8**.

5.1 Freight Performance Measures

Maryland values tracking performance of the transportation network to engage in process improvement and to provide a better experience for all transportation system users. These efforts include freight performance measures that have evolved since 2012 in relation to new data resources and the state's ongoing freight planning initiatives. These measures provide insight into how the freight transportation system is reacting as freight movement patterns or volumes change, or as strategies and tactics are put into place. They also work holistically alongside other performance reporting efforts currently used at MDOT, including:

- MDOT Annual Attainment Report (AR) on Transportation System Performance¹;
- MDOT Transportation Asset Management Plan (TAMP)²;
- MDOT Managing for Results (MFR) Program³;
- MAP-21 performance measures required per federal Transportation Performance Management (TPM) Policy⁴; and
- Other MDOT TBU performance programs.

The subset of freight system performance measures compiled in this plan (**Exhibit 5.1**) is intended to further an understanding of freight needs and benefits and create a common point of reference for subsequent discussion of improvements.

It is important to note that performance measures – no matter how sophisticated – can never tell a complete story of how the freight system is operating and cannot substitute for detailed analysis of freight operations and planning. Such analysis may draw from a much broader pool of knowledge founded in extensive data resources, relevant plan references, and overall agency, stakeholder, public, and freight transportation system user insights. Therefore, the continued and enhanced use and reporting of freight performance measures as summarized by goal area in this section of the freight plan is just one key feature of the plan's strategic direction that provides a snapshot of baseline and current conditions.

EXHIBIT 5.1: MARYLAND FREIGHT PERFORMANCE MEASURES (SUMMARY LIST AND GENERAL SOURCES)

FREIGHT PERFORMANCE MEASURE <i>(see Sections 5 and 6 for data and trend details)</i>	GENERAL SOURCE <i>(see endnotes for source details)</i>
GOAL: SAFETY, SECURITY, AND RESILIENCE	
CRASHES INVOLVING HEAVY TRUCKS WITH FATALITIES	NHTSA FARS ⁵
CRASHES INVOLVING HEAVY TRUCKS WITH INJURIES	Maryland Open Data Portal ⁶
LANE CLOSURES DUE TO FATAL CRASHES INVOLVING HEAVY TRUCKS	MDOT SHA ⁷
COMMERCIAL VEHICLE SAFETY INSPECTIONS	MDOT SHA MCD ⁸
TRUCK PARKING SPACES/FACILITIES (PUBLIC)	MD Statewide Truck Parking Study ⁹
TRUCK PARKING SPACES/FACILITIES (PRIVATE)	MD Statewide Truck Parking Study ¹⁰
CRASHES AT HIGHWAY-RAIL CROSSINGS	FRA ¹¹
CRASHES AT HIGHWAY-RAIL CROSSINGS WITH INJURIES OR FATALITIES	FRA ¹²
HAZARDOUS MATERIAL RELEASE INCIDENTS	PHMSA ¹³
GOAL: ECONOMIC OPPORTUNITY AND EFFICIENCY	
FREIGHT ORIGINATING AND TERMINATING IN MARYLAND (TONNAGE)	FHWA FAF, MDOT AR ¹⁴
FREIGHT ORIGINATING AND TERMINATING IN MARYLAND (VALUE)	FHWA FAF, MDOT AR ¹⁵
PORT OF BALTIMORE FOREIGN CARGO TONNAGE	MDOT AR ¹⁶
MDOT MPA GENERAL CARGO TONNAGE	MDOT AR ¹⁷
RAIL CARLOADS ORIGINATING IN MARYLAND	AAR State Rankings ¹⁸
RAIL CARLOADS TERMINATING IN MARYLAND	AAR State Rankings ¹⁹
TOTAL CARGO (FREIGHT & MAIL) AT BWI MARSHALL AIRPORT	BWI Marshall Airport ²⁰
STATEWIDE TOTAL CONGESTION COST ON FREEWAYS/EXPRESSWAYS	MDOT SHA Mobility Report ²¹
FREIGHT CONGESTION COST ON FREEWAYS/EXPRESSWAYS	MDOT SHA Mobility Report ²²
MARYLAND TOP 100 TRUCK BOTTLENECK CONGESTION COSTS	MDOT SHA MRPT ²³
MARYLAND TOP 100 TRUCK BOTTLENECK DELAY	MDOT SHA MRPT ²⁴

EXHIBIT 5.1: MARYLAND FREIGHT PERFORMANCE MEASURES (SUMMARY LIST AND GENERAL SOURCES) CONT.

FREIGHT PERFORMANCE MEASURE <i>(see Sections 5 and 6 for data and trend details)</i>	GENERAL SOURCE <i>(see endnotes for source details)</i>
GOAL: SYSTEM PRESERVATION AND MODERNIZATION	
VEHICLES WEIGHED INCLUDING VWS	MDOT SHA MCD ²⁵
OVERWEIGHT VEHICLES	MDOT SHA MCD ²⁶
MARYLAND ONE PERMIT SYSTEM – ALL MOVES ≥ 120K	MDOT SHA MCD ²⁷
MARYLAND ONE PERMIT SYSTEM – PORT MOVES	MDOT SHA MCD ²⁸
MARYLAND ONE PERMIT SYSTEM – SUPERLOADS	MDOT SHA MCD ²⁹
MARYLAND SHA NETWORK IN OVERALL PREFERRED MAINTENANCE CONDITION	MDOT AR ³⁰
OVERALL ACCEPTABLE PAVEMENT CONDITION (RIDE QUALITY)	MDOT AR ³¹
NUMBER (AND PERCENT) OF BRIDGES IN POOR CONDITION	MDOT AR ³²
DREDGED MATERIAL PLACEMENT CAPACITY REMAINING (HARBOR)	MDOT AR ³³
DREDGED MATERIAL PLACEMENT CAPACITY REMAINING (POPLAR ISLAND)	MDOT AR ³⁴
GOAL: QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE	
MARYLAND ONE PERMIT SYSTEM – TOTAL PERMITS ISSUED	MDOT SHA MCD ³⁵
MARYLAND ONE PERMIT SYSTEM – AUTO-ISSUED PERMITS	MDOT SHA MCD ³⁶
ANNUAL HOURS OF DELAY FOR TRUCKS	MDOT AR ³⁷
TRUCK TRAVEL TIME RELIABILITY INDEX (TTTR)	MDOT AR ³⁸
TRUCK MOBILITY AROUND THE PORT OF BALTIMORE	TTI SUMA Tool ³⁹
TRUCK MOBILITY COST AROUND THE PORT OF BALTIMORE	TTI SUMA Tool ⁴⁰
AVERAGE TRUCK TURN TIME AT SEAGIRT MARINE TERMINAL	MDOT AR ⁴¹

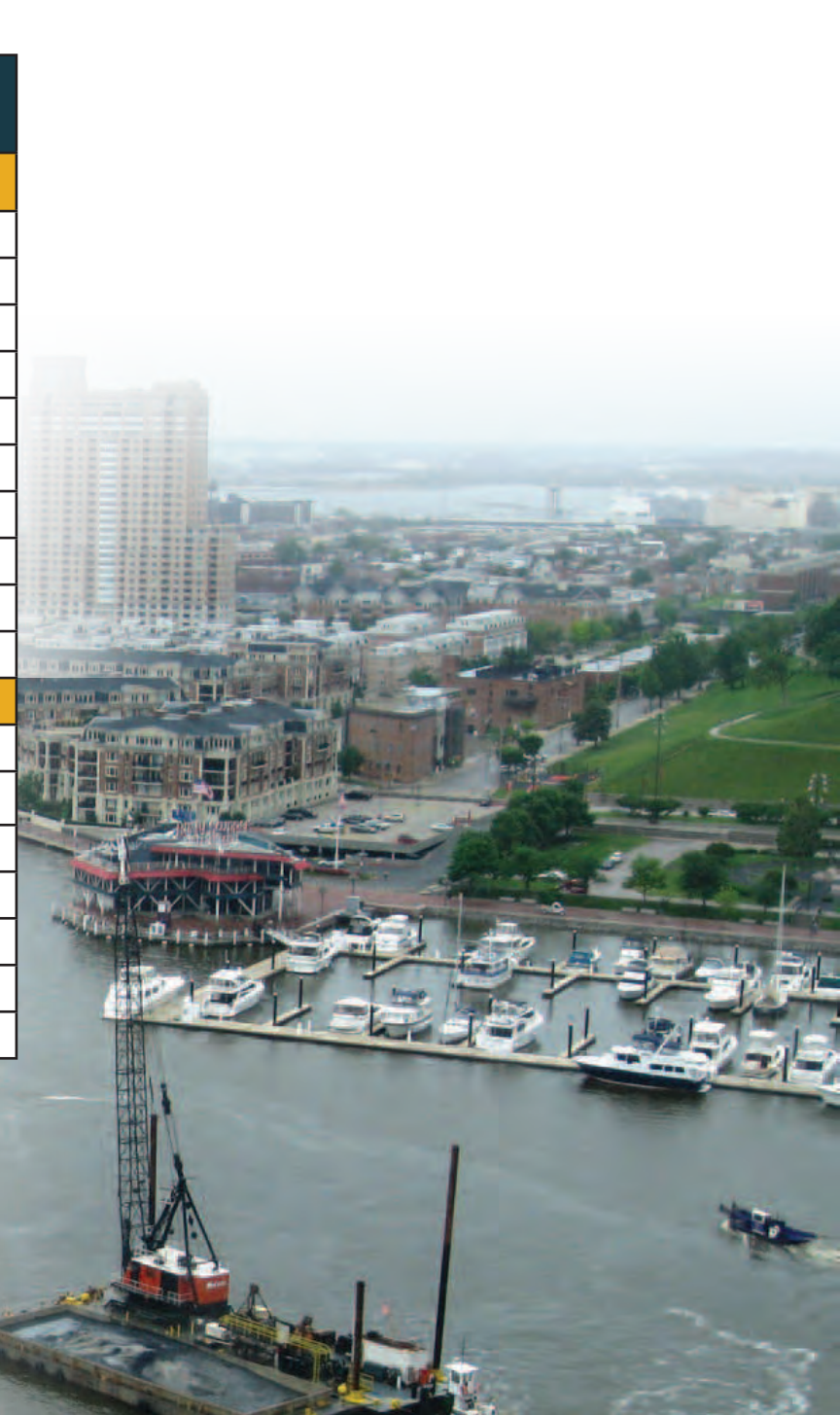


EXHIBIT 5.1: MARYLAND FREIGHT PERFORMANCE MEASURES (SUMMARY LIST AND GENERAL SOURCES) CONT.

FREIGHT PERFORMANCE MEASURE <i>(see Sections 5 and 6 for data and trend details)</i>	GENERAL SOURCE <i>(see endnotes for source details)</i>
GOAL: ENVIRONMENTAL PROTECTION AND SENSITIVITY	
WASTED FUEL AMOUNT FOR TRUCKS	MDOT SHA Mobility Report, EIA ⁴²
WASTED FUEL COST FOR TRUCKS	MDOT SHA Mobility Report ⁴³
FREIGHT EMISSIONS COST	MDOT SHA Mobility Report ⁴⁴
CONGESTED CO _{2e} ON THE MARYLAND FREIGHT NETWORK	MDOT SHA MRPT ⁴⁵
CONGESTED CO _{2e} ON CRITICAL RURAL FREIGHT CORRIDORS	MDOT SHA MRPT ⁴⁶
CONGESTED CO _{2e} ON CRITICAL URBAN FREIGHT CORRIDORS	MDOT SHA MRPT ⁴⁷
MID-ATLANTIC DRAY TRUCK REPLACEMENT PROGRAM	MDOT MPA ⁴⁸
GOAL: FISCAL RESPONSIBILITY	
USER COST SAVINGS FOR THE TRAVELING PUBLIC DUE TO INCIDENT MANAGEMENT	MDOT AR ⁴⁹
USER COST SAVINGS FOR THE TRAVELING PUBLIC DUE TO CAPITAL PROJECTS	MDOT SHA Mobility Report ⁵⁰
GOAL: TRANSPORTATION CHOICES AND CONNECTIONS	
TRUCK TRAVEL ON THE MARYLAND FREIGHT NETWORK	MDOT SHA MRPT ⁵¹
RAIL MILES IN MARYLAND – CLASS I	MD Rail Plan, AAR State Data ⁵²
RAIL MILES IN MARYLAND – CLASS II (REGIONAL)	MD Rail Plan, AAR State Data ⁵³
RAIL MILES IN MARYLAND – CLASS III (SHORT LINE)	MD Rail Plan, AAR State Data ⁵⁴
NONSTOP AIRLINE MARKETS SERVED BY BWI MARSHALL AIRPORT	MDOT AR ⁵⁵

Data Years and Trend Assumptions:

The freight performance measures and trends in this freight plan generally focus on a timeframe spanning approximately 2015-2020. However, data availability, update cycles, and other factors varied considerably across the range of resources used to assess the many different aspects of Maryland's freight performance. Additionally, circumstances such as a change in datasets, creation of newer assessment tools, or (very notably) the influence of the COVID-19 pandemic have made it difficult to stick to just one consistent timeframe. As such, the specific years indicated for each of the performance results throughout this plan vary considerably with the intent of selecting data and timeframes that would most appropriately reflect current or anticipated trends.

5.1.1 SAFETY, SECURITY, AND RESILIENCE

Freight performance data relating to safety, security, and resilience conditions in Maryland generally imply steady or improving conditions. However, some challenges are evident and will continue to be monitored, such as those related to crashes involving heavy trucks or highway-rail grade crossings. Highlights are summarized in Exhibit 5.2 and the notes that follow.



EXHIBIT 5.2: MARYLAND FREIGHT PERFORMANCE MEASURES (SAFETY, SECURITY, AND RESILIENCE)

FREIGHT PERFORMANCE MEASURE (unit)	LAST ESTIMATE (year)	LATEST ESTIMATE (year)	TREND
GOAL: SAFETY, SECURITY, AND RESILIENCE			
CRASHES INVOLVING HEAVY TRUCKS WITH FATALITIES (#)	60 (2016)	59 (2020)	
CRASHES INVOLVING HEAVY TRUCKS WITH INJURIES (% of all truck crashes)	9.2% (2016)	12.9% (2020)	
LANE CLOSURES DUE TO FATAL CRASHES INVOLVING HEAVY TRUCKS (total lane closure hours per year)	234 (2016)* 136 (2017)*	182 (2020)	
COMMERCIAL VEHICLE SAFETY INSPECTIONS (annual # performed)	107,211 (2016)	116,339 (2019)	
TRUCK PARKING SPACES/FACILITIES (PUBLIC) (# available)	492/20 (2015)	595/26 (2020)	
TRUCK PARKING SPACES/FACILITIES (PRIVATE) (# available)	2,544/49 (2015)	2,307/27 (2020)	—
CRASHES AT HIGHWAY-RAIL CROSSINGS (#)	20 (2016)	22 (2020)	—
CRASHES AT HIGHWAY-RAIL CROSSINGS WITH INJURIES OR FATALITIES (% of all highway-rail crossing crashes)	5.0% (2016)	9.1% (2020)	—
HAZARDOUS MATERIAL RELEASE INCIDENTS (#)	223 (2017)	346 (2019)* 173 (2020)*	—

LEGEND: Facing Challenges Steady or Making Progress On Track or Improving — Inconclusive

* **Table Note:** multiple data years imply notable one-year differences that may vary significantly from longer-term trends due to a potential change in data references, COVID-19 influences, or other isolated factors.

- **Truck Crash Activity:** Fatality occurrences in crashes involving heavy trucks appear to be steady; however, crashes involving injuries show a notable increase in 2020. Anecdotally, this increase may coincide with higher speed travel (and thus higher speed crashes) that occurred in 2020 as a result of lower congestion levels due to the influence of the COVID-19 pandemic on overall travel conditions.
- **Lane Closure Impacts:** Fatal truck crashes can also substantially degrade travel reliability relative to extended lane closure times for incident investigation, clearance, and recovery. Despite an initial drop from 2016 to 2017, annual lane closure hours caused by fatal crashes involving heavy trucks steadily increased from 2017 to 2020.
- **Truck Parking Availability:** From a safety perspective, truck parking availability is a critical component to providing drivers with adequate opportunities to stop for rest, food, staging, or other needs. The number of public truck parking spaces owned/operated by MDOT increased by 20% from 2015 through 2020. The number of private spaces appears to show a decrease, but this may reflect a difference in facility assumptions between the 2015 and 2020 reference sources. In either case, details in the 2020 Maryland Statewide Truck Parking Study clearly note that unmet parking demand and undesignated truck parking clusters are still critical issues to address.
- **Highway-Rail Crossing Incidents:** While 97 highway-rail crossing incidents were reported in Maryland from 2016-2020, the year-to-year incident numbers, injuries, and fatalities all vary with no consistent trends. Rail safety, however, was identified during outreach efforts as a critical interest area, especially for densely populated urban areas, such as Baltimore, where interactions between rail and other travel modes are more frequent.
- **Hazardous Material Release Incidents:** Data for 2017 through 2020 identified 1,090 hazardous material release incidents, but with no consistent trends from year-to-year. Ongoing planning, monitoring, and management of hazardous material movements are anticipated to remain vital to freight safety and operations.
- **Security Considerations:** Though not reflected in specific performance data for this goal, freight elements pertaining to secure facilities, secure cargo, and cybersecurity will remain integral to successful overall freight planning.

Additional details related to these topics are explored further in **Section 6** of this plan, including safety/security discussions (**6.1**), technology perspectives (**6.2**), and truck parking details (**6.5**).



5.1.2 ECONOMIC OPPORTUNITY AND EFFICIENCY

Freight performance data relating to economic opportunity and efficiency in Maryland generally indicate positive trends. However, some challenges are evident and will continue to be monitored, such as those related to rail service opportunities or the influence of congestion and bottlenecks. Highlights are summarized in **Exhibit 5.3** and the notes that follow.



EXHIBIT 5.3: MARYLAND FREIGHT PERFORMANCE MEASURES (ECONOMIC OPPORTUNITY AND EFFICIENCY)

FREIGHT PERFORMANCE MEASURE (unit)	LAST ESTIMATE (year)	LATEST ESTIMATE (year)	TREND
GOAL: ECONOMIC OPPORTUNITY AND EFFICIENCY			
FREIGHT ORIGINATING AND TERMINATING IN MARYLAND (TONNAGE) (million tons)	290 (2017)	281 (2020)* 304 (2025)*	
FREIGHT ORIGINATING AND TERMINATING IN MARYLAND (VALUE) (\$ billions)	\$381 (2017)	\$376 (2020)* \$446 (2025)*	
PORT OF BALTIMORE FOREIGN CARGO TONNAGE (millions of tons)	32.4 (2015)	43.6 (2019)* 37.3 (2020)*	
MDOT MPA GENERAL CARGO TONNAGE (millions of tons)	9.7 (2015)	11.0 (2019)* 10.4 (2020)*	
RAIL CARLOADS ORIGINATING IN MARYLAND (# carloads)	87,000 (2017)	75,934 (2019)	
RAIL CARLOADS TERMINATING IN MARYLAND (# carloads)	383,900 (2017)	378,666 (2019)	
TOTAL CARGO (FREIGHT & MAIL) AT BWI MARSHALL AIRPORT (metric tons)	163,406 (2016)	226,913 (2019)* 269,930 (2020)*	
STATEWIDE TOTAL CONGESTION COST ON FREEWAYS/EXPRESSWAYS (\$ millions)	\$2,050 (2015)	\$3,584 (2019)	
FREIGHT CONGESTION COST ON FREEWAYS/EXPRESSWAYS (\$ millions)	\$119 (2015)	\$251 (2019)	
MARYLAND TOP 100 TRUCK BOTTLENECK CONGESTION COSTS (\$ millions)	\$174 (2018)	\$179 (2019)	
MARYLAND TOP 100 TRUCK BOTTLENECK DELAY (truck person-hours of delay in millions)	3.17 (2018)	3.76 (2019)	

LEGEND: Facing Challenges Steady or Making Progress On Track or Improving Inconclusive

* **Table Note:** multiple data years imply notable one-year differences that may vary significantly from longer-term trends due to a potential change in data references, COVID-19 influences, or other isolated factors.

- **Overall Freight Growth:** Despite COVID, Maryland's freight tonnage and value is expected to grow significantly between 2020 and 2050 with an overall 53% increase in freight tonnage and a 108% increase in freight value (see previous [Section 3.1](#)).
- **Multimodal Opportunities:** Multimodal freight movements through the Port of Baltimore and BWI Marshall Airport continue to grow and serve as critical elements of the supply chain. Port terminal activity continues to rebound from the influence of the COVID-19 pandemic, while demands for air cargo have increased constantly during the past several years, including through the pandemic. Rail transportation also is a critical element of the freight transportation system. Recent rail data shows a slight decline in carloads for Maryland, which may be reflective of declines in coal, nonmetallic minerals, chemicals, and other products.
- **Congestion Impacts:** Ever-increasing levels of congestion, bottleneck delays, and the corresponding costs of congestion generally remain as significant challenges for Maryland. The freight congestion cost on Maryland's freeways/expressways alone more than doubled from 2015 to 2019 (based on MDOT SHA Mobility Report data), while the top 100 truck bottlenecks in Maryland account for more than 3.76 million hours of truck delay (based on Maryland Roadway Performance Tool data).
- **Workforce Issues:** Though not reflected in specific performance data for this goal, maintaining timely and efficient freight movement by all modes requires an available and qualified workforce of truck drivers, stevedores, rail personnel, and freight and logistics support staff, among others. In a 2021 survey of critical issues in the trucking industry, the American Transportation Research Institute (ATRI) identified truck driver shortages as the number one concern for the fifth year in a row.⁵⁶

Additional details related to these topics are explored further in [Section 6](#) of this plan, including extensive congestion details ([6.4](#)), supply chain cargo flow interests ([6.6](#)), and e-commerce considerations ([6.9](#)).



5.1.3 SYSTEM PRESERVATION AND MODERNIZATION

Freight performance data relating to system preservation and modernization in Maryland indicate that conditions are generally well managed and improving. Notable trends include advancements in permitting, oversize/overweight (OS/OW) vehicle tracking/enforcement, and asset management. Highlights are summarized in **Exhibit 5.4** and the notes that follow.



EXHIBIT 5.4: MARYLAND FREIGHT PERFORMANCE MEASURES (SYSTEM PRESERVATION AND MODERNIZATION)

FREIGHT PERFORMANCE MEASURE <i>(unit)</i>	LAST ESTIMATE <i>(year)</i>	LATEST ESTIMATE <i>(year)</i>	TREND
GOAL: SYSTEM PRESERVATION AND MODERNIZATION			
VEHICLES WEIGHED INCLUDING VWS <i>(# millions)</i>	5.6M (2016)	11.3M (2019)	
OVERWEIGHT VEHICLES (#)	14,178 (2016)	11,658 (2019)	
MARYLAND ONE PERMIT SYSTEM – ALL MOVES ≥ 120K (#)	no data	31,190 (2020)	—
MARYLAND ONE PERMIT SYSTEM – PORT MOVES (#)	no data	18,749 (2020)	—
MARYLAND ONE PERMIT SYSTEM – SUPERLOADS (#)	no data	5,540 (2020)	—
MDOT SHA NETWORK IN OVERALL PREFERRED MAINTENANCE CONDITION (%)	78.8% (2015)	84.3% (2021)	
OVERALL ACCEPTABLE PAVEMENT CONDITION (RIDE QUALITY) (%)	91% (2015)	90% (2021)	
NUMBER (AND PERCENT) OF BRIDGES IN POOR CONDITION (# and %)	70 (2.4%) (2015)	29 (1.0%) (2021)	
DREDGED MATERIAL PLACEMENT CAPACITY REMAINING FOR HARBOR MATERIAL <i>(mcy)</i>	16.5 (2015)	8.0 (2021)	
DREDGED MATERIAL PLACEMENT CAPACITY REMAINING FOR POPLAR ISLAND SITE MATERIAL <i>(mcy)</i>	12.3 (2015)	30.3 (2021)	

LEGEND: Facing Challenges Steady or Making Progress On Track or Improving — Inconclusive

- **OS/OW Vehicles:** As freight demands in Maryland increase, so do the proportions of OS/OW vehicle movements that have a higher potential impact relative to safety, routing decisions, or pavement/bridge deterioration. More than 11.3 million vehicles were weighed in Maryland in 2019, more than double the count from 2016. However, the number of vehicles found to be overweight actually decreased by approximately 18% during the same timeframe, tentatively highlighting the state's success in OS/OW vehicle management and permitting efforts. These efforts include the Maryland One Permit System and proactive monitoring for critical movements such as those related to the port, loads greater than 120,000 pounds, or superloads.
- **Road and Bridge Conditions:** Despite funding, staffing, and work activity constraints that MDOT has been challenged with as a result of the COVID-19 pandemic, effective asset management programs continue to yield positive improvements in overall roadway and bridge conditions across the state. Based on the latest available AR data for the year 2021, preferred maintenance conditions on the MDOT SHA network, overall acceptable pavement conditions, and the number of bridges that are in poor condition are all either on-track or at/above their intended performance targets. For bridge conditions specifically, MDOT recorded only 29 poor rated MDOT SHA bridges in 2021, the lowest level since tracking began and one of the lowest percentages of any state transportation agency in the nation.
- **Dredged Material Management:** Dredged material placement sites and capacity are crucial for MDOT MPA to maintain safe and accessible shipping channels for the Port of Baltimore. Based on the latest available AR data for the year 2021, the state's capacity for dredged material management is on-target for a rolling 20-year plan. In fact, as of January 2021, MDOT MPA and the U.S. Army Corps of Engineers (USACE) completed the Poplar Island Ecosystem Restoration Project lateral expansion, which provides 575 additional acres of dredged material placement area, adding storage capacity for 28 million cubic yards (mcy) of material.

Additional details related to these topics are explored further in **Section 6** of this plan, including technology and permitting components (**6.2**) and asset preservation and improvement programs (**6.3**).



5.1.4 QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE

Freight performance data relating to quality of service, efficiency, and customer experience generally indicate positive trends with the exception of ongoing congestion and mobility issues that affect freight access around the Port of Baltimore. Highlights are summarized in **Exhibit 5.5** and the notes that follow.

EXHIBIT 5.5: MARYLAND FREIGHT PERFORMANCE MEASURES (QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE)

FREIGHT PERFORMANCE MEASURE (<i>unit</i>)	LAST ESTIMATE (<i>year</i>)	LATEST ESTIMATE (<i>year</i>)	TREND
GOAL: QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE			
MARYLAND ONE PERMIT SYSTEM – TOTAL PERMITS ISSUED (#)	no data	123,388 (2020)	—
MARYLAND ONE PERMIT SYSTEM – AUTO-ISSUED PERMITS (<i>average auto-issue rate</i>)	no data	80% (2020)	—
ANNUAL HOURS OF DELAY FOR TRUCKS (<i>hours</i>)	5,396 (2017)	5,096 (2019)* 3,516 (2021)*	
TRUCK TRAVEL TIME RELIABILITY INDEX (TTTR) (<i>index value</i>)	1.89 (2017)	1.95 (2019)* 1.81 (2021)*	
TRUCK MOBILITY AROUND THE PORT OF BALTIMORE (<i>truck hours of delay in millions</i>)	1.24 (2017)	1.66 (2019)	
TRUCK MOBILITY COST AROUND THE PORT OF BALTIMORE (<i>truck congestion cost in \$ millions</i>)	\$70.30 (2017)	\$110.50 (2019)	
AVERAGE TRUCK TURN TIME AT SEAGIRT MARINE TERMINAL (<i>minutes</i>)	89 (2018)	72 (2021)	

LEGEND: Facing Challenges Steady or Making Progress On Track or Improving Inconclusive

* **Table Note:** multiple data years imply notable one-year differences that may vary significantly from longer-term trends due to a potential change in data references, COVID-19 influences, or other isolated factors.



- Permitting Efficiency:** The Maryland One Permit System allows for efficient and timely issuance of permits to minimize delays and costs that may otherwise affect OS/OW vehicle planning and operations. Based on 2020 Motor Carrier Division (MCD) data, 80% of permits were auto-issued within seconds, despite challenges due to the COVID-19 pandemic such as waiving of Maryland State Police (MSP) escorts and changes in functionality. Beyond auto-issuance, 96% of permits were issued in two hours or less, and 99.3% within two days or less, including all megaloads greater than 500,000 pounds.
- Truck Delay and Reliability:** Predictable travel time is an important element for facilitating consistent, efficient, and cost-effective goods movement. Truck delay and reliability measures, including the TTTR index associated with federal performance measure reporting requirements, show varying trends from 2017 through 2021 with very obvious anomalies caused by the COVID-19 pandemic. To support future decision-making, congestion and reliability trends will need to be carefully monitored as Maryland travel returns to relatively normal conditions.
- Truck Mobility around Port of Baltimore:** Congestion that affects the Baltimore metropolitan area will also negatively impact efficient access and mobility for trucks to/from the Port of Baltimore. Using a Support for Urban Mobility Analysis (SUMA) tool developed by Texas Transportation Institute (TTI), truck performance data was compiled for all NHS roadways within a five-mile radius around the Port. Just from 2017 to 2019, substantial increases in congestion are apparent with a 34% increase in truck delay and a 57% increase in truck-related congestion costs.
- Truck Turn Time at Seagirt Marine Terminal:** Using gate scanner equipment and truck radio-frequency identification (RFID) tag monitoring at Seagirt Marine Terminal, truck turn times provide a measure of how quickly trucks are able to get into and out of the terminal. Truck turn times inform Port officials and logistics coordinators of Port efficiency and product availability. They are a critical part of goods delivery in Maryland, nationwide, and globally, with shorter turn times translating to higher throughput capacity and environmental benefits in the long term. While data from 2018 through 2021 generally show a decrease (improvement) in truck turn times at Seagirt Marine Terminal, some of the difference may be related to the influence of the COVID-19 pandemic on cargo volumes.

Additional details related to these topics are explored further in **Section 6** of this plan, including technology and permitting elements (6.2), extensive congestion details (6.4), and additional port access and terminal improvement details (6.7).



5.1.5 ENVIRONMENTAL PROTECTION AND SENSITIVITY

MDOT has a well-rounded approach to environmental stewardship spanning a range of natural resources including air, land, and water, coupled with actions that encompass climate change mitigation, reducing GHG emissions, increasing climate adaptation and resiliency, and conservation of resources for sustainable agency operations and service delivery. Ongoing challenges, however, are evident in freight performance data relating to wasted fuel, emissions, and other aspects of freight-related congestion. Highlights are summarized in **Exhibit 5.6** and the notes that follow.

EXHIBIT 5.6: MARYLAND FREIGHT PERFORMANCE MEASURES (ENVIRONMENTAL PROTECTION AND SENSITIVITY)

FREIGHT PERFORMANCE MEASURE (<i>unit</i>)	LAST ESTIMATE (<i>year</i>)	LATEST ESTIMATE (<i>year</i>)	TREND
GOAL: ENVIRONMENTAL PROTECTION AND SENSITIVITY			
WASTED FUEL AMOUNT FOR TRUCKS (<i>millions of gallons</i>)	3.8M (2015)	7.9M (2019)	
WASTED FUEL COST FOR TRUCKS (<i>\$ millions</i>)	\$10.4 (2015)	\$24 (2019)	
FREIGHT EMISSIONS COST (<i>\$ millions</i>)	\$2.7 (2015)	\$6.0 (2019)	
CONGESTED CO2e ON THE MARYLAND FREIGHT NETWORK (<i>pounds</i>)	186,597 (2018)	193,384 (2019)	
CONGESTED CO2e ON CRITICAL RURAL FREIGHT CORRIDORS (<i>pounds</i>)	2,126 (2018)	2,122 (2019)	
CONGESTED CO2e ON CRITICAL URBAN FREIGHT CORRIDORS (<i>pounds</i>)	18,734 (2018)	24,637 (2019)	
MID-ATLANTIC DRAY TRUCK REPLACEMENT PROGRAM (# of trucks replaced via the Port of Baltimore)	275 (2008-2018)	93 (2019-2021)	

LEGEND: Facing Challenges Steady or Making Progress On Track or Improving Inconclusive

Table Note: Carbon dioxide equivalent or CO2e accounts for the collective impact of carbon dioxide and/or other GHG emissions using carbon dioxide as a common reference to measure their equivalent global warming potential in a single metric.



- Wasted Fuel and Freight Emissions:** Freight congestion costs are tracked annually as part of MDOT SHA's Mobility Report and include components for wasted fuel and freight emissions. As truck delay, bottlenecks, and congestion increase – as evidenced by other freight performance measures summarized throughout the previous goal discussions – so too will the fuel usage and emissions related to truck travel.
- Dray Truck Replacements:** Dray trucks typically cover short-distance freight movements between modes, as part of the intermodal loading/unloading process, or for local delivery/distribution activities tied to centralized warehousing. While these trucks play a critical role in transferring cargo, they often include older vehicles that are operated for extended service lives, and they “often can release significant emissions as they make frequent trips... and idle while awaiting cargo.”⁵⁷ MDOT MPA offers a dray truck replacement program as part of their Port of Baltimore Diesel Equipment Upgrade Program. The program provides grants up to \$30,000 toward the purchase of newer model trucks to help reduce air pollution and greenhouse gas emissions.⁵⁸ The program continues to be successful with 93 trucks replaced from 2019 through 2021.
- Other Environmental Initiatives:** Though not reflected in the specific performance data for this goal, a number of other environmental initiatives are in-place in Maryland and across the MDOT TBU's. These initiatives encompass additional air, energy, and water quality management strategies through the Port of Baltimore; overlap with dredged material management programs; statewide interests in efficient and alternative energy sources; EV technology opportunities; or vulnerability and adaptation strategies.
- Refinements for Justice40:** Relative to the MDOT performance measures and environmental protection/sensitivity data throughout the Maryland Freight Plan, the federal government's Justice40 Initiative (at right) and its implementation may influence future refinements to MDOT's performance measurement details. Examples may include specific measures, tracking, or targets that focus on GHG emissions or other environmental justice considerations. It is anticipated that MDOT will assess new performance measure needs, requirements, or opportunities throughout future updates of the MDOT AR or other applicable plans.

Additional details related to these topics are explored further in **Section 6** of this plan, including technology opportunities (6.2), congestion issues (6.4), dredged material management (6.3), port details (6.7), and specific resilience and environmental initiatives (6.11).

Justice40 Initiative

Executive Order (EO) 14008, *Tackling the Climate Crisis at Home and Abroad*, created the government-wide Justice40 initiative on January 27, 2021. This initiative aims to deliver 40% of the overall benefits of federal investments in climate and clean energy, including sustainable transportation, to disadvantaged communities.

As of May 2022, efforts under this initiative have included the development and beta-testing of a Climate and Economic Justice Screening Tool (CEJST) by the White Council on Environmental Quality (ECQ), development of an interim definition to identify disadvantaged communities for Justice40-covered programs, and a list of funding opportunities that are actively using this definition.

As Justice40 and its implementation continue to evolve, updates may be reviewed at <https://www.transportation.gov/equity-Justice40>.

5.1.6 FISCAL RESPONSIBILITY

Freight performance data relating to fiscal responsibility generally indicate successful efforts in terms of project implementations and related project benefits. These details are typically tracked on an annual basis and overlap the project delivery insights, incident management benefits, and capital project program benefits summarized by MDOT's annual AR and the MDOT SHA Mobility Report. Highlights are summarized in **Exhibit 5.7** and the notes that follow.

EXHIBIT 5.7: MARYLAND FREIGHT PERFORMANCE MEASURES (FISCAL RESPONSIBILITY)

FREIGHT PERFORMANCE MEASURE (<i>unit</i>)	LAST ESTIMATE (<i>year</i>)	LATEST ESTIMATE (<i>year</i>)	TREND
GOAL: FISCAL RESPONSIBILITY			
USER COST SAVINGS FOR THE TRAVELING PUBLIC DUE TO INCIDENT MANAGEMENT (<i>\$ millions</i>)	\$1,356 (2015)	\$1,393 (2019)* \$1,080 (2020)*	
USER COST SAVINGS FOR THE TRAVELING PUBLIC DUE TO CAPITAL PROJECTS (<i>opening year benefits in \$ millions</i>)	\$4.3 (2015)	\$58 (2019)	

LEGEND: Facing Challenges Steady or Making Progress On Track or Improving Inconclusive

* **Table Note:** multiple data years imply notable one-year differences that may vary significantly from longer-term trends due to a potential change in data references, COVID-19 influences, or other isolated factors.

- Project Innovation and Partnership:** MDOT's ability to leverage funding and promote efficient management and delivery of contracts and services is reflected in a commitment to identifying the best delivery methods including public-private partnerships (P3), design-build (DB), construction management at risk projects (CMAR), or other innovative and alternative contracting and delivery options. Additional efficiencies also have been achieved via projects using A+B (or cost + time) bidding and through the implementation of cost-efficient management options such as TSMO-related strategies. Ongoing performance management efforts at MDOT currently are refining the development and integration of additional performance measures to help quantify innovative project delivery methods or partnerships. Such details may be referenced in future updates to the Maryland Freight Plan as they become available and/or in coordination with related updates to MDOT's AR or MFR.



- Incident Management Benefits:** Specific user cost savings related to MDOT's incident management programs are tracked annually as part of MDOT's AR and Mobility Report efforts. Savings reflect MDOT CHART successes based on delay reductions, operational benefits, technology implementations, interagency teamwork, and other tangible benefits. Though highly successful, data for 2020 still shows a drop in benefits due to the effects of COVID-19 and, based on AR reporting, falls short of MDOT's \$1.2 billion target.
- Capital Project Benefits:** Specific user cost savings related to MDOT's capital projects program are tracked annually as part of MDOT SHA's Mobility Report. This program is one of the most recognizable ways that MDOT SHA addresses congestion and reliability issues. Improvements yield reductions in delay, fuel savings, and safety benefits for all vehicles. Implementations in 2019 included 11 projects with more than \$58 million in user cost savings in the opening year, or approximately \$5 million per project on average.
- Future Funding Opportunities:** MDOT will continue to explore, prioritize, and implement key project opportunities through a combination of its capital projects program and TBU modal plans. It also is anticipated that MDOT will consider innovative funding options for key eligible projects alongside the variety of competitive grant opportunities that were included as part of the 2021 IJA.

Additional details related to these topics are explored further in **Section 6** of this plan, including technology and operational programs (**6.2**), asset preservation and improvement programs (**6.3**), and multi-state freight coordination opportunities (**6.8**). Additionally, **Section 7** formally addresses the state's freight financial plan and NHFP funding, while **Section 8** encompasses broader strategies and implementation efforts that also relate to project opportunities.

5.1.7 TRANSPORTATION CHOICES AND CONNECTIONS

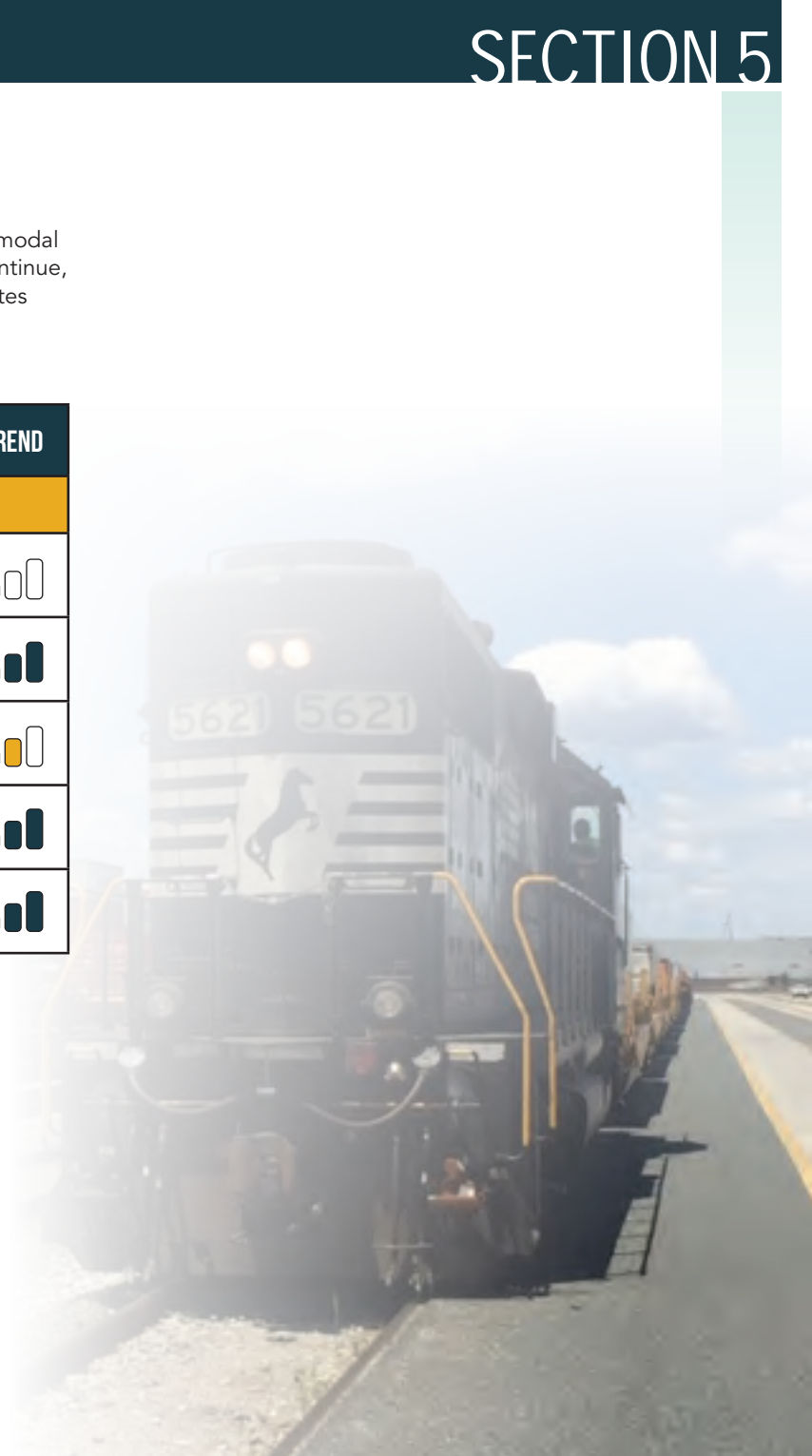
Freight performance data relating to transportation choices and connections generally imply a healthy multimodal system within the state. However, challenges with truck demands on the highway system are expected to continue, particularly in light of future anticipated freight growth. Highlights are summarized in **Exhibit 5.8** and the notes that follow.

EXHIBIT 5.8: MARYLAND FREIGHT PERFORMANCE MEASURES (TRANSPORTATION CHOICES AND CONNECTIONS)

FREIGHT PERFORMANCE MEASURE <i>(unit)</i>	LAST ESTIMATE <i>(year)</i>	LATEST ESTIMATE <i>(year)</i>	TREND
GOAL: TRANSPORTATION CHOICES AND CONNECTIONS			
TRUCK TRAVEL ON THE MARYLAND FREIGHT NETWORK <i>(total truck vehicle miles traveled)</i>	1,101,899 (2018)	1,179,819 (2019)	
RAIL MILES IN MARYLAND – CLASS I <i>(total miles operated, including trackage rights)</i>	823 (2015)	805 (2019)	
RAIL MILES IN MARYLAND – CLASS II (REGIONAL) <i>(total miles operated, including trackage rights)</i>	125 (2015)	88 (2019)	
RAIL MILES IN MARYLAND – CLASS III (SHORT LINE) <i>(total miles operated, including trackage rights)</i>	197 (2015)	259 (2019)	
NONSTOP AIRLINE MARKETS SERVED BY BWI MARSHALL AIRPORT (#)	77 (2015)	93 (2020)* 86 (2021)*	

LEGEND: Facing Challenges Steady or Making Progress On Track or Improving Inconclusive

* **Table Note:** multiple data years imply notable one-year differences that may vary significantly from longer-term trends due to a potential change in data references, COVID-19 influences, or other isolated factors.



- Truck/Highway Demands:** Truck vehicle-miles traveled (VMT) on the Maryland Freight network are expected to increase in direct relation to growth in the state's overall freight tonnage. An increase in VMT usually means more congestion, emissions, and reduced mobility. With these impacts in mind, MDOT will continue efforts to manage congestion and reliability on their freight network, while also ensuring viable multimodal freight transportation options and efficiencies. Additionally, as noted in **Section 4** of this plan, changes under the IJA doubled the state's allowable CRFC/CUFC mileage allotments. Future network expansion using the additional mileage may enhance freight funding eligibility for broader portions of Maryland's roadway network and support efforts toward ensuring its ability to meet current and future freight demands.
- Rail Network:** Via updates to the Maryland State Rail Plan, MDOT documents rail system details, freight and passenger rail assessments, and a rail service and investment program to ensure continued support for rail operations statewide. Positive trends since the prior rail plan update have included an expansion in short line rail services including, for example, Tradepoint Rail (TA) operations that link the Tradepoint Atlantic site with NS and CSX Class I services, and creation of the Delmarva Central Railroad (DCR) that replaced NS operations along the Delmarva Secondary on Maryland's Eastern Shore. Future completion of the Howard Street Tunnel project will also create new significant opportunities for double-stacked container trains to/from the Port of Baltimore.
- Port Opportunities:** Cargo operations at the Port of Baltimore provide some of the most diverse port opportunities in the United States with key commodities spanning autos, roll-on/roll-off cargo, containers, forest products, and project cargo. Positive trends are reflected in several freight performance measures from the previous goal categories based on cargo tonnage, dredged material placement capacity, and average truck turn time at Seagirt Marine Terminal. Container opportunities at the port will also continue to grow with significant expansion efforts such as the 2021 arrival of four additional Neo-Panamax cranes at Seagirt Marine Terminal and the 2021 ground-breaking for the Howard Street Tunnel project that, upon completion, will facilitate double-stacked container trains to and from the Port.
- Air Cargo Opportunities:** As detailed in MDOT's annual AR, the number of airline markets served through BWI Marshall Airport is an example of Maryland's reach regionally, nationwide, and globally. This reach provides benefits not just for passenger travel, but also in relation to broader opportunities surrounding business and freight markets, air cargo opportunities and efficiencies, and overall airport competitiveness. While data indicates a decrease in markets from 93 to 86 in FY 2021 due to the influence of the COVID-19 pandemic, recovery to previous levels and service expansion are expected.

Additional details related to these topics are explored further in **Section 6** of this plan, including technology and operational programs (**6.2**), freight congestion and mitigation (**6.4**), port details (**6.7**), and the influence of e-commerce on multimodal freight activity (**6.9**).

5.2 Agency and Stakeholder Perspectives

The freight performance and trend insights summarized previously were paired with background content from **Sections 1-4** of the Maryland Freight Plan to compile an initial set of freight-related needs, project candidates, and strategy assumptions, constituting Milestone #2 of the plan update. The Milestone #2 content was presented to various agency/stakeholder groups and the general public for review and feedback using an online survey linked through MDOT's freight plan website and in coordination with the MDOT TBUs Freight Roundtable, SFAC meetings, and outreach to the state's MPOs.

Results from the Milestone #2 survey are summarized in **Appendix 5A**. These results encompass feedback on regional needs and interests, unfunded project needs by region, freight strategies by goal area, and other input on state freight planning focus areas. This feedback was used to further inform and refine the summary of needs in the remainder of this section of the plan, as well as the freight projects (**Section 7**) and strategies (**Section 8**) that make up the final freight action plan.



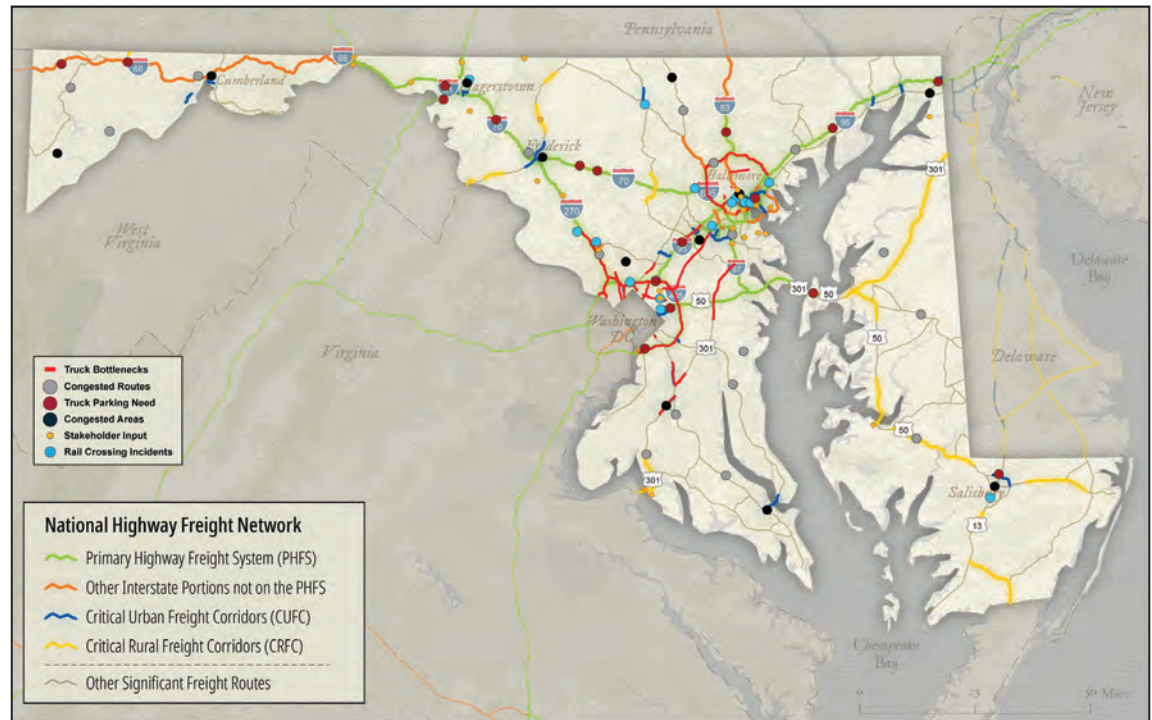
5.3 Summary Freight Needs – Regional Perspectives

To reflect the uniqueness of different regions across Maryland and help balance regional relevancy and interests alongside broader statewide priorities, the Maryland Freight Plan summarizes freight needs for five regions across the state. Regions were defined to match assumptions in the 2040 Maryland Transportation Plan, plus a separate detail for the Baltimore City/Harbor area. Regions include:

- Western Maryland;
- Eastern Shore;
- Southern Maryland;
- Baltimore Metro Region (and Baltimore City/Harbor Area); and
- Washington Metro Region.

Based on freight data and inventories alongside agency and stakeholder input, potential freight needs by region were compiled to identify truck parking needs, congested routes, congested areas, truck bottlenecks, and other freight-relevant stakeholder input. Highlights are included at right (**Exhibit 5.9**), and details by region are included in **Appendix 5B**.

EXHIBIT 5.9: MARYLAND REGIONAL FREIGHT NEEDS SUMMARY



Western Maryland Region

Western Maryland identifies several undesignated truck parking needs that were prioritized in the statewide truck parking study. Potential congestion affects truck travel along portions of US 219, US 40, and MD 135, and there are a variety of needs and freight project interests clustered around the Hagerstown area, particularly related to the junction of I-70 and I-81.

Additional areas identified by stakeholder input further emphasized needs related to truck parking, roadway or corridor improvements, multimodal freight opportunities, incident management, and expansion of logistics and warehousing activities. Specific corridor interests re-emphasized freight impacts along I-70 and I-81, as well as I-68, US 210, MD 51, and MD 63.

Eastern Shore Region

Needs on the Eastern Shore focus on undesignated truck parking; congestion on US 50, MD 213, and MD 404; and potential freight opportunities in areas such as Salisbury and Cambridge, including multimodal access via Eastern Shore rivers.

Additional areas identified by stakeholder input further emphasized the relevance of freight connections along US 50 and US 301, truck parking, toll and weight enforcement, and ensuring the consideration of climate change impacts on critical freight infrastructure. Multimodal opportunities on the Eastern Shore also highlighted the relevance of Wicomico River dredging, activities related to the Port of Salisbury, and expansion of rail/truck transloading operations.

Southern Maryland Region

Needs in Southern Maryland include limited congestion on MD 2, MD 4, MD 5, MD 235, and US 301, and around highway junctions in California and Waldorf. Interests also include coordinating freight activities related to CSX rail and freight access to Patuxent Naval Air Station. Stakeholder input also noted the relevance of MDTA's Nice/Middleton Bridge widening and replacement project.

Baltimore Metro Region

The Baltimore Metro region includes some of the state's top bottlenecks, including nationally ranked bottlenecks (from FHWA's Top 100 list) on I-95 and I-695. The Baltimore area in particular includes a wide range of project activities relative to rail, port, and air freight assets in the area.

Additional areas identified by stakeholder input included multiple bottleneck locations on I-70, US 50 near the Bay Bridge, US 29, and I-195 among other routes. Other needs related to truck parking, efficient operations at the Port of Baltimore, roadway/pavement maintenance, support for multimodal connections, and balancing the impact of freight (e.g., noise, pavement damages) in relation to local communities.

Washington Metro Region

The Washington Metro region also includes some of the state's top bottlenecks and nationally ranked bottlenecks, particularly along I-495 and I-270. Strategic access for military freight in both the Washington and Baltimore Metro regions also is a focal point that aligns with new state freight planning requirements under the IIJA.

Additional areas identified by stakeholder input related to congestion along I-70, US 301, and US 340. Other potential needs related to truck parking and the impacts of freight routing and truck travel affecting local roads and community access.

5.4 Summary Freight Needs – Statewide Perspectives

Based on the overarching set of information gathered to this point in the Maryland Freight Plan update, a summary set of freight needs were categorized and aligned within the previously established freight goals (**Exhibit 5.10**). These statewide needs perspectives aim to highlight the broader freight emphasis areas and/or topics for MDOT and its planning partners to consider throughout the preparation and execution of future freight action plans. As such, these insights help to further inform the development of freight-related project planning (**Section 7**) and overall freight strategy, program, and implementation planning (**Section 8**) as summarized in later sections of this plan.



EXHIBIT 5.10: MARYLAND SUMMARY FREIGHT NEEDS BY GOAL



ENDNOTES

1. MDOT, Attainment Report, <https://www.mdot.maryland.gov/tso/pages/Index.aspx?PagelId=121>.
2. MDOT, Asset Management, <https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PagelId=308>.
3. MDOT, Managing for Results (MFR): Performance-Informed Budgeting in Maryland, <https://dbm.maryland.gov/pages/managingresultsmaryland.aspx>.
4. USDOT FHWA, Transportation Performance Management, updated January 20, 2022, <https://www.fhwa.dot.gov/tpm/>.
5. NHTSA, Fatality Analysis Reporting System (FARS): 2005-2018 Final File and 2019 Annual Report File (ARF), <https://cdan.dot.gov/>. Note that 2020 FARS data was not available at the time of summary, so the 2020 fatal count as reported reflects a proportional estimate based on 2019 FARS data relative to a corresponding change in 2019-2020 fatal truck crash report counts recorded separately by MDOT SHA.
6. Maryland Open Data Portal, Maryland Statewide Vehicle Crashes – Person Details (Anonymized), including compilation of number of crash reports by type of injury (including possible injury) involving trucks and relative to all truck related crashes, 2016-2020, <https://opendata.maryland.gov/Public-Safety/Maryland-Statewide-Vehicle-Crashes-Person-Details-/py4c-dicf>.
7. MDOT SHA, CHART Crash Report Data – Heavy Truck Fatalities (including single unit trucks, single unit trucks with trailers, tractor trailers, and double tractor trailers), dataset for January 1, 2016 through December 31, 2020. Provided by MDOT SHA, August 2021; compiled by freight plan development team, December 2021.
8. MDOT SHA, Motor Carrier Division, compiled from Commercial Vehicle Operations data, July 23, 2021.
9. MDOT, Maryland Statewide Truck Parking Study – Final Report, 2020, <https://www.mdot.maryland.gov/tso/pages/Index.aspx?PagelId=80>. Note that the study referenced new truck parking inventories for 2020 data but cross-referenced the 2015 data to a separate historic source via Jason's Law Truck Parking Survey Results 2015.
10. Ibid.
11. Federal Railroad Administration, Safety Data and Reporting – Highway/Rail Grade Crossing Incident Dashboard, including 2016-2020 data compiled for Maryland, <https://railroads.dot.gov/accident-and-incident-reporting/highwayrail-grade-crossing-incidents/highwayrail-grade-crossing>.
12. Ibid.
13. Pipeline and Hazardous Materials Safety Administration (PHMSA), Oracle BI Interactive Dashboards – Hazmat Incident Report Search (2017-2021), <https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics>.
14. Based on assessments of Maryland state totals for tonnage (kTons) and value (\$M in 2017 dollars) using FHWA Freight Analysis Framework Version 5 (FAF5) data from <https://faf.ornl.gov/faf5/SummaryTable.aspx>. Note that the FAF5 data reported here reflects a more recent dataset than the FAF4 projections referenced in MDOT's 2022 Annual Attainment Report (AR) on Transportation System Performance for comparable measures.
15. Ibid.
16. As reported in MDOT's 2022 Annual Attainment Report (AR) on Transportation System Performance, <https://www.mdot.maryland.gov/tso/pages/Index.aspx?PagelId=121>.
17. Ibid.
18. Association of American Railroads (AAR), Data Center – State Data – State Rankings 2017, uploaded May 2019, <https://www.aar.org/wp-content/uploads/2019/05/AAR-State-Rankings-2017.pdf>; and State Rankings 2019, uploaded February 2021, <https://www.aar.org/wp-content/uploads/2021/02/AAR-State-Rankings-2019.pdf>.
19. Ibid.
20. BWI Marshall Airport – Statistics, compiled from December annual reports, 2016-2020, <https://www.bwiairport.com/flying-with-us/about-bwi/statistics?web=1&wdLOR=c9F914853-568E-4F78-9019-FB0C1A3125E1>.
21. MDOT SHA, Maryland State Highway Mobility Report, compiled from report years 2016-2020, <https://roads.maryland.gov/mdotsha/pages/Index.aspx?PagelId=711>.
22. Ibid.
23. MDOT SHA, Maryland Roadway Performance Tool (MRPT) – Top 100 Truck Bottleneck Data, compiled January 2022 for data years 2018-2019, <https://mrptui.z21.web.core.windows.net/>.
24. Ibid.
25. MDOT SHA, Motor Carrier Division Statistics and TWIS Trend Data, as provided July 2021.
26. Ibid.
27. Ibid.

29. Ibid.
30. See Endnote 16.
31. Ibid.
32. Ibid.
33. Ibid.
34. Ibid.
35. See Endnote 25.
36. Ibid.
37. See Endnote 16.
38. Ibid.
39. Texas A&M Transportation Institute (TTI), Support for Urban Mobility Analysis (SUMA) Tool – Facility Congestion Data for Port of Baltimore, compiled January 2022 for data years 2017-2019, <https://tableau.tamu.edu/t/TTI/views/?%3AshowAp&%3AisGuestRedirectFromVizportal=y&%3Aembed=y>.
40. Ibid.
41. See Endnote 16.
42. Calculated estimate based on average diesel fuel cost per gallon for each data year as reported by EIA (https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_m.htm), coupled with the corresponding year's truck fuel cost component within the overall freight congestion cost as reported by the MDOT SHA Maryland State Highway Mobility Report (<https://roads.maryland.gov/mdotsha/pages/Index.aspx?PagelId=711>).
43. See Endnote 21.
44. Ibid.
45. MDOT SHA, Maryland Roadway Performance Tool (MRPT) – Maryland Freight Network Data, compiled January 2022 for data years 2018-2019, <https://mrptui.z21.web.core.windows.net/>.
46. Ibid.
47. Ibid.
48. MDOT MPA, data as reported for 2008-2018 and 2019-2021, received February 2022.
49. See Endnote 16.
50. See Endnote 21.
51. See Endnote 45.
52. 2015 mileage data from: MDOT, Maryland Statewide Rail Plan, April 2015, https://www.mdot.maryland.gov/OPCP/State_Rail_Plan_2015.pdf. 2019 mileage data from: Association of American Railroads (AAR), State Fact Sheet – Freight Railroads in Maryland, 2019, <https://www.aar.org/wp-content/uploads/2021/02/AAR-Maryland-State-Fact-Sheet.pdf>.
53. Ibid.
54. Ibid.
55. See Endnote 16.
56. American Transportation Research Institute (ATRI), Critical Issues in the Trucking Industry – 2021, October 2021, <https://truckingresearch.org/atri-research/top-industry-issues/>.
57. EPA, Drayage Truck Replacements Improve Air Quality in the Mid-Atlantic, accessed February 2022, <https://www.epa.gov/ports-initiative/drayage-truck-replacements-improve-air-quality-mid-atlantic>.
58. EcoLogix Group Inc., Port of Baltimore Diesel Equipment Upgrade Program, 2017, accessed February 2022, <http://www.dieselupgrades.org/>.

SECTION 6 FREIGHT FOCUS AREAS AND PROGRAMS

SECTION TABLE OF CONTENTS

6	FREIGHT FOCUS AREAS AND PROGRAMS	6-3	6.6.3	Multimodal Opportunities	6-42
6.1	Safety and Security	6-3	6.6.4	Freight Efficient Land Use	6-42
6.1.1	Truck Crash Activity	6-3	6.6.5	Freight Workforce Issues	6-43
6.1.2	Highway-Rail Crossing Incidents	6-5	6.6.6	Freight Fluidity Initiatives	6-43
6.1.3	Hazardous Material Release Incidents	6-7	6.7	Commercial Ports	6-45
6.1.4	Freight Security Considerations	6-7	6.7.1	Port Overview	6-45
6.2	Operational Programs and Innovative/Disruptive Technologies	6-8	6.7.2	Port Infrastructure	6-45
6.2.1	Transportation Mobility and Operations	6-8	6.7.3	Port Access and Mobility	6-46
6.2.2	Truck Permitting, Monitoring, and Routing	6-10	6.7.4	M-95 Marine Highway Corridor	6-46
6.2.3	Connected and Automated Transportation Systems	6-11	6.7.5	Inland Waterways	6-47
6.2.4	Other Evolving Freight Technologies	6-13	6.8	Multistate Freight Coordination	6-48
6.3	Asset Preservation and Improvement Programs	6-16	6.8.1	Multistate Coalitions	6-49
6.3.1	Bridge Management Program	6-17	6.8.2	Multistate MPO coordination	6-49
6.3.2	Pavement Management Program	6-18	6.8.3	Adjoining State Perspectives	6-51
6.3.3	Dredged Material Management Program	6-19	6.9	E-commerce and Related Planning Considerations	6-52
6.4	Freight Congestion and Reliability	6-20	6.9.1	Trade, Transportation, and Warehousing influences	6-52
6.4.1	Truck Volumes and Major Freight Corridors	6-20	6.9.2	Local Planning and Zoning	6-53
6.4.2	Background Congestion and Reliability Issues	6-22	6.9.3	Local Consolidation Centers	6-53
6.4.3	Truck Bottleneck Details	6-28	6.9.4	Local Curb Management	6-53
6.4.4	Truck Reliability Details	6-30	6.10	Military Freight Considerations	6-54
6.4.5	Truck Congestion Costs	6-30	6.10.1	Maryland Military Installations	6-54
6.4.6	Freight Mobility Improvement Opportunities	6-33	6.10.2	Strategic Defense Networks	6-56
6.5	Truck Parking Facilities	6-34	6.10.3	Anticipated Freight Project/Program Influences	6-57
6.5.1	Designated Truck Parking	6-35	6.11	Freight Resilience, Environmental, and Equity Considerations	6-58
6.5.2	Undesignated Truck Parking	6-38	6.11.1	Climate Change Vulnerabilities	6-58
6.5.3	Truck Parking Challenges and Opportunities	6-40	6.11.2	Emergency Freight Access	6-60
6.6	Supply Chain Cargo Flows	6-41	6.11.3	Alternative and Efficient Energy Initiatives	6-60
6.6.1	Cargo Flows	6-41	6.11.4	Air Quality, Community, and Equity Considerations	6-62
6.6.2	Key Industries and Supply Chains	6-41			

SECTION TABLE OF EXHIBITS

Exhibit 6.1:	Maryland Fatal/Injury Crash Trends Involving Heavy Trucks	6-3	Exhibit 6.24:	Freight Congestion Cost Trends (2015-2019) on Maryland's Freeway/Expressway System	6-32
Exhibit 6.2:	Maryland Fatal Crashes involving Heavy Trucks by Region (2016-2020)	6-4	Exhibit 6.25:	Freight Congestion Costs Due to Maryland's Top 100 Truck Bottleneck Segments	6-32
Exhibit 6.3:	Maryland Fatal Crashes Involving Heavy Trucks by Route (2016-2020)	6-4	Exhibit 6.26:	Public and Private Truck Parking Locations in Maryland	6-36
Exhibit 6.4:	Maryland Lane Closure Hours Due to Fatal Crashes Involving Heavy Trucks	6-4	Exhibit 6.27:	Emergency Truck Parking Locations in Maryland	6-37
Exhibit 6.5:	Maryland Highway-Rail Crossing Inventory	6-5	Exhibit 6.28:	Priority Clusters of Undesignated Truck Parking (Map)	6-39
Exhibit 6.6:	Maryland Highway-Rail Grade Crossing Incident Trends	6-5	Exhibit 6.29:	Priority Clusters of Undesignated Truck Parking (Table)	6-40
Exhibit 6.7:	Maryland Highway-Rail Grade Crossing Incidents by Region (2016-2020)	6-6	Exhibit 6.30:	Maryland Freight Fluidity Overview Map (I-95 Test Corridor)	6-44
Exhibit 6.8:	Maryland Highway-Rail Crossings with Two or More Incident Occurrences (2016-2020)	6-6	Exhibit 6.31:	M-95 Marine Highway Corridor Summary	6-47
Exhibit 6.9:	Maryland Hazardous Material Release Incidents	6-7	Exhibit 6.32:	Maryland Metropolitan Planning Organizations	6-50
Exhibit 6.10:	Number of MDTA and MDOT SHA Bridges in Poor Condition	6-17	Exhibit 6.33:	Military Facilities in Maryland	6-55
Exhibit 6.11:	Percent of MDOT SHA Network in Preferred Maintenance Condition	6-18	Exhibit 6.34:	Strategic Defense Networks and Military Facilities in Maryland	6-56
Exhibit 6.12:	Overall Acceptable Pavement Condition	6-18	Exhibit 6.35:	Maryland CTP Projects Overlapping the Strategic Defense Networks	6-57
Exhibit 6.13:	Port of Baltimore Channel System and Dredging Sites	6-19	Exhibit 6.36:	MDOT SHA Climate Change Vulnerability Viewer (sample)	6-59
Exhibit 6.14:	Maryland Truck Volume Map	6-21	Exhibit 6.37:	Maryland Alternative Fuel Corridors	6-61
Exhibit 6.15:	Maryland Congestion Map (2019 AM Peak)	6-24			
Exhibit 6.16:	Maryland Congestion Map (2019 PM Peak)	6-25			
Exhibit 6.17:	Maryland Reliability Map (2019 AM Peak)	6-26			
Exhibit 6.18:	Maryland Reliability Map (2019 PM Peak)	6-27			
Exhibit 6.19:	Maryland 2019 Truck Bottlenecks (Ranked 1-25 by Truck Delay per Mile)	6-29			
Exhibit 6.20:	Maryland 2019 Truck Bottlenecks (Ranked 26-50 by Truck Delay per Mile)	6-29			
Exhibit 6.21:	Maryland 2019 Truck Bottlenecks (Ranked 51-100 by Truck Delay per Mile)	6-29			
Exhibit 6.22:	Maryland's Least Reliable Corridors for Truck Travel (2019 TTTR Based)	6-31			
Exhibit 6.23:	Freight Congestion Cost Components on Maryland's Freeway/Expressway System	6-32			



6 FREIGHT FOCUS AREAS AND PROGRAMS

Within the realm of freight planning, an extremely diverse set of topics, activities, data, measures, program areas, and other resources influence or relate to the overall state of affairs for goods movement and multimodal freight transportation systems in Maryland. Many of these can be captured under the required categories for state freight plans as defined by the IIJA. Others span trends, recent successes, and ongoing initiatives across MDOT and their freight planning partners that occur independent of the four-year update cycle applied to state freight plans.

Section 6 of the Maryland Freight Plan builds upon the data, performance measures, and trend highlights from the previous section of the plan to provide a broader overview of 11 key freight focus areas and programs in Maryland:

- Safety and security
- Operational programs and innovative/disruptive technologies
- Asset preservation and improvement programs
- Freight congestion and reliability
- Truck parking facilities
- Supply chain cargo flows
- Commercial ports
- Multistate freight coordination
- E-commerce considerations
- Military freight considerations
- Freight resilience and environmental impacts

6.1 Safety and Security

6.1.1 TRUCK CRASH ACTIVITY

Truck Crash Fatality and Injury Trends

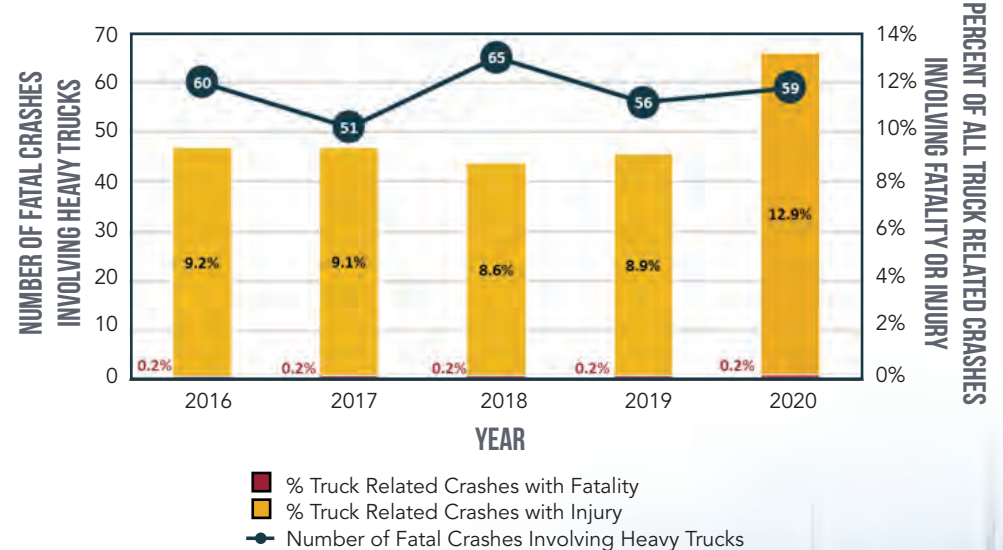
A review of truck crash trends yields mixed findings. The number of heavy truck crashes and the occurrence of fatalities, though unfortunate, appear to be steady; however, the occurrence of injuries appears to be increasing.

The relative proportion of heavy truck crashes compared to all vehicle crashes has steadily declined (improved) from approximately 3.0% in 2016 to only 1.3% in 2020.¹ Additionally, the proportion of fatalities among all heavy truck crashes has remained steady over the same timeframe, despite the number of fatal crashes varying from year to year (**Exhibit 6.1**). In contrast, the proportion of injuries among crashes involving trucks jumped from an average of approximately 9% across 2016-2019 to 12.9% in 2020 (**Exhibit 6.1**).

Focus Areas:

- ✓ Truck crash activity
- ✓ Highway-rail crossing incidents
- ✓ Hazardous material release incidents
- ✓ Freight security considerations

EXHIBIT 6.1: MARYLAND FATAL/INJURY CRASH TRENDS INVOLVING HEAVY TRUCKS²

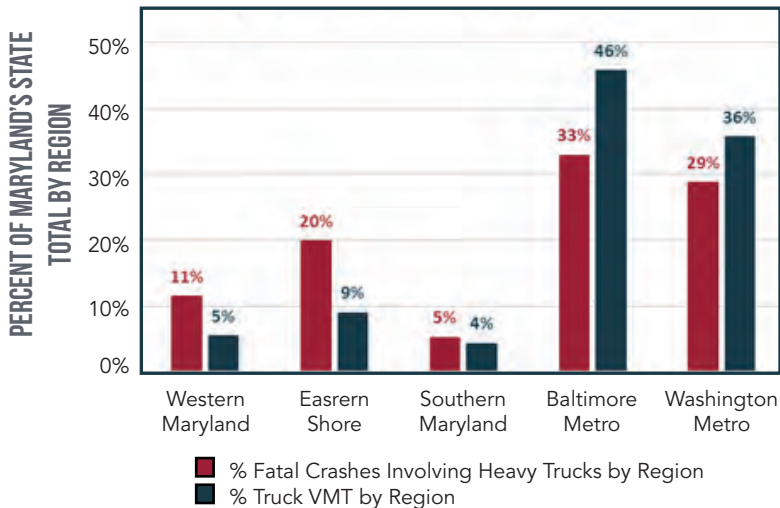


As detailed for overall traffic conditions (not truck travel specifically) in MDOT SHA's 2022 AR, the influence of the COVID-19 pandemic resulted in less vehicles on the roadways, which led to increased speeding, impaired driving, unrestrained occupants, and a continuing disturbing trend of more severe crashes. Research from the National Highway Traffic Safety Administration (NHTSA) also confirmed that driving patterns and behaviors changed significantly, and many of those who remained on the road engaged in more risky behavior. Such conditions may also help to explain the increasing proportion of injuries among heavy truck crashes in Maryland in 2020. Additional research would be needed to further assess specific injury trends; however, regardless of the potential findings, reducing crashes, injuries, and fatalities will remain important objectives for MDOT.

Truck Crash Locations

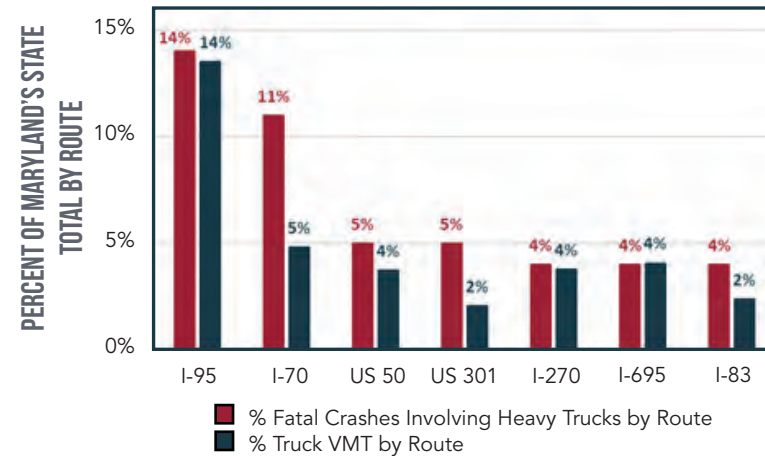
A review of fatal crashes involving heavy trucks by location shows that on a regional basis, most of the reported fatal crashes occurred throughout the Baltimore and Washington metropolitan regions. However, as a positive trend, those proportions are lower than the corresponding levels of significant truck activity through those regions based on total truck VMT (**Exhibit 6.2**). In contrast, the regional proportions of fatal crashes involving heavy trucks in Western Maryland and on the Eastern Shore are approximately double their corresponding proportions of the state's total truck VMT.

EXHIBIT 6.2: MARYLAND FATAL CRASHES INVOLVING HEAVY TRUCKS BY REGION (2016-2020)³



More than half of Maryland's fatal crashes involving heavy trucks occurred on major interstate or US routes. Routes with the highest proportions include I-95 and I-70, US 50 and US 301, I-270, I-695, and I-83 (**Exhibit 6.3**). Notably, the route-specific proportions of fatal crashes involving heavy trucks along I-70, US 301, and I-83 are approximately double their corresponding proportions of the state's total truck VMT.

EXHIBIT 6.3: MARYLAND FATAL CRASHES INVOLVING HEAVY TRUCKS BY ROUTE (2016-2020)⁴



Lane Closure Impacts Due to Truck Crashes

Beyond their direct safety implications, fatal truck crashes also substantially degrade travel reliability due to extended lane closure times for incident clearance, recovery, and investigation. A review of MDOT SHA fatal truck crash report data shows hundreds of hours of lane closures each year (**Exhibit 6.4**). Despite improvement from 2016 to 2017, annual lane closure hours have steadily increased from 2017 through 2020. Continued emphasis on safety improvements and incident response efforts, including programs led by Maryland's Coordinated Highways Action Response Team (CHART), will remain critical to improving the reliability and resilience (in terms of incident recovery) of the state's highway system.

EXHIBIT 6.4: MARYLAND LANE CLOSURE HOURS DUE TO FATAL CRASHES INVOLVING HEAVY TRUCKS⁵



6.1.2 HIGHWAY-RAIL CROSSING INCIDENTS

Highway-Rail Crossing Fatality and Injury Trends

Current FRA crossing inventories identify 1,881 total at-grade, grade-separated, or unspecified highway-rail crossings in Maryland (Exhibit 6.5). For the 2016-2020 timeframe, there were 97 highway-rail crossing incidents in the state, but no consistent or readily apparent trends – the annual number of incidents, injury proportions, and fatality proportions all varied year-to-year (Exhibit 6.6). In total, the 2016-2020 data identified four incidents with fatalities (4.1%), 20 incidents with injuries (20.6%), and highlighted truck-trailer combinations in only 16% of all incidents.

EXHIBIT 6.5: MARYLAND HIGHWAY-RAIL CROSSING INVENTORY⁶

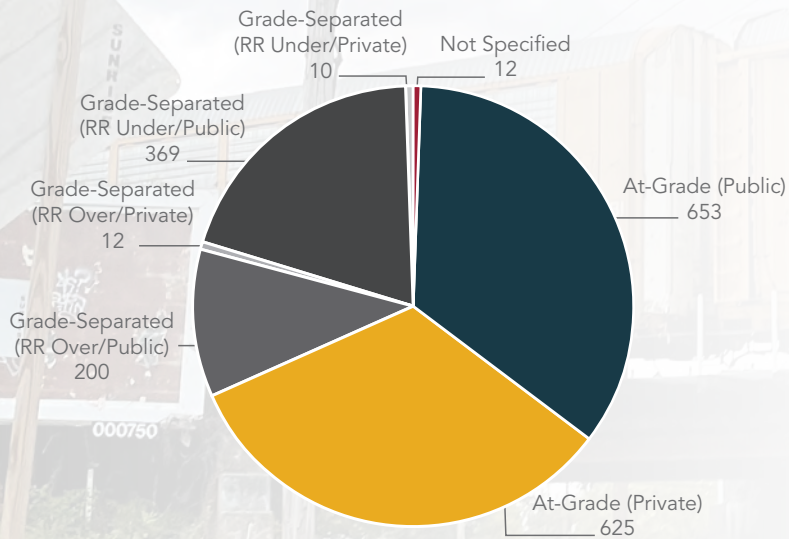
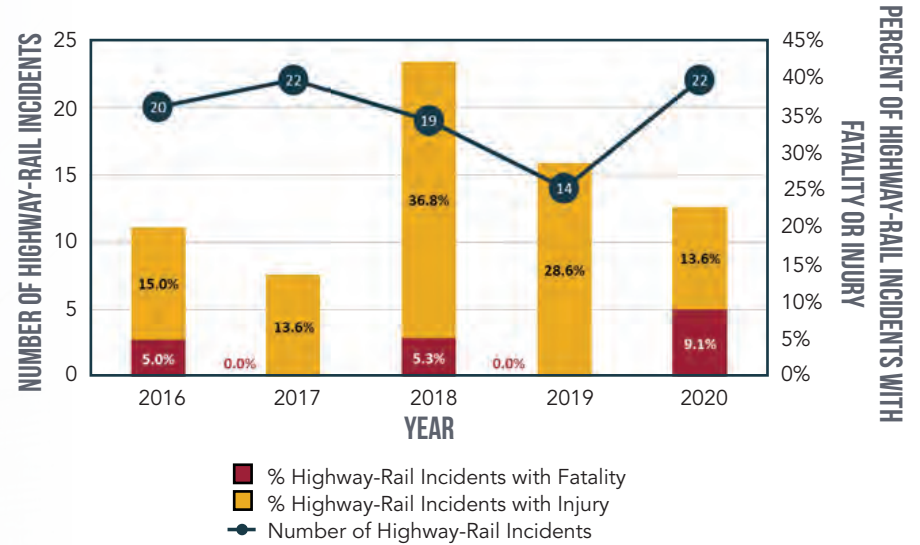


EXHIBIT 6.6: MARYLAND HIGHWAY-RAIL GRADE CROSSING INCIDENT TRENDS⁷



Highway-Rail Crossing Incident Locations

Approximately 77% of all highway-rail incidents in 2016-2020 occurred within the Baltimore and Washington metropolitan regions (**Exhibit 6.7**). That rate exceeds the corresponding proportion of grade crossings located in those regions, which is likely due to a higher potential for crossing conflicts (relative to other parts of the state) where train volumes, vehicular volumes, and pedestrian/bicycle activity are generally higher in the metropolitan areas. Additionally, more than half of the 97 total crossing incidents occurred in just 4 counties, including Baltimore City (17 incidents), Montgomery County (14), Baltimore County (11), and Prince George’s County (9). A closer review of the data identified only 15 specific crossings throughout the state that recorded more than a single incident during the 2016-2020 timeframe (**Exhibit 6.8**).

EXHIBIT 6.7: MARYLAND HIGHWAY-RAIL GRADE CROSSING INCIDENTS BY REGION (2016-2020)⁸

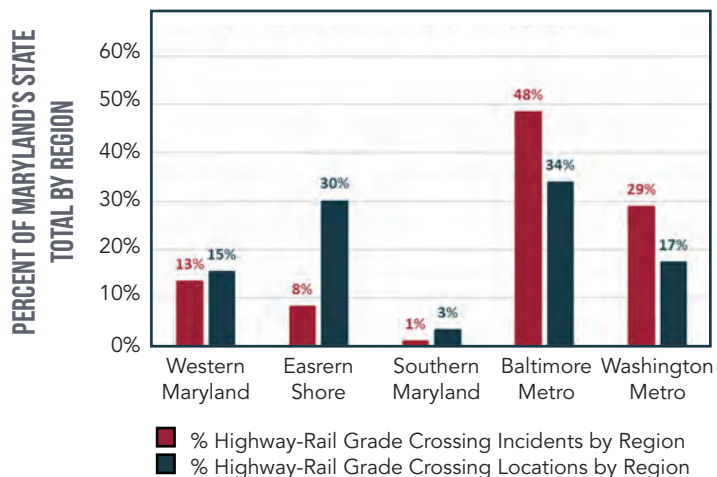


EXHIBIT 6.8: MARYLAND HIGHWAY-RAIL CROSSINGS WITH TWO OR MORE INCIDENT OCCURRENCES (2016-2020)⁹

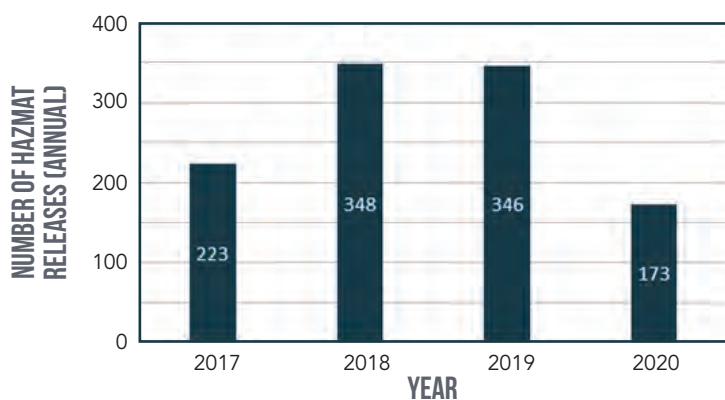
RANK	CROSSING ID	COUNTY	CITY	TOTAL INCIDENTS	FATAL INCIDENTS	INJURY INCIDENTS
1	140488D	Montgomery	Silver Spring	5	-	1
2	140866W	Baltimore City	Baltimore	3	-	-
3	140393V	Baltimore City	Baltimore	3	-	1
4	140828M	Baltimore	Rosedale	3	-	1
5	140262S	Prince George’s	Hyattsville	2	-	-
6	140507F	Montgomery	Gaithersburg	2	-	-
7	140869S	Baltimore City	Baltimore	2	-	-
8	140883M	Anne Arundel	Hanover	2	-	-
9	140905K	Prince George’s	Riverdale	2	-	-
10	530224K	Wicomico	Fruitland	2	-	-
11	831697V	Carroll	Westminster	2	-	-
12	961382A	Baltimore	Baltimore	2	-	-
13	140409P	Howard	Ellicott City	2	-	1
14	831836N	Washington	Hagerstown	2	-	1
15	643756C	Montgomery	Germantown	2	2	-



6.1.3 HAZARDOUS MATERIAL RELEASE INCIDENTS

Hazardous material release incidents can pose freight related safety issues, as well as environmental, community, or supply chain impacts. Available data for 2017-2020 identified 1,090 hazardous material release incidents during the four-year period, but with no consistent or readily apparent trend with the number of occurrences varying year-to-year (**Exhibit 6.9**). Ongoing monitoring and management of hazardous material movements, emergency response plans, contingency routing plans, or other relevant efforts to ensure the safe and secure transportation of potentially hazardous materials are anticipated to remain as important elements of overall freight operations.

EXHIBIT 6.9: MARYLAND HAZARDOUS MATERIAL RELEASE INCIDENTS¹⁰



6.1.4 FREIGHT SECURITY CONSIDERATIONS

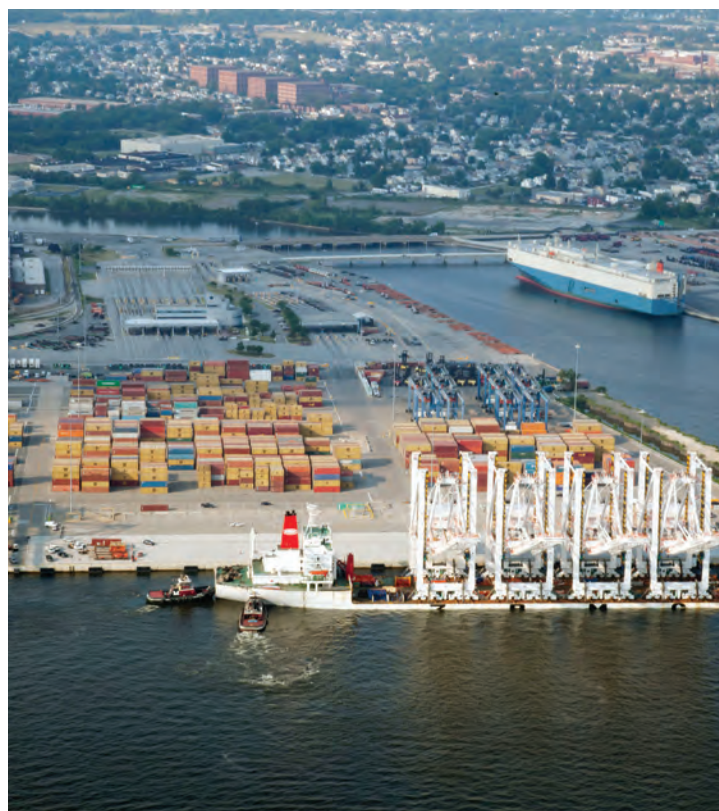
Freight-related security continues to be important to Maryland's overall freight system and operations. Security considerations pertain to secure facilities, secure cargo, or broader cybersecurity issues, with examples as follows:

- **Secure facility examples** – physical security management in truck parking areas, or security clearances and entrance control for site-specific freight/delivery access
- **Secure cargo examples** – physical security of cargo storage areas, or screening and inspection of inbound/outbound cargo at ports, rail yards, or other freight transfer sites
- **Cybersecurity examples** – technologies for defending against and recovering from cyberattacks, which will only increase in criticality with expanded use of new technologies such as connected and automated vehicles, unmanned aerial vehicles/drones, or personal delivery devices, and with increasing levels of uncertainty in global supply chains that may be influenced by international affairs

These types of security considerations will inevitably span multiple freight goals, focus areas, programs, and agencies; but security elements should be an integral part of the action planning components included in later sections of this plan.

The Port of Baltimore received a \$1.6 million grant from the Federal Emergency Management Agency (FEMA) to enhance its cybersecurity infrastructure to protect against cyberattacks and upgrade physical security fixtures such as fencing, lighting, and closed-circuit televisions (CCTV).

(MDOT 2022 Annual Attainment Report)



6.2 Operational Programs and Innovative/ Disruptive Technologies

6.2.1 TRANSPORTATION MOBILITY AND OPERATIONS

MDOT SHA's Office of Transportation Mobility and Operations (OTMO) manages the CHART and TSMO programs. Through these programs, OTMO uses ITS technologies, Advanced Traffic Management Systems (ATMS), and partnerships to monitor traffic, clear incidents, assist stranded motorists, and provide real-time travel information. OTMO's responsibilities also include planning and preparing for connected and automated vehicles. More information on OTMO can be found <https://www.roads.maryland.gov/mdotsha/Pages/OTMO-Home.aspx?pageid=902>.¹¹

Coordinated Highway Action Response Team (CHART)

Incident management is a critical component of helping to manage and operate Maryland's highway system. CHART is a statewide, multidisciplinary program responsible for providing traffic monitoring, 24/7 traffic management, traveler information (MD 511) services, and incident response and management services.

Heavy volumes of traffic, stop-and-go commuter peaks, and lack of comprehensive information regarding current, real-time conditions on available alternatives contribute to, and compound the effects of, unexpected incidents. With traffic growth outpacing realistic hopes of expanding capacity through building new highways or expanding existing ones, it is imperative to operate the existing system more efficiently through the application of ITS technologies and interagency teamwork.

Intelligent Transportation Systems (ITS)

CHART uses a combination of ITS devices including traffic speed detectors, traffic counting devices, CCTV cameras, pavement weather sensors, and field unit reports to assess and report real-time traffic flow. This information is transmitted to motorists via dynamic message signs, highway advisory radio, and mobile applications or third-party services such as Waze. ITS is a key component in safe work zone management in Maryland to monitor the worksite and to keep motorists informed. The CHART system also coordinates with the statewide arterial signal system to manage freeway and arterial traffic flows based on real-time conditions.

Focus Areas:

- ☑ Transportation mobility and operations (TSMO, CHART, ITS)
- ☑ Truck permitting, monitoring, and routing
- ☑ Connected and automated transportation systems
- ☑ Other evolving freight technologies (UAV, PDD, truck modeling)

CHART's incident management saved roadway users \$1.08 billion in CY 2020, a decrease in savings from CY 2019 (\$1.393 billion). This drop is due to the effects of COVID-19.

(MDOT 2022 Annual Attainment Report)

Transportation Systems Management & Operations (TSMO)

TSMO is an integrated approach to planning, engineering, operating, and maintaining existing facilities to maximize their full-service potential and ultimately improve the safety, security, and reliability of the transportation network. TSMO strategies generally do not add capacity to facilities; rather they leverage ITS technologies to improve operations on existing facilities.

In addition to CHART, examples of TSMO strategies deployed in Maryland include smart signals, the I-270 innovative congestion management (ICM) project, I-695 TSMO project, P3 managed lanes program, all-electronics (cashless) tolling (AET) at MDTA facilities. Following the 2018 TSMO Strategic Plan, MDOT SHA developed a TSMO Master Plan in 2020 identifying major TSMO systems and strategies, including Freight/CAV corridors such as I-68, I-70, US 301, US 50, and US 113.¹²

Currently, OTMO is evaluating opportunities to deploy technology to enhance truck parking by monitoring space availability in real time and pushing this information to truck drivers so they can find safe parking in Maryland.



MDTA also is working on an automated lane closures system for the Bay Bridge crossovers to reduce the response time and improve safety for implementing lane closure and two-way traffic operations on the bridge for incidents and construction work.

(MDOT 2022 Annual Attainment Report)



6.2.2 TRUCK PERMITTING, MONITORING, AND ROUTING

MDOT SHA's Motor Carrier Division (MCD) leads the state's efforts related to truck permitting, monitoring, and routing. These efforts include the management of oversize/overweight (OS/OV) vehicle operations and permit issuance via the Maryland One Permit System (reflected in the permit-related freight performance measures in **Section 5** of this plan). Focus areas relevant to MCD permitting, monitoring, and routing needs are highlighted below.

Truck Monitoring Systems

Upgrades and enhancements to truck monitoring systems may encompass Maryland's weigh-in-motion (WIM) and/or virtual weigh station (VWS) capabilities, as well as related permit system and monitoring technology upgrades, including the following:

- **Scale Houses and WIM/VWS Infrastructure:** Maryland's truck scale houses periodically need upgrades to the static scales to continue to operate safely. The Truck Size and Weight program is a critical safety program, and Maryland needs to ensure safe operation of trucks on its roadways. These scale houses along with WIM/VWS capabilities help to improve safety and reduce infrastructure degradation caused by overweight trucks statewide and in the mega-region.
- **WIM/VWS Program:** Needed improvements to the state's WIM/VWS systems include upgrades to the VWS program used to host the application and database. The program is critical to identifying overweight trucks and freight flow issues in Maryland and to maintaining compliance with federal safety standards. It is important to make the hardware upgrades for VWS to enhance safety and infrastructure preservation.
- **Maryland One Permit System:** MCD's permit system allows the state to process permit applications more effectively for large shipments. In lieu of hours or days, the improved automated hauling permit system auto-issues 80% of permits within seconds, and approximately 96% within two hours or less if the route analysis is approved (see **Section 5** of this freight plan for performance measure details). Planned improvements or refinements to the system include testing a new mobile app, adding a QR code to permits to enhance tracking opportunities, and reconfiguring data tracking so that individual truck trips can be counted within any single blanket permit count.

- **Detection Systems:** Maryland is implementing additional overheight and bridge impact detection systems at strategically critical locations. New impact detection systems include a pilot project at the Baltimore Harbor Tunnel Thruway to pair impact monitoring with video recordings to enhance enforcement opportunities and the potential recovery of cost liabilities due to damages. Overheight detection systems also include Hawk scan devices being installed at the Port of Baltimore to monitor truck weight, height, width, and length, including opportunities to tie weight measurements to permit validations.
- **GIS Tracking Data:** MCD is coordinating development of a comprehensive GIS layer within their bridge system to enhance tracking of bridge hit locations, related damage costs, enforcement details, and relevant construction or diversion details. The intent is to consolidate bridge, roadway, and construction information into a central GIS clearinghouse layer to improve tracking, management, and enforcement details.



Truck Routing Considerations

Effective truck routing and guidance is critical to the safe movement of goods throughout Maryland's roadway network, particularly in areas where major roadway junctions, freight hubs, background congestion, or nearby communities require extra attention. MCD identified the following opportunities to help support effective truck routing and guidance:

- **Guide Sign Improvements:** Clear and timely route guidance is critical for ensuring trucks are able to follow their appropriate and intended routes, particularly for OS/OW vehicles where the potential challenges and impacts of following an incorrect route can be more problematic. Coordination among MDOT SHA MCD, MDOT SHA Office of Traffic and Safety (OOTS), MDTA, and others continues to monitor conditions, reaffirm that any existing signing is still valid as permit, facility, or route details change over time, and identify potential areas for improvement.
- **Bridge Clearance Postings:** Up-to-date bridge height clearances are critical for appropriate routing assumptions as part of the truck permitting process, especially for system-generated auto-issue permits. Timely system updates need to consider height constraints by lane, as well as any changes that occur as a result of re-paving operations, ongoing construction, temporary lane shifts, or other work zone-related factors that could influence the appropriate routing guidance.
- **Special Barrier Delineation:** Operational experience could be paired with safety data to help identify potential areas where additional linear delineation of concrete barriers could be beneficial. One example includes barrier treatments that were previously applied along the I-695 East ramp to I-83 North.
- **OS/OW Considerations in New Construction:** As freight demand continues to grow, bigger, heavier, and more frequent OS/OW loads are also expected. With this trend in mind, new construction activities throughout the state need to consider OS/OW loads early in the design process, particularly where designs may be more restrictive, such as across bridges, through roundabouts, or in the context of Complete Streets initiatives.

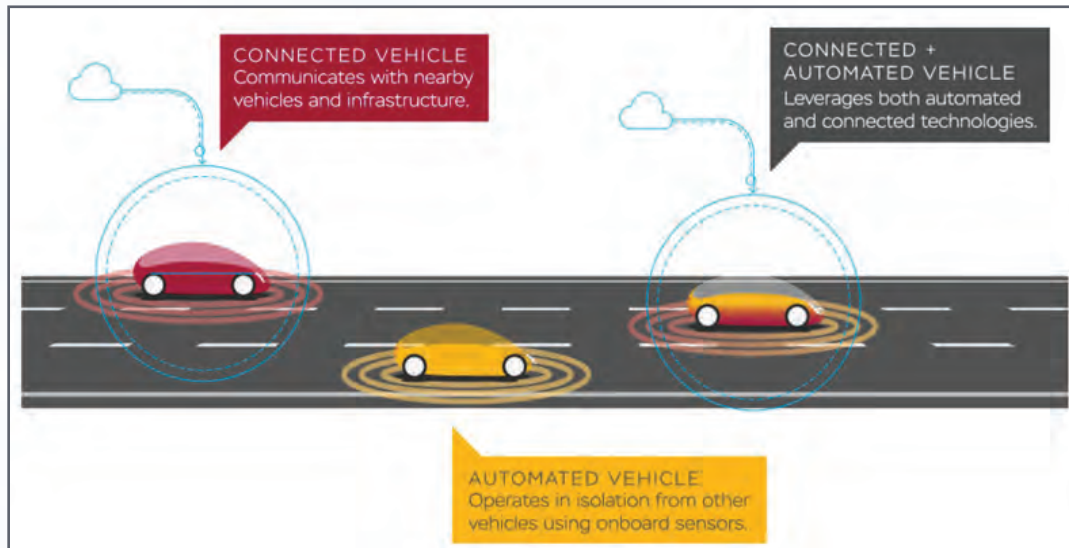
6.2.3 CONNECTED AND AUTOMATED TRANSPORTATION SYSTEMS

Connected and automated transportation systems encompass technology in the realm of CAV, advanced driver assistance systems (ADAS), truck platooning initiatives, connected freight networks, and related interest areas. These types of technologies and systems provide new and expanding opportunities to help address some of Maryland's most pressing freight needs and issues, potentially including a direct influence on truck crashes, truck mobility, truck parking, and commercial vehicle safety inspections. At a high-level, CAV technologies could help to:

- **Save lives and reduce the severity of injuries**, with the possibility of almost eliminating crashes altogether;
- **Improve reliability**, potentially reducing congestion and, by extension, reducing vehicular GHG emissions and improving air quality;
- **Enable new mobility service solutions** to enhance the lives of the young, aging, people with disabilities and medical conditions, and others who choose not to drive by providing better access to employment, medical services, health care, shopping, entertainment, or all opportunities for improved quality of life; and
- **Improve the movement of commodities and service providers**, thereby lowering the cost of goods and services to consumers.

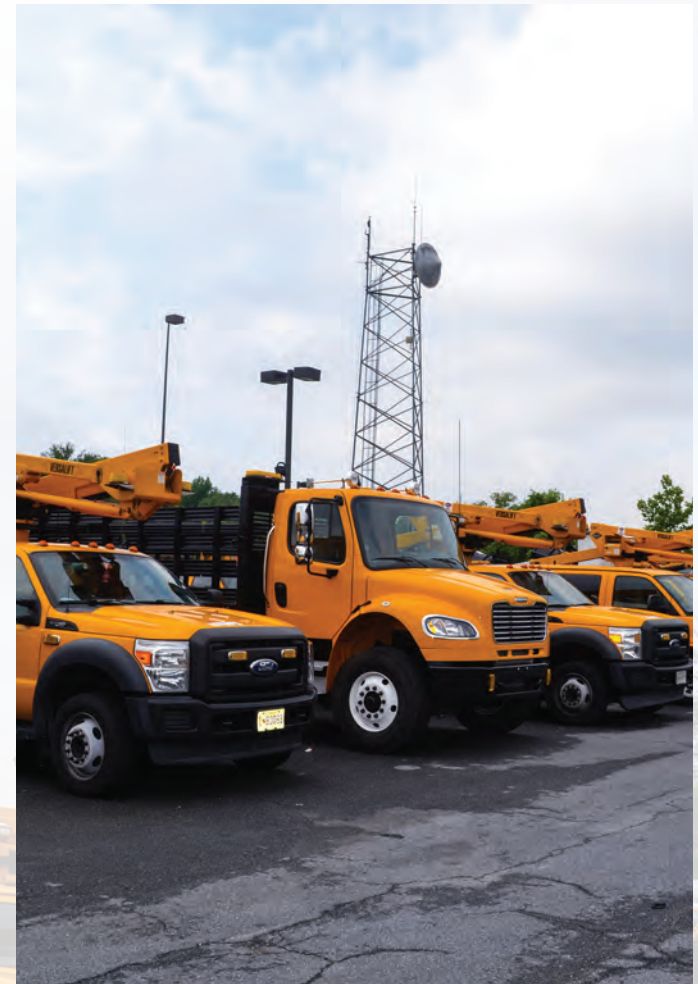
Maryland CAV Working Group

The Maryland CAV Working Group was established by MDOT in 2015 as the central point of coordination for the development and deployment of emerging CAV technologies in the state. The Maryland CAV Working Group comprises a diverse membership by including elected officials, state and local agency representatives, highway safety organizations, non-transportation experts, academia, and representatives from the private sector and automotive industry – totaling engagement of more than 500 people.



Driver assistance technologies are already helping to save lives and prevent injuries. Many vehicles on the road today have crash avoidance features, including Automatic Emergency Braking, Lane Keeping Assistance, Blind Spot Warning, and other safety technologies. These features help vehicles understand surroundings and either warn the driver or act to avoid a crash.

Maryland now has more than 40 connected vehicle roadside units in Montgomery and Prince George's counties that broadcast signal phase and timing (SPaT), intersection map data (MAP), pedestrian warning, and traveler and/or information messages over a mix of radio (DSRC) and cellular (LTE C-V2X) technology. MDOT also developed and launched a statewide security credential management system for any agency to register their roadside unit (RSU) or on-board unit (OBU) in an effort to increase trust and cybersecurity of connected vehicle data exchanges.



Truck Platooning

Following recent changes in state law and adoption of regulations, MDOT MVA has implemented a collaborative, constructive, and expedient process for the authorization of truck platooning in Maryland. Additional information on truck platooning is available on MDOT MVA's CAV website bit.ly/mdtruckplatooning.

Truck platooning utilizes vehicle-to-vehicle communications technology to allow two or more vehicles to be synced electronically with one another via radar, GPS, and Wi-Fi. The technology allows trucks to communicate information on braking, speed, and oncoming obstacles to ensure following trucks perform in a more consistent and predictable manner. Truck platooning reduces the reaction time of the following trucks in a platoon and therefore reduces the likelihood of rear-end or chain-reaction crashes.

Maryland truck platoons, are currently limited to two trucks, with safety restrictions as follows:

- Each truck is required to have a driver who has a valid commercial driver license with appropriate endorsements.
- Each driver must be trained on that specific vehicle's platooning system and is still responsible for care and control of the vehicle they are in.
- All trucks must follow all traffic laws and rules of the road, and travel in a reasonable and prudent manner.
- Platooning vehicles must have a sticker displayed on the power unit near other official decals and stickers.

As the technology evolves, Maryland will stay engaged to sustain truck platooning and develop enhancements for the future. This may include consideration of platoons, with more than two trucks, platoons for other heavy vehicles including buses and military vehicles, and platoons with a human driver only in the lead vehicle paired with automated control in the following vehicle.



6.2.4 OTHER EVOLVING FREIGHT TECHNOLOGIES

Personal Delivery Devices (PDD)

Maryland has implemented a collaborative, constructive, and expedient process for the operation of PDD in Maryland. This process follows a recent state law change that requires MDOT MVA to establish a PDD pilot program. The pilot period ends and full implementation of the new law begins on 7/1/22. The current definition of a PDD is a powered device that:

- is operated primarily on shoulders, sidewalks, and crosswalks;
- is intended for the transport of property on public rights-of-way;
- weighs not more than 550 pounds, excluding cargo; and
- is capable of navigating with or without the active control or monitoring of an individual.

MDOT monitors emerging and innovative technologies such as PDDs to adapt to, and take advantage of, technologies reshaping mobility choices. PDDs have emerged as an innovative technology promising to improve the efficiency of deliveries and may have a significant influence on last-mile deliveries in congested urban environments.



Personal Delivery Device (PDD) Pilot Program Requirements in Maryland:

MDOT MVA Page: <https://mva.maryland.gov/Pages/pdd.aspx>

Process Details: <https://mva.maryland.gov/Documents/Pilot-Process-for-Authorizing-the-Operation-of-PDD.pdf>

Personal Delivery Device (PDD) Pilot Program Examples:

Program: Morgan State University (MSU), Baltimore, MD, PDD Pilot Program

PDD Partner: **Kiwibot**

Details: <https://msu.sodexomyway.com/kiwibot>

Program: City of Pittsburgh, PA, PDD Pilot Program

PDD Partner: **Kiwibot**

Details: <https://engage.pittsburghpa.gov/pdd-pilot>

Program: Foster City, CA, Autonomous Robot Delivery Service Pilot Program

PDD Partner: **Starship Technologies**

Details: <https://sustainable.fostercity.org/autonomous-robots/>

Program: City of Frisco, TX, FedEx Delivery Device Testing

PDD Partner: **FedEx Roxo and DEKA Research & Development Corporation**

Details: <https://www.friscotexas.gov/1640/FedEx-Delivery-Robot>

UAV or Drones

Unmanned Aerial Vehicle (UAV) systems and delivery drones may be used to transport lightweight packages, medical supplies, food, or other goods. This newer mode of transportation has the potential to change last-mile delivery economics for smaller and lighter packages by replacing deliveries currently made by traditional car, van, or truck delivery services. Potential benefits of drone package delivery may support reductions in traffic congestion, environmental pollution, delivery times, and transportation costs; and several companies in the U.S. and across the globe are actively vying to expand their markets and operations in the rapidly evolving drone package delivery industry (see sidebar).¹³ There are, however, potential challenges to broader overall usage and acceptance of drone delivery systems including, for example, licensing, insurance, and operating requirements in compliance with Federal Aviation Administration (FAA), state, or other applicable regulations; operational constraints during wind, rain, or other inclement weather; cybersecurity and package security concerns; bird/wildlife conflicts; or general public acceptance.

In addition to smaller UAVs and package delivery drones, larger Advanced Air Mobility (AAM) systems through companies such as **Lilium**, **HopFlyt**, or **Lift Aircraft** also are evolving in ways that could further enhance small business delivery options, emergency service deliveries, and personal travel options.¹⁴ As UAV, drone, and AAM systems and technologies continue to evolve or become implemented, so may the need for state agencies to stay abreast of and collaborate on their evolving needs. Relative to state agency jurisdictional areas, potential topics of interest could, for example, pertain to:

- Policies affecting the operation of UAV or AAM systems in the state;
- Advance mapping data and systems that may support aerial routing decisions; and
- Supporting infrastructure placement (e.g., ground radar and communications systems along interstate or rail corridors) that may support future aerial travel corridors.

Top 10 Companies in the Drone Package Delivery Industry

As reported by Emergen Research, March 2022, based on company revenue:¹³

- Prime Time Air (\$280B)
- UPS Flight Forward (\$74B)
- FedEx (\$69B)
- DHL Parcelcopter (\$55B)
- Wing (\$41.2B)
- Zipline (\$251M)
- Matternet (\$34M)
- Flytrex (\$20M)
- Flirtey (\$16M)
- Wingcopter (\$15.7M)

Maryland's Unmanned and Autonomous Systems

MDOT's CAV Team coordinates directly with the Maryland Department of Commerce and their Aerospace Program. With several decades of experience as a center of unmanned and autonomous systems activity, Maryland is on the leading edge of a robust and rapidly growing unmanned vehicle community that also includes artificial intelligence and robotics. Example initiatives include a proposal to create a Chesapeake Unmanned Aircraft System Route Network overlaying the Chesapeake Bay that supports government, civil, and commercial operations; research; and public safety.

For more details, see: https://issuu.com/stateofmaryland/docs/uas_brochure_2022_8x11_v3?fr=sY2MyZjQ4MDAyMzl

Freight Modeling and Analytics

The Maryland Statewide Transportation Model (MSTM) was developed in 2009. Throughout the years, FHWA has invested in MDOT and the Baltimore Regional Transportation Board (BRTB) to improve on the MSTM model for freight using the FHWA C20¹⁵ program. MDOT continues to invest in newer data, model updates, tools, and scenario applications to support overall freight model calibration and validation enhancements, truck specific enhancements, and freight CAV enhancements.



Maryland is investing in resources that provide analytical information quickly and align with the Maryland highway network – One Maryland One Centerline (OMOC), which mirrors the Maryland Highway Performance Monitoring System (HPMS) network.¹⁶ These efforts allow Maryland to use its vast data resources aligned with OMOC to understand the performance of different types of measures and comprehensively assess the network. Maryland is developing congestion and truck parking analytical tools using INRIX truck probe data, which enhances MDOT's ability to understand freight movement. MDOT also is exploring concepts of freight fluidity and improved freight data to best assess OMOC from the freight user perspective.

Other Technology Systems

Beyond typical transportation infrastructure and support systems, there are a multitude of other evolving technologies that also influence broader aspects of the freight and goods movement industry, particularly from the perspective of shippers, freight forwarders, third-party logistics companies and other businesses involved in supply chain decisions. While such topics are often beyond MDOT's jurisdictional control, they are important to recognize in terms of communicating and collaborating with the state's public and private freight stakeholders who rely on efficient and agile freight systems. While innovations pertaining to CAV, platooning, data, and other resources noted previously are critical, other relevant examples of innovative technology systems include (but are not limited to) the following:

- **Fleet Management Systems (FMS):** FMS software uses GPS, telematics, and other information technologies to drive fleet efficiency optimization and influence route management, asset tracking and management, fuel management, vehicle maintenance, driver profile and behavior monitoring, and digital documentation.¹⁷
- **Blockchain:** Blockchain has potential to change the future of freight security by offering more transaction verification options to shippers throughout the supply chain. The accessibility of information will be an important aspect of this technology as all parties can access consolidated ledgers to gauge authenticity and examine records.¹⁸

- **Robotics Process Automation and Advanced Machine Learning (AML):** These technologies provide opportunities such as digitization of physical assets and related operations (such as port) to allow for automated data analysis, predictive maintenance, pattern identification, real-time performance tracking, forecasting, and other automated processes where humans and technology cooperate to enhance resource utilization and improve operations across the supply chain.¹⁹
- **Internet of Things (IoT):** IoT forms a network of devices and vehicles that help with shipment and location tracking, environment sensing, fleet management, eco-friendly shipping, and supply demand balance.²⁰

6.3 Asset Preservation and Improvement Programs

The MDOT Strategic Asset Management Plan (SAMP) guides the Asset Management Program for MDOT, its five TBUs, and the MDTA.²¹ The SAMP's goals and strategies focus on addressing seven critical assets: facilities, pavement, structures, tunnels, rail, vehicle fleet and equipment, and major information technology (IT) systems.

MDOT SHA's Asset Management Office (AMO) guides the agency's asset management program toward optimal performance using risk-based resource allocation to maintain all roadway assets in good condition. AMO supports performance-based planning, life cycle planning, and state-of-good-repair planning. It develops the TAMP to comply with current federal highway authorization requirements. The TAMP is currently being updated; therefore, the bridge and pavement asset conditions included in this freight plan are based on the latest AR data.

Focus Areas:

- ✓ Bridge management program
- ✓ Pavement management program
- ✓ Dredged material management program

6.3.1 BRIDGE MANAGEMENT PROGRAM

MDOT SHA's bridge rehabilitation and preservation program seeks to minimize the number of bridges that would have deteriorated to a poor rating (**Exhibit 6.10**) without rehabilitation. Examples of specific improvements include the following:

- MDOT SHA opened a \$13.0 million MD 355 bridge over CSX railroad infrastructure in the Monocacy National Battlefield in partnership with the National Park Service; a new \$19.0 million MD 180 bridge over US 15 and US 340 as part of a collaboration between Frederick County, the City of Frederick, MDOT, and a private sector partner; and a package of improvements to the Solarex Court intersection.
- MDTA completed the Westbound Bay Bridge right lane deck rehabilitation ahead of schedule in April 2020, installing a new tolling gantry and implementing full-time AET.
- MDTA advanced major bridge projects including the replacement of the I-895 Bridge in Baltimore and Nice/Middleton Bridge in Southern Maryland.

Previous budget constraints due to COVID-19 required temporary adjustments to future bridge work and funding. Despite these constraints, critical projects such as the MDTA Nice/Middleton Bridge Replacement, Bay Crossing Tier I NEPA Study, and ongoing Bay Bridge future work were able to be continued. MDOT remains dedicated to ensuring the safety of bridge assets, as well as the overall system's state of good repair, and will continue to develop plans for bridges with a poor rating that cannot be repaired under the preservation program.

MDOT SHA recorded 29 bridges rated in poor condition in 2021, which is the lowest level since tracking began and one of the lowest percentages of any state transportation agency in the nation. This reduction can be attributed to the efficient use of federal funds for current bridge replacement projects and the successful bridge rehabilitation and preservation program.

(MDOT 2022 Annual Attainment Report)

EXHIBIT 6.10: NUMBER OF MDTA AND MDOT SHA BRIDGES IN POOR CONDITION

CALENDAR YEAR	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
NUMBER OF MDTA BRIDGES IN POOR CONDITION	4	1	1	1	1	1	1	1	1	0
NUMBER OF MDOT SHA BRIDGES IN POOR CONDITION	97	87	81	69	69	67	62	52	36	29
TOTAL NUMBER OF BRIDGES IN POOR CONDITION	101	88	82	70	70	68	63	53	37	29
PERCENT OF BRIDGES IN POOR CONDITION	3.5%	3.0%	2.8%	2.4%	2.4%	2.4%	2.2%	1.8%	1.3%	1.0%



6.3.2 PAVEMENT MANAGEMENT PROGRAM

Pavement condition can affect safety, efficiency, mobility, and accessibility for all vehicles throughout Maryland, including freight traffic. MDOT conducts yearly roadway inspections. MDOT's pavement management program focuses on the overall condition of the network. Effective asset management strategies ensure continued usability, quality, and safety along Maryland's roadways. Highway conditions based on 2021 AR reporting data include summaries of preferred maintenance status (**Exhibit 6.11**) and overall acceptable pavement conditions (**Exhibit 6.12**). Condition trends are indicative of the positive effect that asset management strategies have on existing highways. Conditions have remained on target despite recent maintenance challenges due to the influence of COVID-19 on maintenance staffing, budgeting, and schedules. MDOT SHA took advantage of the 50% drop in traffic volumes that occurred during the pandemic to extend work hours and advance project improvements while still ensuring that MDOT employees remained safe with appropriate physical distancing and use of personal protective equipment.

EXHIBIT 6.11: PERCENT OF MDOT SHA NETWORK IN PREFERRED MAINTENANCE CONDITION²²

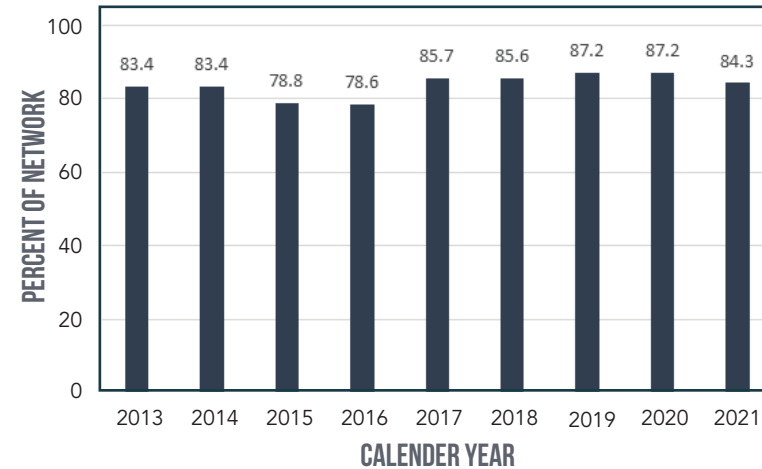
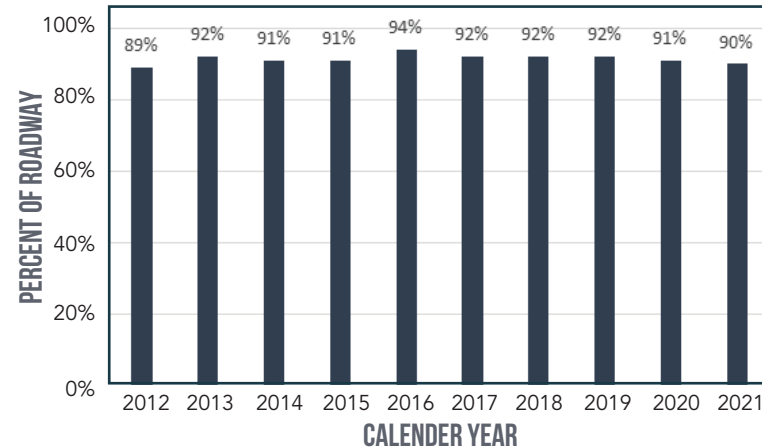


EXHIBIT 6.12: OVERALL ACCEPTABLE PAVEMENT CONDITION²³



6.3.3 DREDGED MATERIAL MANAGEMENT PROGRAM

Dredging makes it possible for cargo ships to continue to move through the Port of Baltimore. It also provides material to create beautiful habitats for thousands of species of birds and animals, and places of man-made wonder for people to discover nature. Dredging related efforts in Maryland are detailed annually in the MDOT MPA DMMP.²⁴ Development of the DMMP is a cooperative effort led by committee and involves a diverse group of public and private stakeholders at all levels. The DMMP is a rolling 20-year plan that provides guidance on the overall management of the state's dredging requirements with a focus on:

- The continual removal of sediment from the shipping channels;
- The identification of the right placement sites to store the sediment; and
- The development of other innovative tools and solutions for managing and using sediment.

To ensure the Port of Baltimore remains safe and accessible, MDOT MPA obtains and manages dredged material placement sites to support dredging operations and maintain shipping channels (**Exhibit 6.13**). Management and capacity of dredged material placement sites currently are on target and in alignment with the rolling 20-year plan.

Poplar Island will continue to receive dredged materials through 2032. Additionally, MDOT MPA and the USACE now are designing the Mid-Chesapeake Bay Island Ecosystem Restoration project. Focused on James and Barren islands, they will replace Poplar Island as the state's primary receiving site for Bay channel dredged sediment.

Future planned work includes maintaining maximum depths for the approach channel at the mouth of the Chesapeake Bay where ultra-sized, neo-Panamax vessels enter on their way to the Port of Baltimore. More details on the dredging needs for the Port of Baltimore are presented in **Section 4**.



EXHIBIT 6.13: PORT OF BALTIMORE CHANNEL SYSTEM AND DREDGING SITES ²⁵



In January 2021, MDOT MPA and the U.S. Army Corps of Engineers completed the Poplar Island Ecosystem Restoration Project lateral expansion. This provided 575 additional acres of dredged material placement, adding 28 million cubic yards (mcy) of storage capacity.

(MDOT 2022 Annual Attainment Report)

6.4 Freight Congestion and Reliability

Maryland is a nationally and regionally significant crossroads for freight movement and, as detailed previously in **Section 3.1**, approximately 78% of the state's total freight tonnage and 76% of total freight value move by truck along the state's highway systems. For these reasons, routinely monitoring congestion and reliability is a critical focus area for MDOT. Maryland's annual Mobility Report helps MDOT to see how well freight moves and to identify and track freight bottlenecks over time. Additionally, MDOT continues to build new resources, such as the MRPT, using truck probe data to understand freight mobility dynamics and the impact of delay on key Maryland supply chains. Based on a snapshot of these resources, freight-related congestion in Maryland is summarized in the sections that follow.



Focus Areas:

- ✓ Truck volumes and major freight corridors
- ✓ Background congestion and reliability issues
- ✓ Truck bottleneck details
- ✓ Truck reliability details
- ✓ Truck congestion costs
- ✓ Freight mobility improvement opportunities

6.4.1 TRUCK VOLUMES AND MAJOR FREIGHT CORRIDORS

An assessment of daily truck traffic in Maryland shows the highest daily truck volumes along the interstate system, as well as high percentages of truck traffic on both interstate and arterial routes (**Exhibit 6.14**). Statewide, the highest levels of truck activity are generally clustered around I-95, I-495, I-695, and I-270 in the Baltimore Metro and Washington Metro regions, as well as the I-81 corridor through Washington County. A high proportion of truck traffic is also apparent on several notable arterial connections such as the MD 159 corridor with access to Aberdeen, the MD 550 corridor northeast of Frederick, and the MD 313 corridor that provides access between US 301 and freight activities in Delaware.

MDOT generally updates their traffic data collection along particular roadways on a three-year cycle. As such, corresponding future changes in truck traffic volumes may be revisited in coordination with future MDOT SHA volume revisions, including annual updates that are typically covered as part of the Mobility Report.

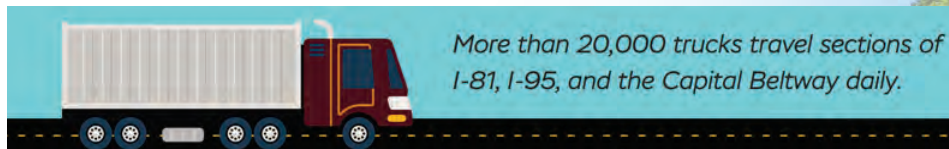


EXHIBIT 6.14: MARYLAND TRUCK VOLUME MAP

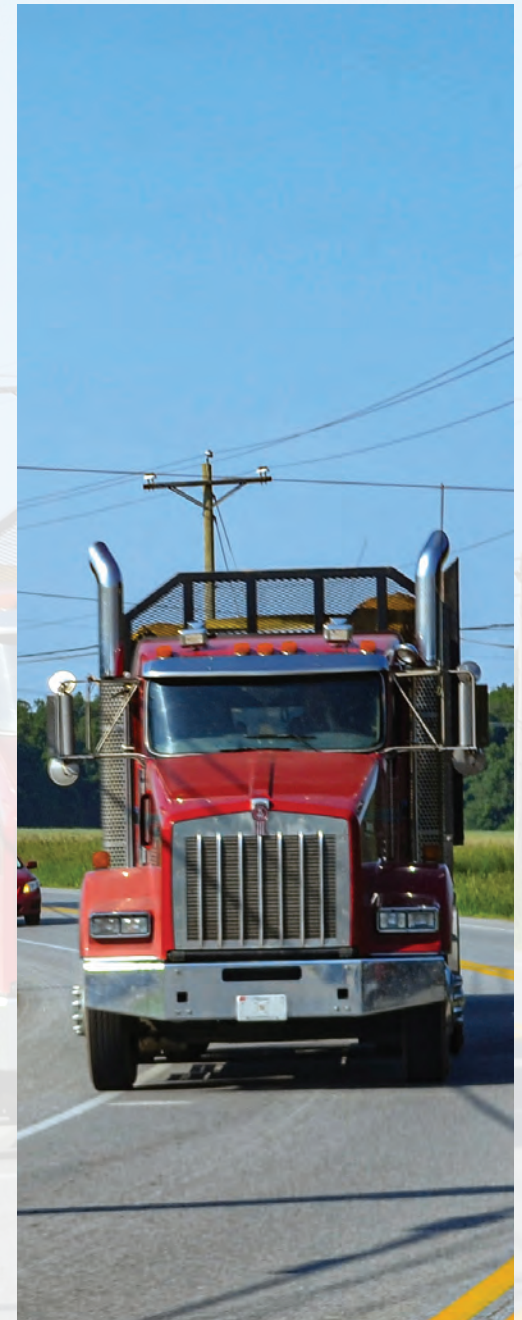


**HIGHEST TRUCK VOLUME LOCATIONS
(TRUCKS PER DAY)**

- 1 28,300 on I-95 (north of I-695)
- 2 22,000 on I-95/I-495 (north of US 50)
- 3 20,900 on I-81 (north of I-70)
- 4 17,000 on I-695 (west of Greenspring Avenue)
- 5 13,900 on I-270 (north of I-370)

**HIGHEST TRUCK PERCENTAGE LOCATIONS
(% TRUCKS PER DAY)**

- 1 32% on MD 159 (south of US 40)
- 2 31% on I-81 (south of Pennsylvania line)
- 3 28% on MD 550 (north of MD 26)
- 4 27% on I-81 (south of US 11)
- 5 25% on MD 313 (south of US 301)



6.4.2 BACKGROUND CONGESTION AND RELIABILITY ISSUES

As noted previously in the context of performance measures from **Section 5** of this plan, concerns with congestion, delay, and reliability generally remain as significant challenges for Maryland. MDOT devotes significant resources to monitoring and managing congestion trends, including summaries that are updated annually as part of the MDOT SHA Mobility Report. This Maryland Freight Plan does not intend to duplicate all of the relevant details from the Mobility Report; but it does make reference to select content and current/future updates that are accessible online <https://roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=711>.²⁶

In terms of overall background traffic congestion and reliability, the Mobility Report typically includes detailed assessments of vehicle probe data for Maryland's freeway/expressway system and arterial system. The primary measure of congestion is based on Travel Time Index (TTI), while the primary measure of reliability is based on Planning Time Index (PTI) (see below and right).

Travel Time Index (TTI)

With vehicle probe data, TTI is used as the primary measure of congestion. The TTI compares the 50th percentile travel time on a segment of roadway for a particular hour to the travel time of a trip during the off-peak (where off-peak equates to free flow or uncongested conditions). The higher the TTI, the longer the travel time.

MDOT SHA Congestion thresholds are:

- Uncongested (TTI < 1.15)
- Moderate Congestion (1.15 ≤ TTI < 1.3)
- Heavy Congestion (1.3 ≤ TTI < 2.0)
- Severe Congestion (TTI ≥ 2.0)

Planning Time Index (PTI)

MDOT SHA evaluates trip reliability using PTI, which in Maryland compares the 95th percentile travel time to the off-peak travel time. The PTI represents the “extra time” factor that motorists and trucks should plan for to ensure on-time arrival at their destination, assuming the 95th percentile generally reflects the time it would take due to nonrecurring congestion such as a major incident or event. As an example, a PTI of 2.0 means that if it takes 10 minutes to travel in free flow conditions, a motorist should allow 20 minutes for travel to ensure a 95% chance of on-time arrival. A lower PTI is a more reliable trip; a higher PTI is a less reliable trip that may take longer.

MDOT SHA Reliability thresholds are:

- Reliable (PTI < 1.5)
- Moderately Unreliable (1.5 ≤ PTI < 2.5)
- Highly to Extremely Unreliable (PTI ≥ 2.5)

With these perspectives in mind, typical annual updates from the Mobility Report that summarize overall background congestion and reliability generally include the following:

- Maryland Congestion Map (AM Peak Hour) (see **Exhibit 6.15**)
- Maryland Congestion Map (PM Peak Hour) (see **Exhibit 6.16**)

- Maryland Congestion Map (Friday Summer Hour)
- Maryland Congestion Map (Saturday Summer Hour/Midday)
- Maryland Congestion Map (Saturday Summer Hour/Evening)

- Top 15 Most Congested Freeway/Expressway Sections (AM Peak Hour)
- Top 15 Most Congested Freeway/Expressway Sections (PM Peak Hour)

- Top 15 Most Congested Arterial Sections (AM Peak Hour)
- Top 15 Most Congested Arterial Sections (PM Peak Hour)

- Maryland Reliability Map (AM Peak Hour) (see **Exhibit 6.17**)
- Maryland Reliability Map (PM Peak Hour) (see **Exhibit 6.18**)

- Maryland Reliability Map (Friday Summer Hour)
- Maryland Reliability Map (Saturday Summer Hour/Midday)
- Maryland Reliability Map (Saturday Summer Hour/Evening)

From a summary congestion perspective, almost all of the state's Top 15 most congested sections are generally located throughout the Baltimore Metro and Washington Metro regions, notably affecting access to, from, or through hubs in and around Baltimore, Washington, D.C., Frederick, and near the Bay Bridge. Statewide summaries from the Mobility Report note that during the peak hours, 15% (AM) to 34% (PM) of the arterial system is congested, 11% (AM) to 18% (PM) of the freeway/expressway system is congested, and 22% (AM) to 31% (PM) of the VMT on the freeway/expressway system occurs in congested conditions.

From a summary reliability perspective, the same congested locations around Baltimore, Washington, D.C., and Frederick also experience the least reliable travel. Statewide summaries from the Mobility Report note that during peak hours, 7% (AM) to 13% (PM) of the freeway/expressway system is unreliable, and 14% (AM) to 24% (PM) of the VMT on the freeway/expressway system occurs in unreliable conditions.



EXHIBIT 6.15: MARYLAND CONGESTION MAP (2019 AM PEAK)²⁷

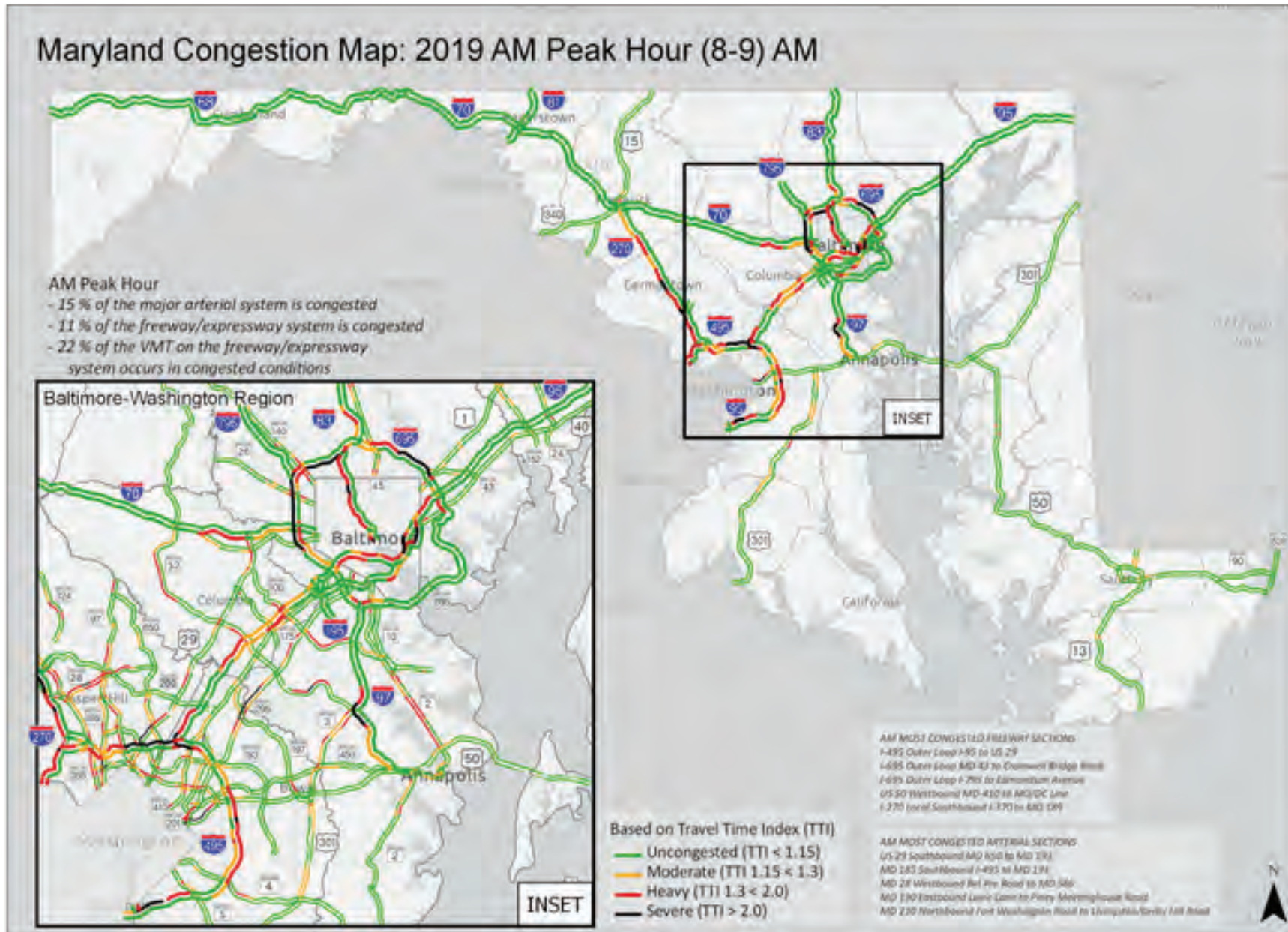


EXHIBIT 6.16: MARYLAND CONGESTION MAP (2019 PM PEAK)²⁸

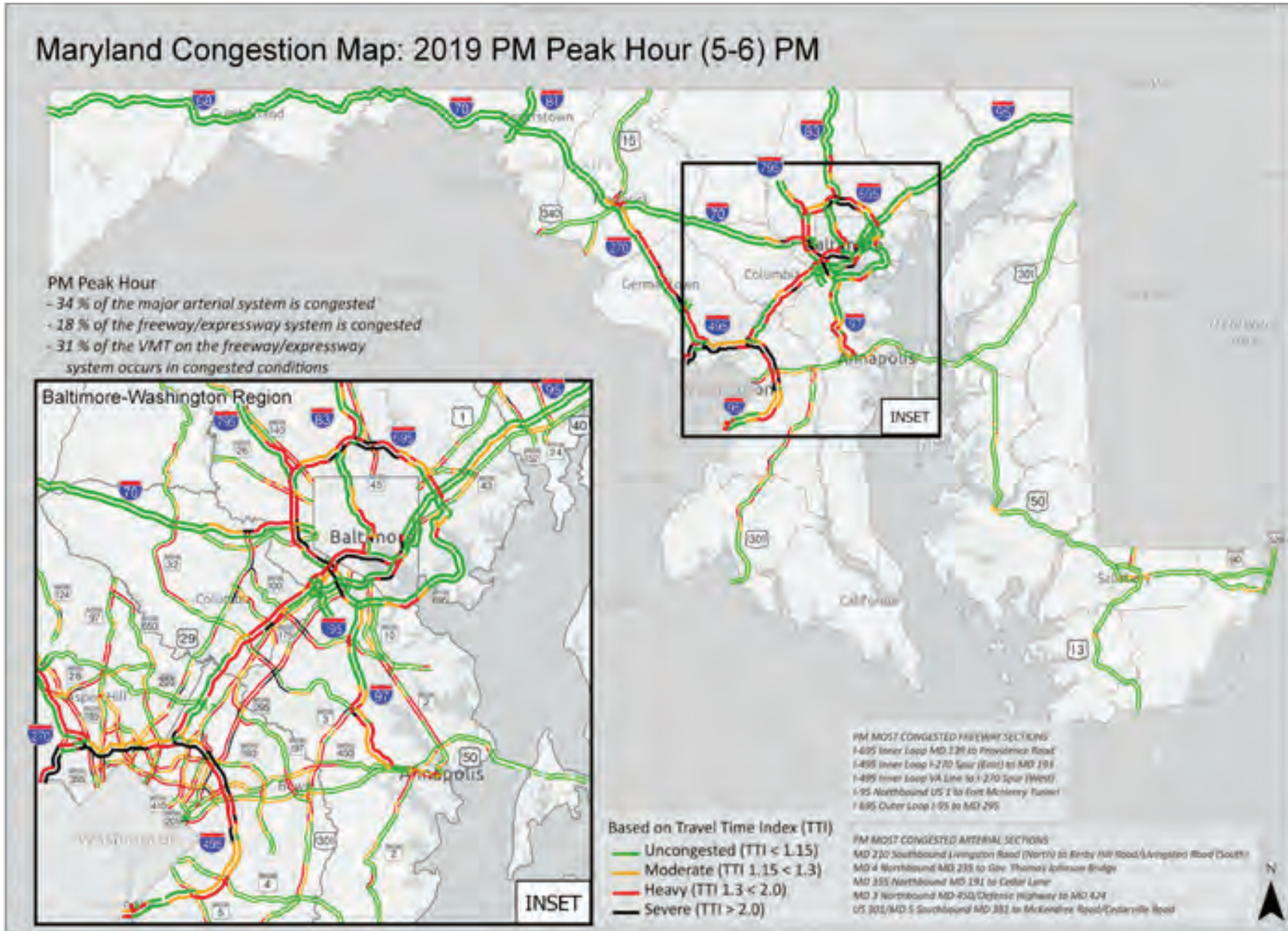


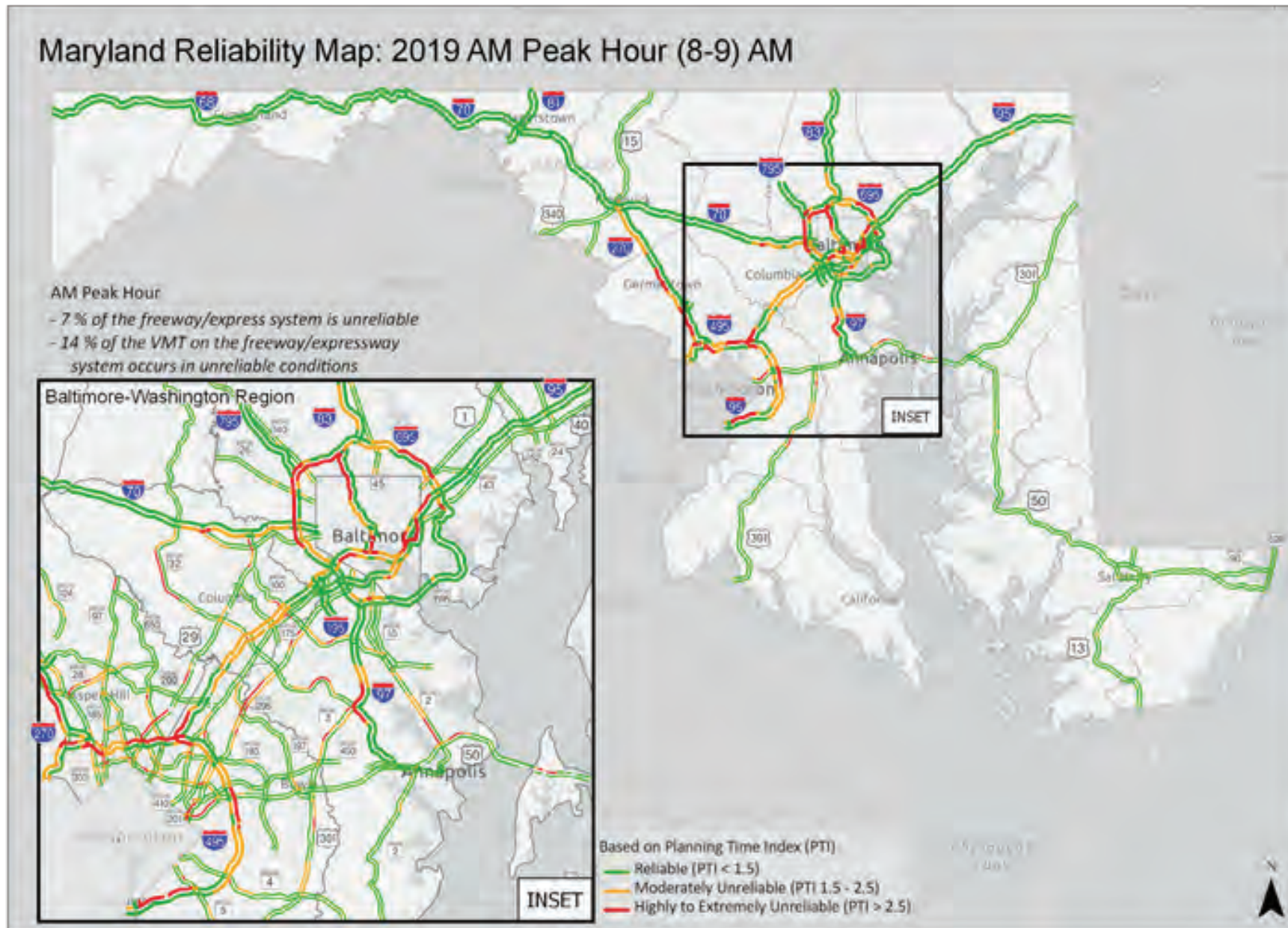
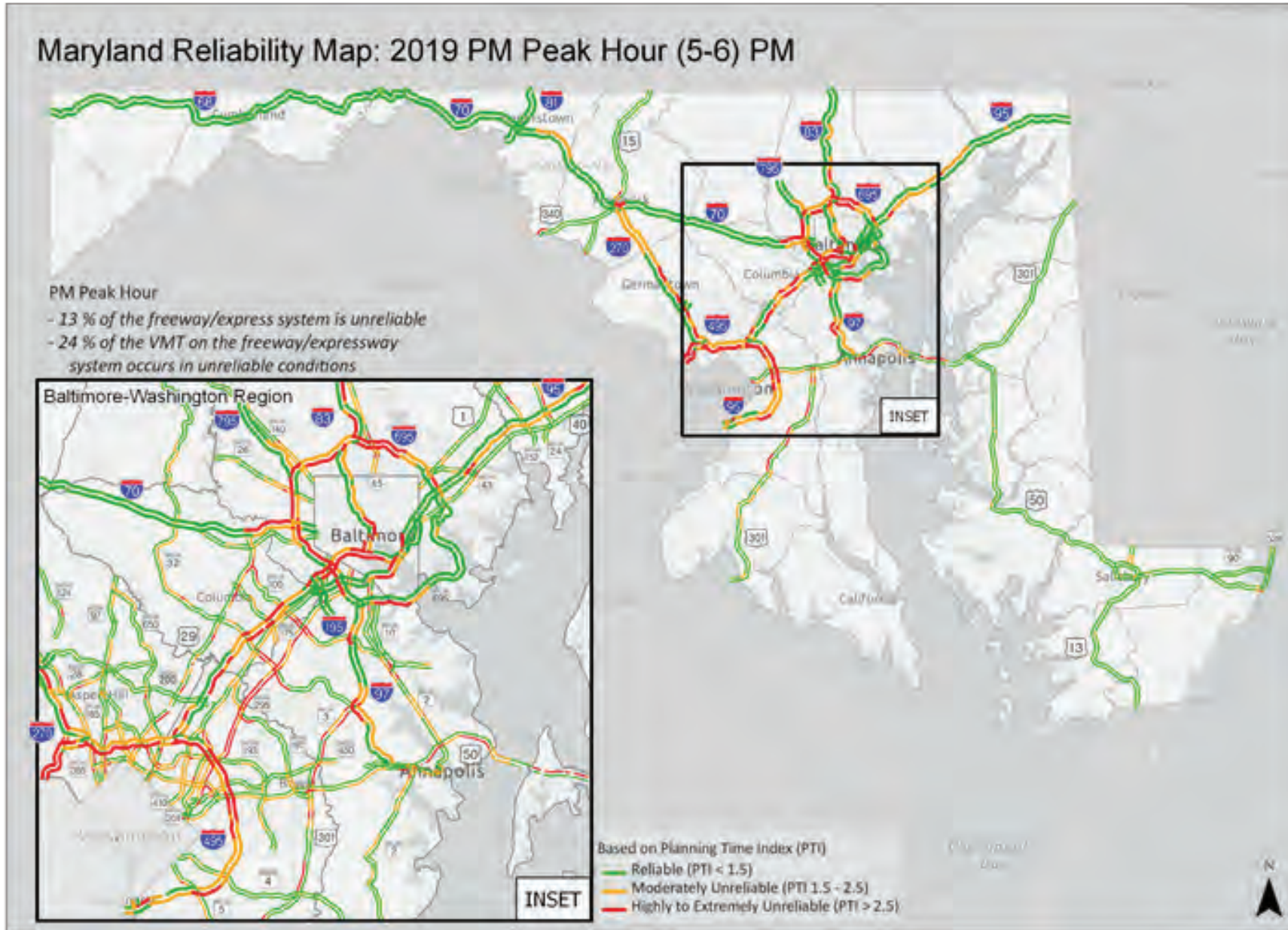
EXHIBIT 6.17: MARYLAND RELIABILITY MAP (2019 AM PEAK)²⁹

EXHIBIT 6.18: MARYLAND RELIABILITY MAP (2019 PM PEAK)³⁰



6.4.3 TRUCK BOTTLENECK DETAILS

Truck bottlenecks, specifically, are a focal point relative to their direct impact on (or their contribution to) freight mobility issues, congestion, and delay. Truck bottlenecks in Maryland may be identified and monitored using a variety of tools.

At the national level, FHWA monitors national freight bottleneck rankings based on delay per mile using an online Freight Mobility Trends tool developed by the Texas A&M Transportation Institute (TTI). Delay per mile is referenced because it accounts for truck volumes and normalizes delay by length of corridor. Of the top 100 bottlenecks in the nation, Maryland has five locations, four of which worsened in 2019, as noted by asterisk (*) in the list below:

- **I-495** from I-66 VA to I-95 MD (Ranked 31*)
- **I-695** from I-95 to I-795 (Ranked 44*)
- **I-95** from I-395 to I-895 (Ranked 58)
- **I-270** at I-495 (Ranked 87*)
- **I-95** from I-495 to MD 200 (Ranked 95*)

At the state-level, MDOT SHA has previously processed bottlenecks using speed, congestion, and delay-based perspectives in conjunction with data from the Maryland CATT Lab Vehicle Probe Project (VPP) Suite. In this approach, Maryland adopts the bottleneck definition from the University of Maryland RITIS VPP where a bottleneck occurs when the speeds observed for a roadway segment drop below 60% of the free-flow speed for a period greater than five minutes. Adjacent roadway segments meeting this condition are joined together to form a bottleneck queue, and the duration of the bottleneck is calculated until speeds are greater than 60% for more than 10 minutes. This definition uses minute-to-minute vehicle probe speeds available across the state highway system to determine congestion patterns for the entire day. By this method, the top five Maryland truck bottlenecks at freeway/expressway junctions with other roadways in 2019 include:

- **I-695** Outer Loop at Edmonson Avenue
- **I-495** Outer Loop at MD 97
- **I-270** SB at MD 109
- **I-695** Inner Loop at MD 122
- **I-95/I-495** at MD 450

More recently, and consistent with FHWA's approach to truck bottleneck identification, MDOT has identified statewide truck bottlenecks using truck delay per mile based on details from the online MRPT. The MRPT is an MDOT SHA resource that aligns INRIX travel time data and traffic volume data to the state's roadway network based on the OMOC Highway Performance Monitoring System (HPMS). MRPT capabilities allow it to run performance measures across the network or for specific segments or corridors, including the ability to isolate truck/freight traffic and bottlenecks. By this method, the top 25 Maryland truck bottleneck segments in 2019 (**Exhibit 6.19**) include:

1. **I-395** onto South Howard Street (Camden Street to East Lombard Street)
2. **I-495** from MD 355 to east of I-95
3. **I-495/I-95** from MD 190 to I-270
4. **I-495/I-95** from Clara Barton Parkway to MD 190
5. **I-495/I-95** from MD 295 to MD 201
6. **Conway Street** from MD 2 to I-395
7. **I-495/I-95** from Suitland Parkway to I-595
8. **I-95** from I-395 to I-895/Newkirk Street
9. **I-495/I-95** from MD 201 to Cherry Hill Road
10. **I-495/I-95** from I-595 to MD 295
11. **Martin Luther King Boulevard** from MD 295 to North Howard Street
12. **I-95** from I-695 (West) to I-395
13. **I-495/I-95** from Suitland Parkway to MD 5
14. **I-695** from I-83 to MD 41
15. **I-695** from I-895 to I-70
16. **I-695** from I-70 to I-795
17. **I-83** from MD 25 to I-83
18. **I-95** from MD 32 to MD 100
19. **US 50** from MD 179 to MD 18
20. **I-695** from I-795 to I-83
21. **South President Steet** from Aliceanna Street to Fayette Street
22. **MD 3** from I-595 to MD 424
23. **US 29** from MD 390 to I-495
24. **MD 201** from US 50 to Good Luck Road
25. **I-95** from I-495 to MD 200

Beyond the top 25 locations referenced above, a broader review of the top 100 truck bottlenecks (Exhibit 6.19 through Exhibit 6.21) show that the vast majority of locations continue to be clustered around the Baltimore Metro and Washington Metro regions. Other locations that appear within bottlenecks ranked 51-100 are limited to US 15, US 40, and MD 26 in/around Frederick, and US 13 north of US 50 near Salisbury on Maryland's Eastern Shore.

EXHIBIT 6.19: MARYLAND 2019 TRUCK BOTTLENECKS (RANKED 1-25 BY TRUCK DELAY PER MILE)³¹

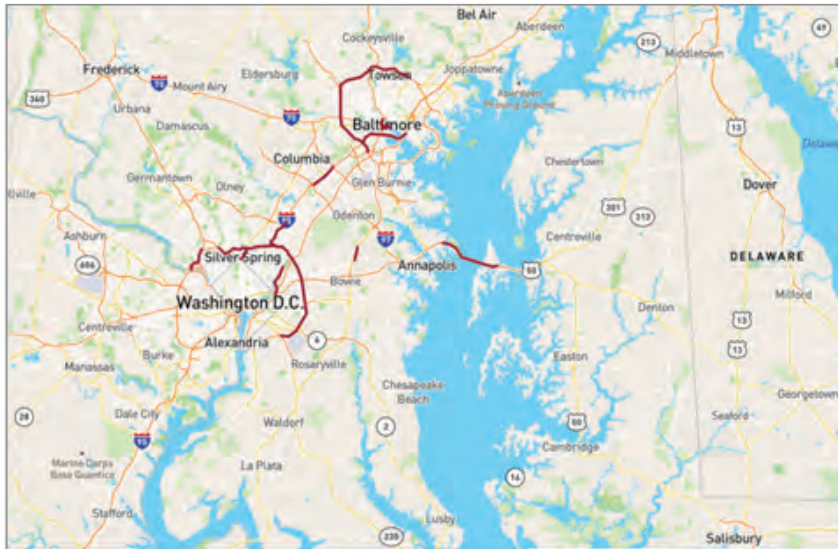


EXHIBIT 6.20: MARYLAND 2019 TRUCK BOTTLENECKS (RANKED 26-50 BY TRUCK DELAY PER MILE)³²

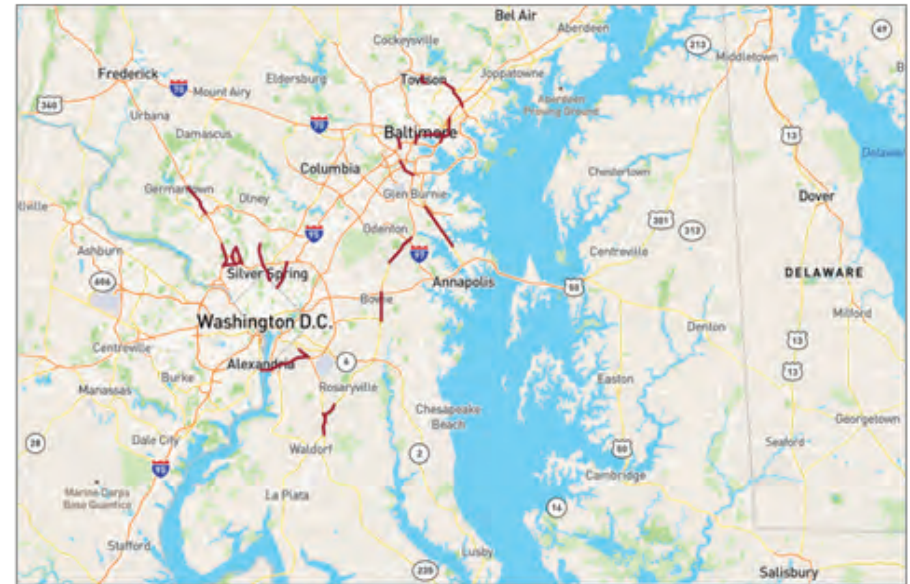
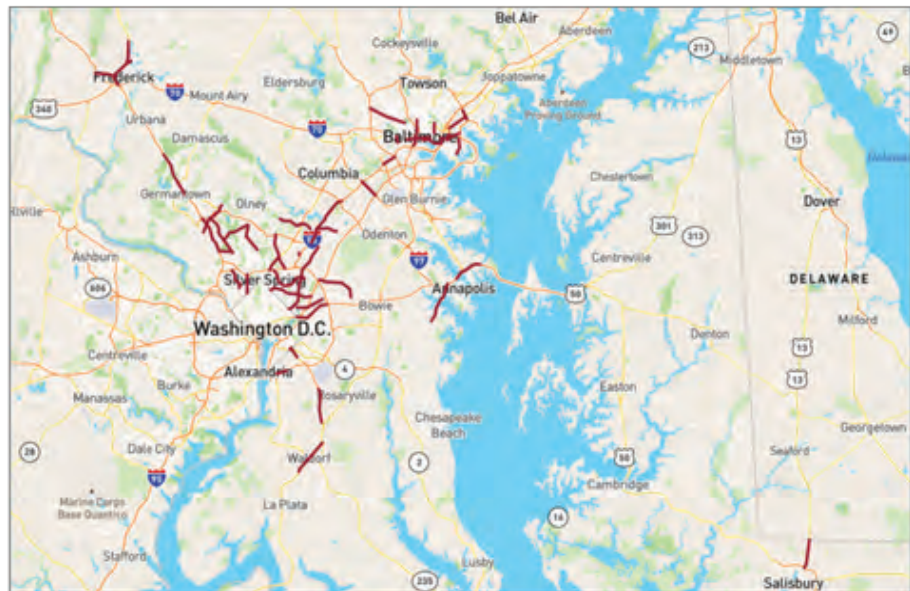


EXHIBIT 6.21: MARYLAND 2019 TRUCK BOTTLENECKS (RANKED 51-100 BY TRUCK DELAY PER MILE)³³



2019 Bottleneck Influences

Relative to all 2019 bottleneck and congestion/reliability trends identified throughout this section, it should be noted that during 2019 there were permanent lane closures in place on I-895 (Baltimore Harbor Tunnel Thruway) and US 50/301 at the Bay Bridge. These closures likely resulted in traffic diversions to the I-95 corridor and affected the performance of I-95, I-895, and US 50/301. Future trends or changes will continue to be monitored and updated as part of MDOT SHA's broader annual reporting efforts, such as those completed through the annual Mobility Report or future updates to the MRPT resources.

6.4.4 TRUCK RELIABILITY DETAILS

As noted previously in **Section 5** of this freight plan, predictable (i.e., reliable) travel time is also an important element for facilitating consistent, efficient, and cost-effective goods movement. One standard measure of reliability specific to trucks is the MAP-21 based TTTR index associated with federal performance measure reporting requirements.

TTTR assessments are included among the typical annual updates covered by the Mobility Report, including combining and filtering segments to identify the Top 15 worst (least reliable) corridors for truck travel (**Exhibit 6.22**). Similar to the previous findings for overall background traffic congestion and reliability, the TTTR perspectives generally show that the least reliable travel conditions specifically for trucks are also clustered around the Baltimore Metro and Washington Metro regions, and along connections affecting travel on US 50 and the Bay Bridge.

6.4.5 TRUCK CONGESTION COSTS

A further emphasis area that MDOT monitors is the specific impact that congestion and delays have on economic opportunities and efficiencies throughout Maryland in terms of freight congestion costs. Summaries for truck travel in year 2019 include the following:

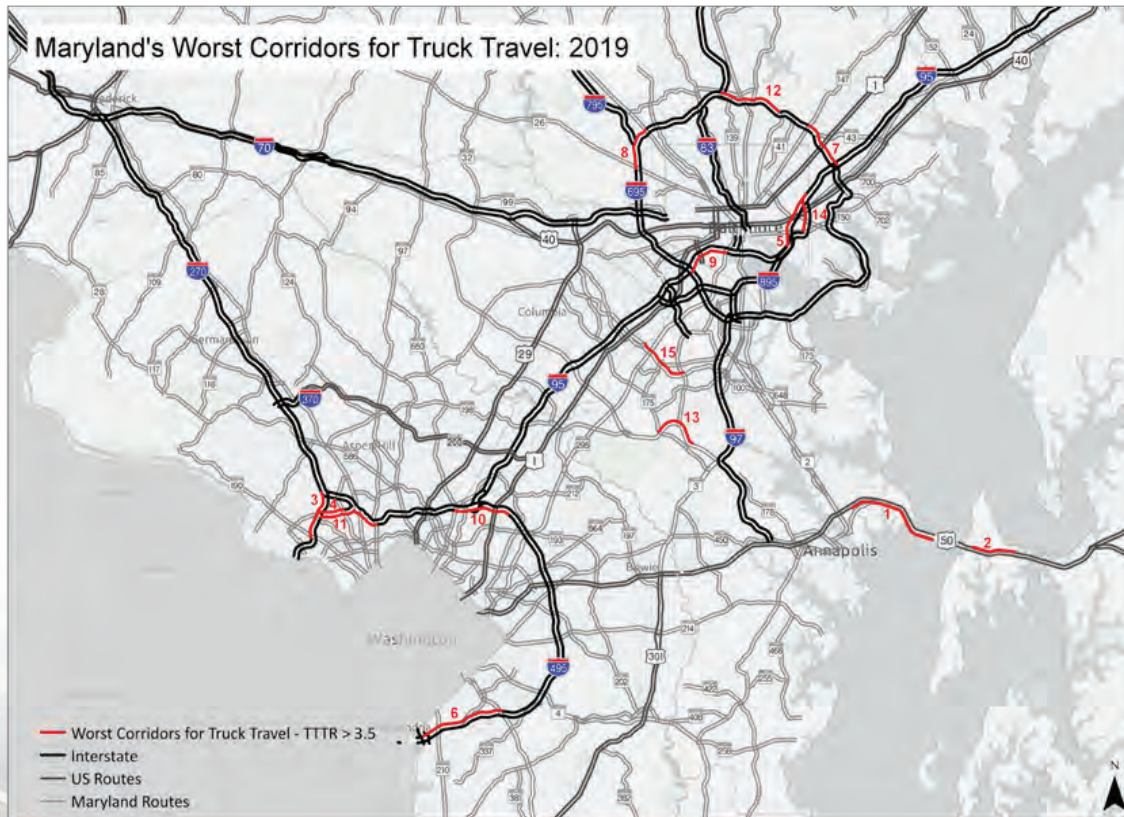
- Details reported annually in the Mobility Report note that freight operators experience significant costs due to truck driver delay and truck cargo delay, as well as additional fuel costs and emissions costs due to travel in congested conditions (**Exhibit 6.23**).
- These components contributed to \$251 million in overall freight congestion costs in 2019 which, similar to the statewide total congestion cost for all vehicles, generally reflects an increasing trend for the time period 2015 through 2019 (**Exhibit 6.24**).
- A closer assessment of specific bottleneck segments in Maryland (using details from the MRPT) showed that just the top 25 ranked locations contributed to more than half of the total freight congestion cost caused by the top 100 bottlenecks (**Exhibit 6.25**).

Truck Travel Time Reliability Index (TTTR)

The TTTR represents the 95th percentile truck travel time divided by the 50th percentile truck travel time for each roadway segment and for five designated time periods. The maximum TTTR value determines the final system performance. The higher the TTTR, the worse (less reliable) the operations are.



EXHIBIT 6.22: MARYLAND'S LEAST RELIABLE CORRIDORS FOR TRUCK TRAVEL (2019 TTTR BASED)³⁴



RANK / ROUTE / TTTR MAX / LIMITS

1. **US 50 EB** (TTTR = 6.0)
Bay Dale Drive to Chesapeake Bay Bridge
2. **US 50 WB** (TTTR = 5.9)
Piney Creek Road to MD 8
3. **I-270 West Spur SB** (TTTR = 5.8)
I-270 Split to I-495
4. **I-495 Outer Loop** (TTTR = 5.0)
MD 187 to MD 190
5. **I-95 SB** (TTTR = 4.4)
I-895 Split to MD 150
6. **I-495 Inner Loop** (TTTR = 4.3)
MD 5 to I-295
7. **I-695 Outer Loop** (TTTR = 4.3)
I-95 to MD 147
8. **I-695 Outer Loop** (TTTR = 4.2)
MD 140 to MD 26
9. **I-95 NB** (TTTR = 4.1)
I-695 to MD 295
10. **I-495 Inner Loop** (TTTR = 4.0)
MD 650 to Greenbelt Metro Station
11. **I-495 Inner Loop** (TTTR = 4.0)
I-270 West Spur to MD 185
12. **I-695 Outer Loop** (TTTR = 3.9)
Cromwell Bridge Road to I-83
13. **MD 32 WB** (TTTR = 3.9)
Sappington Station Road to MD 175
14. **I-895 SB** (TTTR = 3.7)
I-95 Split to Ponca Street
15. **MD 100 WB** (TTTR = 3.6)
MD 170 to Coca Cola Drive

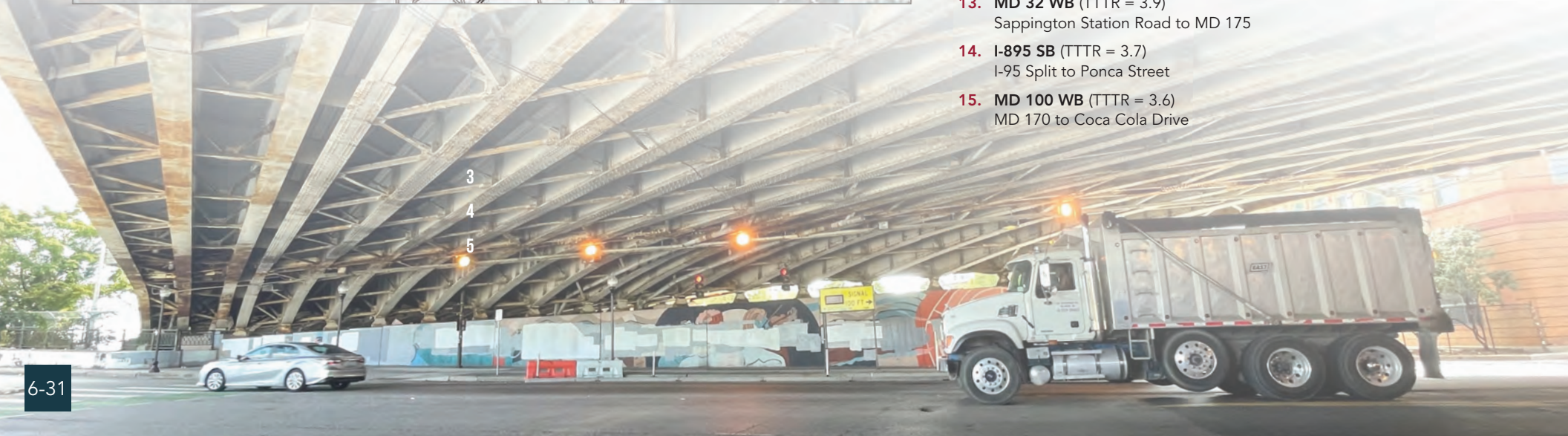


EXHIBIT 6.23: FREIGHT CONGESTION COST COMPONENTS ON MARYLAND'S FREEWAY/ EXPRESSWAY SYSTEM³⁵

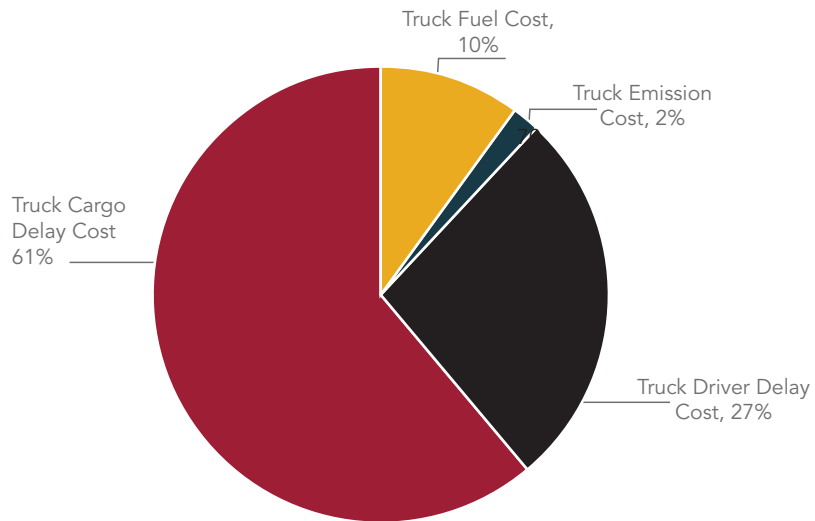
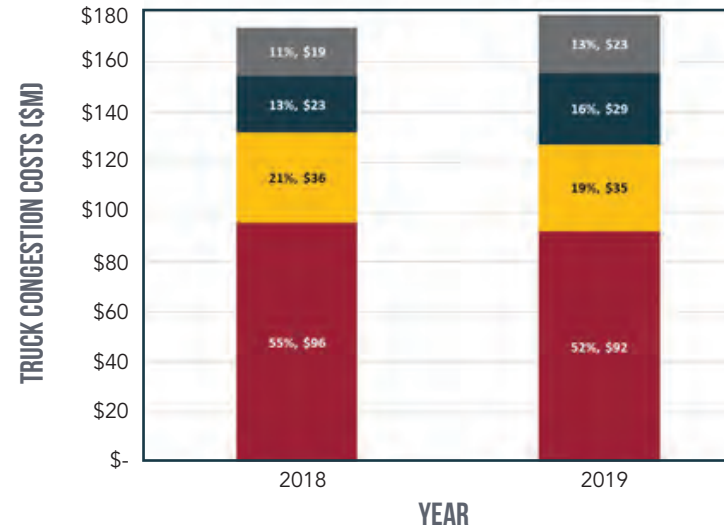
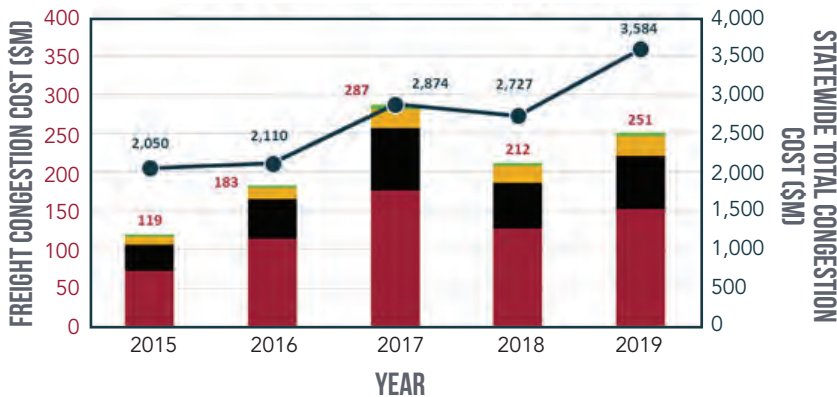


EXHIBIT 6.25: FREIGHT CONGESTION COSTS DUE TO MARYLAND'S TOP 100 TRUCK BOTTLENECK SEGMENTS³⁷



- Truck Bottlenecks 76-100
- Truck Bottlenecks 51-75
- Truck Bottlenecks 26-50
- Truck Bottlenecks 1-25

EXHIBIT 6.24: FREIGHT CONGESTION COST TRENDS (2015-2019) ON MARYLAND'S FREEWAY/EXPRESSWAY SYSTEM³⁶



- Truck Cargo Delay Cost
- Truck Fuel Cost
- Statewide Total Congestion Cost
- Truck Driver Delay Cost
- Truck Emissions Cost



6.4.6 FREIGHT MOBILITY IMPROVEMENT OPPORTUNITIES

Referencing the types of details summarized previously will allow MDOT to continue to leverage the state's data resources in ways that help to inform and support strategic planning, investments, and improvements that maximize potential benefits. Such actions will continue to build onto the success of past implementation efforts. For example, as documented each year in the Mobility Report, the capital projects program is one of the most recognizable ways that MDOT SHA addresses congestion and reliability issues. The projects completed each year provide congestion relief, improve safety, and enhance traffic operations. The resulting improvements provide benefits to the traveling public through reductions in delays incurred by motorists and commercial vehicles, fuel savings, and safety benefits. From 2015 through 2019, the capital program included 61 completed projects amounting to almost \$290 million in opening year benefits, including more than \$58 million for projects completed just in 2019.³⁸

Congestion and reliability issues can affect many things in a supply chain beyond just the truck transporting the goods. Freight mobility improvement opportunities, therefore, encompass both highway and multimodal assets and operations. For example, relevant implementation successes highlighted in Maryland's 2022 AR include (but are not limited to) the following:

- Tolls in Maryland were collected 99.99% electronically in 2021 because AET has been instituted at all toll facilities across the state.
- CHART is installing ATMS and advanced traffic information system (ATIS) technologies on interstate highways and arterials statewide, including cameras, traffic detectors, weather sensors, dynamic message signs (DMS), highway advisory radios (HAR), websites, and telecommunication networks.
- The Midfield Taxiway Rehabilitation Project at BWI Marshall Airport rehabilitated more than 95,000 square yards (SY) of existing asphalt taxiway and added 13,700 SY of new concrete taxiway providing direct access to runway 10, providing more reliable and direct access to high-use cargo buildings.
- Several modernization projects ranging from cranes to yard equipment to lane reconfigurations have been implemented at Seagirt Marine Terminal. Additional or ongoing phases of improvement will install radiation monitors for Seagirt's back gate, which will allow inbound and outbound access for trucks with loaded containers. Weigh In Motion scales and additional optical character recognition equipment are being installed at the terminal gates to increase the speed of truck processing.

Future summary actions to address the state's freight mobility needs will be reflected in the overall projects, strategies, and implementation details covered in subsequent **Sections 7** and **8** of this Maryland Freight Plan.



6.5 Truck Parking Facilities

Truck parking is critical to the safe operation of Maryland's freight infrastructure, supply chains, and the economy. Facilities with available truck parking are essential to providing a safe place for truck drivers to get the rest they need to comply with federal Hours of Service (HOS) regulations and to stage their vehicles for scheduled deliveries and pickups.

An emphasis on providing safe and reliable truck parking was notably strengthened in 2012 with the introduction of Section 1401 of the Moving Ahead for Progress in the 21st Century Act (MAP-21), also known as "Jason's Law." This statute was established to provide a national priority on addressing the shortage of long-term parking for commercial motor vehicles on the National Highway System to improve the safety of motorized and non-motorized users and for commercial motor vehicle operations.³⁹

Today, truck parking continues to be a priority at the federal and state levels with the introduction of new state freight planning requirements under the IIJA to explicitly include commercial motor vehicle parking assessments as part of the state freight plan update process (see sidebar). Such assessments in the state of Maryland were completed in 2020 for the Maryland Statewide Truck Parking Study.⁴⁰ Truck parking details below include relevant highlights from that study, aligned with reference to the new IIJA requirements.



Focus Areas:

- ☑ Designated truck parking
- ☑ Undesignated truck parking
- ☑ Truck parking challenges and opportunities

State Requirements for Commercial Motor Vehicle Parking Facilities Assessments

New details included per IIJA §21104(f) (which updates 49 USC §70202) require that each state, in consultation with relevant state motor carrier safety personnel, conduct an assessment of:

1. the capability of the state, together with the private sector in the state, to provide adequate parking facilities and rest facilities for commercial motor vehicles engaged in interstate transportation;
2. the volume of commercial motor vehicle traffic in the state; and
3. whether there exist any areas within the state with a shortage of adequate commercial motor vehicle parking facilities, including an analysis of the underlying causes of such a shortage.

6.5.1 DESIGNATED TRUCK PARKING

As of 2020, there were 2,902 designated truck parking spaces in Maryland (**Exhibit 6.26**). This total reflects the following:

- **Public Spaces:** There are 595 spaces at 26 public facilities owned/operated by MDOT. These facilities include 12 public rest areas, travel plazas, or welcome centers, and 14 Truck Weigh and Inspection Stations (TWIS). Although there are more TWIS locations, rest areas provide 56% of the public truck parking capacity, and the majority of locations allow truck parking all day.
- **Private Spaces:** There are 2,307 spaces at 27 private truck stop facilities in Maryland. More than 53% of the private spaces are located along the I-95 corridor, while the second highest concentration (17%) occurs along the I-81 corridor.

Based on a comparison of data from 2015 and 2020 (see **Section 5** of this plan), the reported total number of public and private truck parking spaces declined from 3,036 in 2015 to 2,902 in 2020; however, the reported number of public spaces increased by 20% during the same timeframe. As such, any reduction in total parking capacity is a result of declines in the reported number of private truck parking spaces only. It is inconclusive if this trend reflects a real reduction. It could potentially be due to specific facilities that may have been included (or excluded) in one year's inventory and not another. The truck parking data reflects two unrelated sources based on a Jason's Law Truck Parking Survey that recorded 49 private facilities in 2015, as compared to the more recent Maryland Statewide Truck Parking Study that recorded only 27 private facilities in 2020.

In addition to the public and private truck parking spaces described above, MDOT also provides spaces for emergency truck parking at commuter parking lots and park-and-ride facilities near major travel corridors (**Exhibit 6.27**). The option and use of emergency truck parking may be triggered by severe weather conditions, such as snowstorms, to provide a safe location for trucks to park and reduce the number of drivers parking at undesignated locations, such as highway ramps. Truck drivers can access information about the availability of these parking locations through Maryland's Emergency Truck Parking Portal.



EXHIBIT 6.26: PUBLIC AND PRIVATE TRUCK PARKING LOCATIONS IN MARYLAND⁴¹

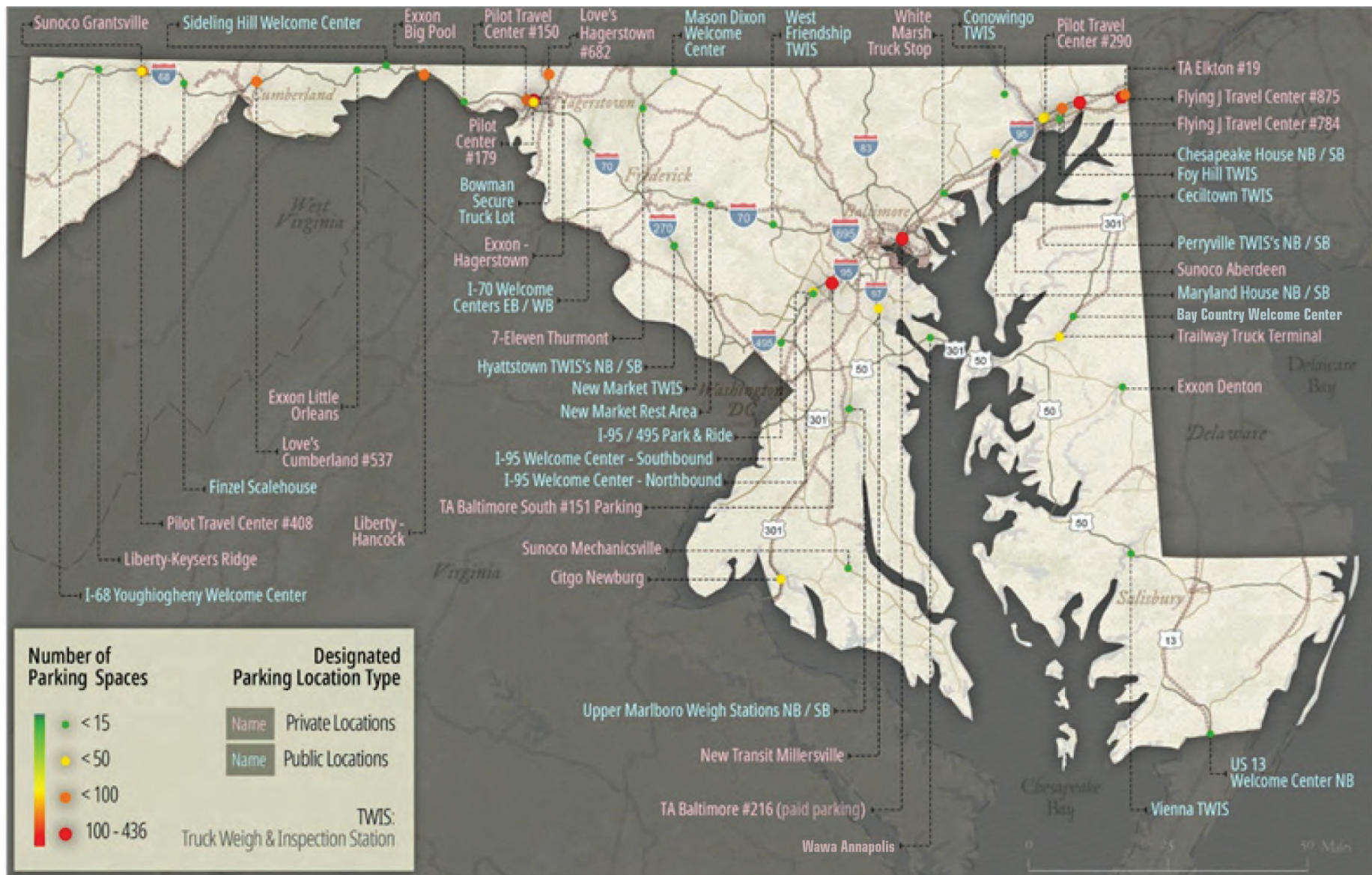
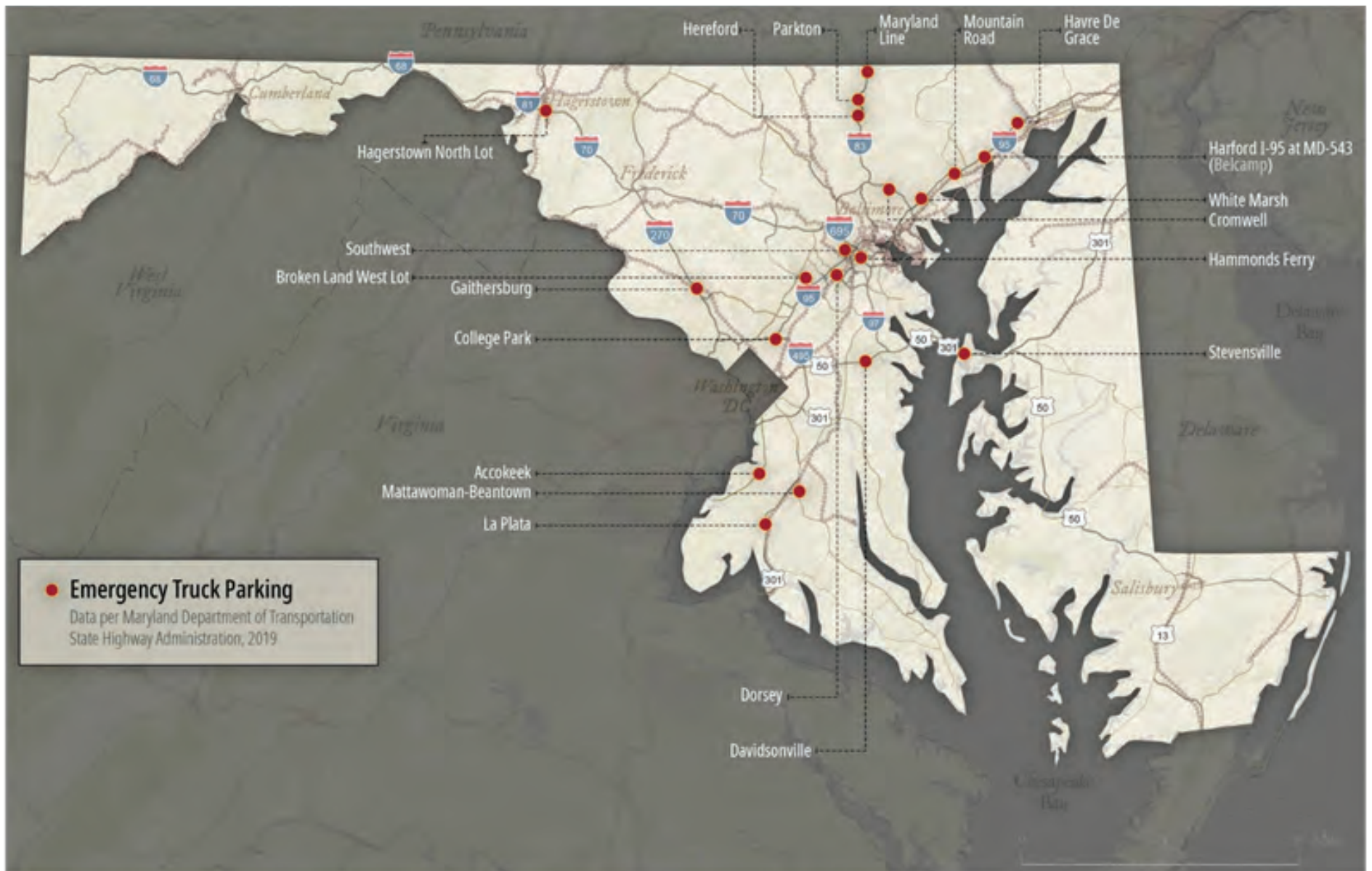


EXHIBIT 6.27: EMERGENCY TRUCK PARKING LOCATIONS IN MARYLAND⁴²



6.5.2 UNDESIGNATED TRUCK PARKING

Whether based on challenges with truck parking capacity, availability, time, or location, unmet truck parking demand occurs throughout the state. Specific clusters of undesignated truck parking were identified as part of the 2020 Maryland Statewide Truck Parking Study (**Exhibit 6.28** and **Exhibit 6.29**). These clusters included 18 locations along various interstate routes/ramps; US 1, US 50, and US 301; and connecting to the Port of Baltimore or nearby industrial clusters.

Based on a four-month truck GPS sample, the truck parking study determined that clusters of undesignated truck parking activity ranged from several trucks to more than 3,000 trucks. Therefore, clusters were prioritized to focus the analysis and solutions on the most severely impacted areas. The analysis of frequently used clusters demonstrated that truck parking issues occurred for multiple reasons that must be addressed through a variety of opportunities and potential solutions. Key takeaways included the following:

- Urban areas have little to no truck parking facilities or available truck parking spaces, and many roadways experience substantial undesignated truck parking.
- Undesignated truck parking in urban areas often occurs on local roadways that connect to commercial/industrial land uses, often including large footprint warehouses and distribution centers.
- Most highway on/off ramps and areas where roadways have wide shoulders showed some undesignated truck parking, with rest area ramps exhibiting the highest density of undesignated truck parking.
- MDOT has opportunities to expand truck parking at key facilities, such as the I-70 South Mountain Welcome Center and the I-95/I-495 Weigh Station at Adelphi. Other opportunities to add truck parking involve partnerships with other public agencies, the private sector, local jurisdictions, and local communities.



EXHIBIT 6.28: PRIORITY CLUSTERS OF UNDESIGNATED TRUCK PARKING (MAP) ⁴³

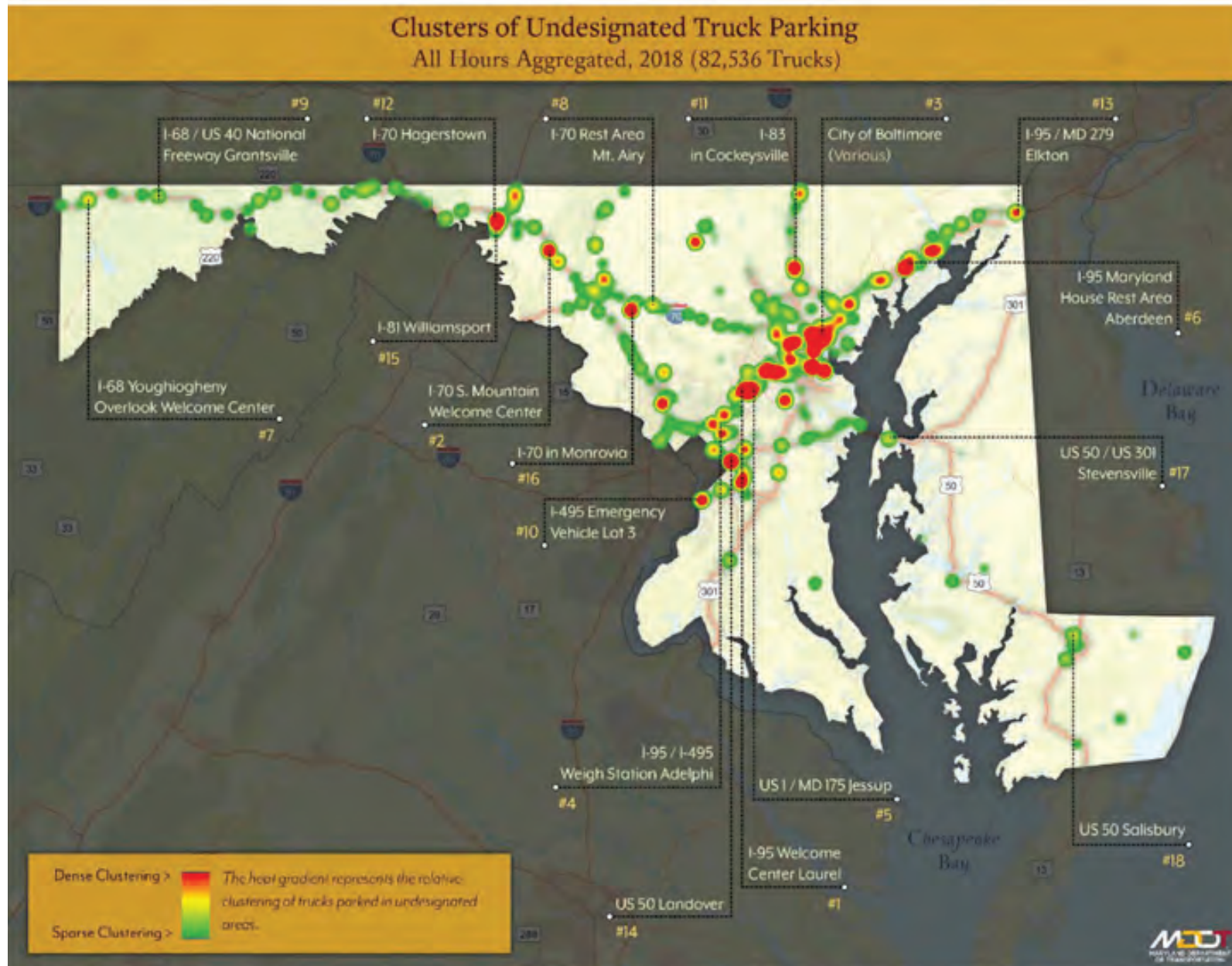


EXHIBIT 6.29: PRIORITY CLUSTERS OF UNDESIGNATED TRUCK PARKING (TABLE) ⁴⁴

RANK	GENERAL ROUTE/AREA	DETAIL DESCRIPTION
1	I-95	On/Off Ramps along I-95 at Welcome Center in Laurel
2	I-70	On/Off Ramps along I-70 at S. Mountain Welcome Center
3	Port of Baltimore	In/around the City of Baltimore Connecting to the Port and Industrial Clusters
4	I-95, I-495	On/Off Ramps along I-95/I-495 at Weigh Station in Adelphi
5	US 1, MD 175	Roadways Connecting to Warehousing near US 1/MD 175 in Jessup
6	I-95	On/Off Ramps along I-95 at Maryland House Travel Plaza near Aberdeen
7	I-68	On/Off Ramps along I-68 at Youghioghney Overlook Welcome Center
8	I-70	On/Off Ramps along I-70 at Rest Area near Mount Airy
9	I-68	Exit 22 On/Off Ramps on I-68 in Grantsville
10	I-495	Emergency Vehicle Lot along I-495 at Exit 3
11	I-83	Emergency Roadside Shoulder on I-83 near Cockeysville
12	I-70	Truck Stop overflow in Hagerstown and Exit 24 On/Off Ramps on I-70
13	I-95, MD 279, MD 277	Shoulders along I-95/MD 279/ MD 277 near Elkton
14	US 50	Roadways Connecting to Warehousing near US 50 in Landover
15	I-81	Roadways Connecting to Warehousing near Exit 1 on I-81 in Williamsport
16	I-70	Roadways Connecting to Warehousing in Monrovia near I-70
17	US 301	Local road near US 301 in Stevensville
18	US 50	Roadways Connecting to Warehousing close to US 50 near Salisbury

6.5.3 TRUCK PARKING CHALLENGES AND OPPORTUNITIES

Overall, the statewide truck parking study identified nine obstacles and challenges through data analysis, stakeholder input, and research. The obstacles and challenges highlight the truck parking needs in Maryland and inform the development of strategic recommendations. General obstacles and challenges included:

- Lack of dedicated and overall truck parking;
- Lack of knowledge of where/how to find truck parking;
- Different truck parking needs in rural and urban areas;
- Safety and the perception of safety;
- Lack of amenities at truck parking facilities;
- Noise in neighboring communities near truck parking facilities;
- Lack of innovation in truck parking;
- Lack of real-time truck parking system and navigation; and
- Legislative challenges.

Based on the challenges above and in coordination with undesignated truck parking insights and study-specific stakeholder outreach, the truck parking study made four overarching recommendations to improve truck parking in Maryland, including:

- Further develop the truck parking program;
- Convene a Truck Parking Committee and further outreach on truck parking issues;
- Integrate truck parking into land use, zoning, and planning; and
- Utilize grants and other alternative funding and partnership opportunities.



6.6 Supply Chain Cargo Flows

6.6.1 CARGO FLOWS

Cargo flows in Maryland were detailed previously in **Section 3.1** of this freight plan, including summaries by tonnage and value for:

- Trade type and directionality;
- Domestic and foreign trade partners;
- Freight modes; and
- Commodity types.

These summaries show a notable long-term increase in the state's cargo flows, including a rapid rebound from short-term declines that may have occurred due to the COVID-19 pandemic. Growth projections in Maryland show a 53% increase in cargo tonnage and a 108% increase in cargo value from 2020 through 2050.

Maryland's domestic trade partners span the nation (see **Exhibits 3.4** and **3.5**) while international trade partners span the globe (see **Exhibits 3.6** and **3.7**). These partners move a wide variety of cargo types (see **Exhibits 3.9** and **3.10**). The state's trade patterns encompass a complex web of freight movements directly to and from Maryland, but also indirectly via freight transfers through almost every other state across the nation. Amidst these complexities, recognizing opportunities to support efficient supply chain cargo flows is crucial to ensuring successful enterprise, lower cost of goods, and better quality of life for businesses and consumers across the state, region, and nation.

6.6.2 KEY INDUSTRIES AND SUPPLY CHAINS

A diverse array of industry sectors makes up Maryland's economy, which relies on an equally diverse set of logistics and supply chain activities. Key industry sector profiles were highlighted previously in **Section 3.3** of this freight plan, including insights pertaining to their overarching supply chain cargo flows and related needs. These industry sectors include:

- Agriculture;
- Mining;
- Construction and utilities;
- Energy;
- Manufacturing;
- Wholesale trade, transportation and warehousing, and retail trade; and
- Other industry sectors (e.g., healthcare, government and services, waste/scrap).

Focus Areas:

- ✓ Cargo flows
- ✓ Key industries and supply chains
- ✓ Multimodal opportunities
- ✓ Freight efficient land use
- ✓ Freight workforce issues
- ✓ Freight fluidity initiatives



6.6.3 MULTIMODAL OPPORTUNITIES

A reliable multimodal freight transportation system is crucial to fulfilling Maryland's broad spectrum of supply chain needs. Maryland's freight network was detailed previously in **Section 4** of this freight plan, and overall freight transportation system improvements are a major focus of the action planning steps that will be presented in **Sections 7** and **8**. MDOT's 2022 update to the AR also summarizes relevant changes and major project/program initiatives that are likely to influence supply chain opportunities in the state. Examples are highlighted below:

- The Port of Baltimore has advanced the CSX Howard Street Tunnel expansion project to construction, which will add double-stacked container shipping capability to and from the Port and is expected to increase container volumes at the port by 160,000 containers annually and create thousands of additional jobs.
- Ports America Chesapeake (PAC) continues to make investments in the Seagirt Marine Terminal at the Port of Baltimore, ensuring that the Port can continue to handle increasingly larger container ships and remain an attractive import and export option for local, regional, and national commerce. In 2019, MDOT MPA and PAC were awarded a \$6.6 million Better Utilizing Investments to Leverage Development (BUILD) grant from USDOT for a \$32.8 million project to modernize Berth 3 at Seagirt. Design and engineering currently are underway. The project will allow the Port to simultaneously handle two ultra large container vessels (ULCV) at Seagirt.
- The number of nonstop airline markets served through BWI Marshall Airport opens them up to Maryland's businesses and residents and reflects the state's reach regionally, nationally, and globally. Despite short-term service cuts and reduced demand due to the COVID 19 pandemic, FY 2021 saw new routes to Jackson, MS; Massena, NY; Pensacola, FL; and Punta Gorda, FL. While the pandemic has brought uncertainty, the number of nonstops is expected to return to pre-COVID levels in the coming years.
- Air cargo tonnage has increased at an average rate of 19% during the past five years from CY 2015 to CY 2020, which saw more than double the volume processed than in CY 2015. BWI Marshall Airport has become one of Amazon's top five busiest air cargo facilities in the nation and currently employs 1,200 people. BWI Marshall Airport has 57% of the regional market share, handling more cargo than Dulles International and Reagan National airports combined.

6.6.4 FREIGHT EFFICIENT LAND USE

Efforts through the National Cooperative Freight Research Program (NCFRP) have documented that land use decisions can play a critical role in supply chain efficiencies. Such efforts include a discussion of Freight-Efficient Land Uses (FELUs) in the following context:

Land-use planning and policymaking is central to how communities manage their economic activity and the social and environmental impacts these activities produce. Because of this central role, enhancing land-use practices to better incorporate the needs and impacts of freight activity has strong potential to improve the efficiency of their associated supply chains. The NCFRP 08-111 project on "Freight-Efficient Land Uses (FELUs)" focused on designing policy procedures to foster land-uses that minimize the private and external costs associated with the production, transportation, and consumption of goods.⁴⁵

Land use, development, and supply chain decisions generally fall beyond MDOT's legal authority, residing instead with local/municipal planning agencies and decision-makers, or with private industry sectors. However, from a resource and educational perspective, a broader understanding of FELU principles can support overall multimodal freight transportation planning. Sample FELU principles from the NCFRP report referenced above include the following, with implications affecting all "stages" of supply chains in terms of their overall origins, destinations, and related upstream/downstream activities or impacts:

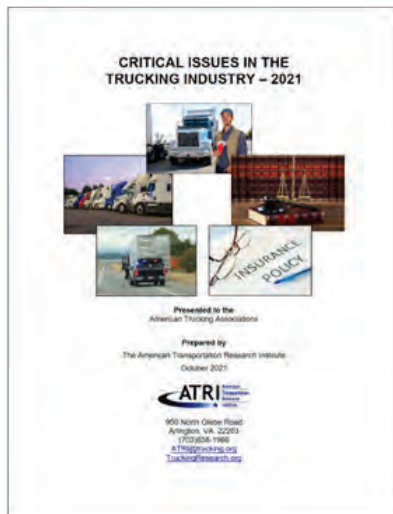
- **Minimize Social Costs** to reduce the private and external costs of supply chains and their stages.
- **Foster Compactness of Supply Chains** to reduce the distance traveled at supply chain stages, up and downstream.
- **Mitigate Supply Chain Externalities** to reduce or eliminate the externalities at supply chain nodes and Large Traffic Generators (LTGs).
- **Seek Appropriate Solutions** that recognize and account for local conditions.
- **Engage Stakeholders** to ensure their points of view and concerns are addressed.

6.6.5 FREIGHT WORKFORCE ISSUES

Efficient supply chain movements rely on an adequate freight workforce. One of the most notable workforce issues is the ongoing shortage of truck drivers. In 2021, this issue topped the list of concerns identified in the American Transportation Research Institute (ATRI)'s annual survey of Critical Issues in the Trucking Industry, which noted the following:

"It really is no surprise that truck driver-related issues – notably the driver shortage and driver retention – ranked so high on the survey. Coming out of the pandemic, with the increased demand for goods and other pressures on the supply chain, getting and keeping drivers has been a real challenge industrywide... We also see the impacts of the current supply chain crunch in how highly issues like driver compensation, truck parking, infrastructure and driver detention ranked on the list."⁴⁶

While driver recruitment, educational programs, and retention generally fall beyond MDOT's legal authority, opportunities for partnerships and collaboration exist to communicate and understand workforce needs, advertise program opportunities, and pursue mutual interests. Such interests include an emphasis on addressing specific infrastructure needs that may help to ease key burdens and challenges that truck drivers face. For example, MDOT may share an interest in pursuing improvements that enhance truck parking facilities and availability, truck permitting and routing efficiencies, congestion mitigation, or reduced truck delays/turn times.



6.6.6 FREIGHT FLUIDITY INITIATIVES

Freight fluidity is an emerging concept that aims to further assess performance, resilience, and other key indicators relevant to critical supply chains. The Eastern Transportation Coalition (ETC) describes the concept relative to a National Freight Fluidity Program as one that aims toward a better understanding of how our freight transportation system supports freight movement with consideration of the following:

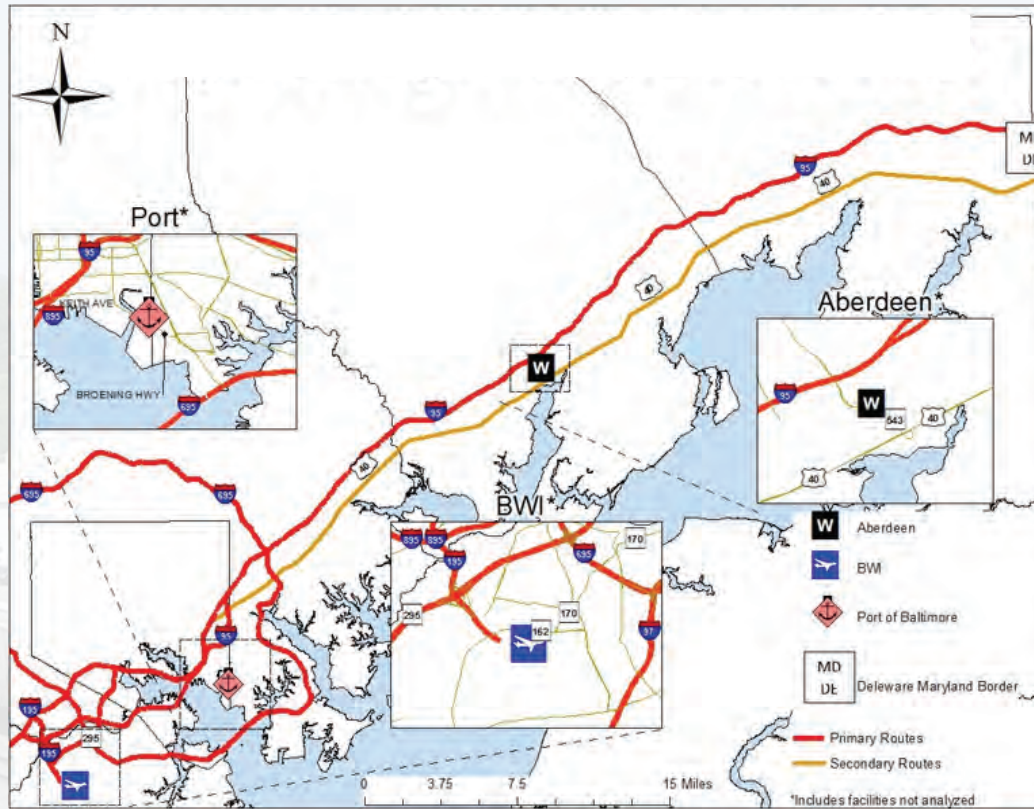
Currently, public policy, program, and investment decisions are guided by information about network and corridor capacity, infrastructure condition, and safety. This national [freight fluidity] effort aims to add the perspectives of shippers, carriers, and receivers by focusing on supply chains and understanding the end-to-end performance of an individual freight trip or shipment moving across multiple modes and jurisdictions.⁴⁷

In developing a framework for use in Maryland, the TTI specifically defined the concept as follows:

Freight Fluidity is a broad term referring to the characteristics of a multi-modal freight network in a geographic area of interest, where any number of specific modal data elements and performance measures are used to describe the network performance (including costs and resiliency) and quantity of freight moved (including commodity value) to inform decision-making.⁴⁸

Under this definition, the key components of freight fluidity include performance and quantity. The performance component describes how well the routes, major freight transfer points, and combined network are operating, where system bottlenecks are located, and how well the system (including infrastructure, users, and agencies) reacts to disruptions (i.e., resilience). The quantity component describes how much freight is moved and where it moves along a given transportation network of interest.

MDOT anticipates that ongoing statewide freight planning initiatives will continue to enhance and expand a broad assessment of critical supply chains with a freight fluidity approach. Efforts to date have assessed fluidity considerations for a test corridor along I-95 from the Port of Baltimore to the Maryland/Delaware state line (**Exhibit 6.30**), explored the use of Big Data in supporting freight fluidity applications, and coordinated with freight flow visualization and modeling tools. Findings have been used to inform decision-making relative to congestion relief projects and freight infrastructure investments, including consideration of major private sector freight infrastructure expansion.

EXHIBIT 6.30: MARYLAND FREIGHT FLUIDITY OVERVIEW MAP (I-95 TEST CORRIDOR)⁴⁹

Future freight fluidity initiatives could explore other major supply chain corridors, such as Maryland's interstate connections to out-of-state freight hubs in Chicago or Atlanta. Deeper dives may assess specific supply chain or commodity value details for a target industry, origin-destination pair, or across other modes. In coordination with MDOT SHA's TSMO Strategic Plan, future freight fluidity efforts also may develop fluidity linkages with MDOT's CAV vision and strategic actions.



6.7 Commercial Ports

6.7.1 PORT OVERVIEW

The Port of Baltimore is an economic engine for Greater Baltimore, the state of Maryland, and the Mid-Atlantic Region. It has experienced steady growth in container volumes since the establishment of a public-private partnership agreement with PAC for the improvement and operations of Seagirt Marine Terminal in 2010. The development of the 50-foot berth, coupled with improvements to on-terminal gate access and egress have improved operational efficiencies without raising costs to the customer. Containerized cargo imports and exports at the Port of Baltimore continue to increase each year, and vessel sizes continue to increase as the market shifts to more of an all-water strategy for containers coming to the East Coast via the Suez Canal and the expanded Panama Canal.

The COVID-19 pandemic impacted cargo volumes in the 4th quarter of FY 2020. MDOT MPA's cargo facilities remained open; however, Seagirt Marine Terminal closed its gates for a few scattered days in the 4th quarter when container traffic in and out of the terminal did not warrant opening the terminal for truck traffic. Cargo volume declines were smaller in Baltimore compared to other East Coast ports due to the strength of the regional consumer market. **Sections 3 and 4** of this freight plan provide more details on the Port of Baltimore's freight demand and relationship to the multimodal freight network.

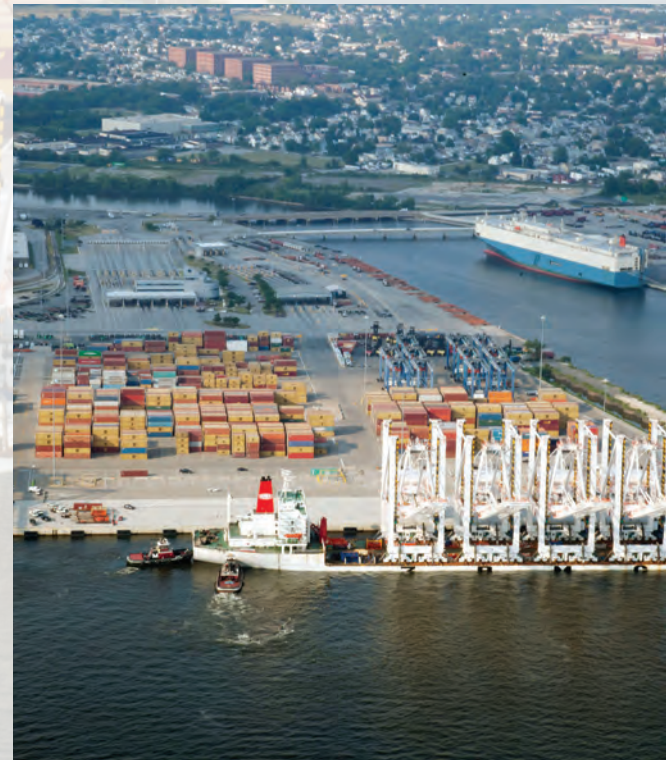
6.7.2 PORT INFRASTRUCTURE

The MDOT MPA's marine terminals are the backbone of the Port of Baltimore, providing the space, infrastructure, cranes, and loading and unloading operations that move cargo through the Port. These facilities comprise the most commonly identified aspects of the Port. The MDOT MPA owns six marine terminals in Baltimore City and Baltimore County (see **Exhibit 4.13**). Many of these facilities are older and all require routine maintenance and upkeep, which is costly but necessary.

System preservation for marine terminals and infrastructure remains one of the most important aspects of operating the MDOT MPA. Terminal preservation demands high capital investments for berth maintenance, construction, and reconstruction. Climate change poses a growing risk to existing and future marine terminals due to their inherent location at the interface of the land and water. The MDOT MPA has prepared an assessment of terminal vulnerability to climate change and developed guidance for new development and construction of terminals. Additional information on Port infrastructure is included in **Sections 4 and 5**.

Focus Areas:

- ☑ Port overview
- ☑ Port infrastructure
- ☑ Port access and mobility
- ☑ M-95 marine highway corridor
- ☑ Inland waterways



6.7.3 PORT ACCESS AND MOBILITY

Moving regional cargo to and from marine terminals for import or export is a vital component of the operation of each port. The Port of Baltimore is well suited to service this regional market because of its location near major metropolitan centers, including Washington, D.C., and Baltimore. As a predominantly truck-based port, Baltimore needs to ensure that an efficient and cost-effective system of Interstate highways remains easily accessible, and that trucks can move to and from the Port safely.

A consistent issue for all ports is the “last mile” of cargo movement. Agency/stakeholder discussions during the course of this freight plan update have identified a number of anecdotal issues and multi-jurisdictional challenges in relation to local first/last mile access for the Port. Examples include roadway maintenance needs (e.g., significant potholes on Broening Highway), safety issues caused by trucks shifting lanes to avoid potholes, routing and transfer/staging needs for OS/OW vehicles, truck parking concerns, safety/security concerns at the Baltimore Travel Plaza, and private property conflicts (e.g., parking/staging that impacts the American Legion site). If access from the terminals to the Interstate transportation system cannot accommodate current and projected levels of growth, then the Port could become increasingly less competitive. Additionally, as cargo volumes increase, neighborhoods that are near terminals may experience additional port-related congestion, air emissions, and issues with truck parking or turning on local streets.

Anecdotally, a thorough review and assessment of localized last-mile concerns, stakeholder relationships, potential improvement strategies, and site-specific implementation plans/costs/responsibilities may be required to fully understand, mitigate, or proactively plan for last mile access and mobility improvements. These efforts could also specifically explore and relate the assessments and/or improvement needs in terms of NHS intermodal connector routes or opportunities, including several existing NHS intermodal connectors that are currently designated along roadway segments around the Port (see **Exhibit 4.5**). FHWA's 2017 Freight Intermodal Connectors Study continues to promote highway intermodal connectors as critical last mile links between major port, rail, airport, and intermodal freight facilities to ensure the timely and reliable movement of freight.⁵⁰ This type of effort would require an independent (separate from this freight plan) comprehensive port access and mobility study.

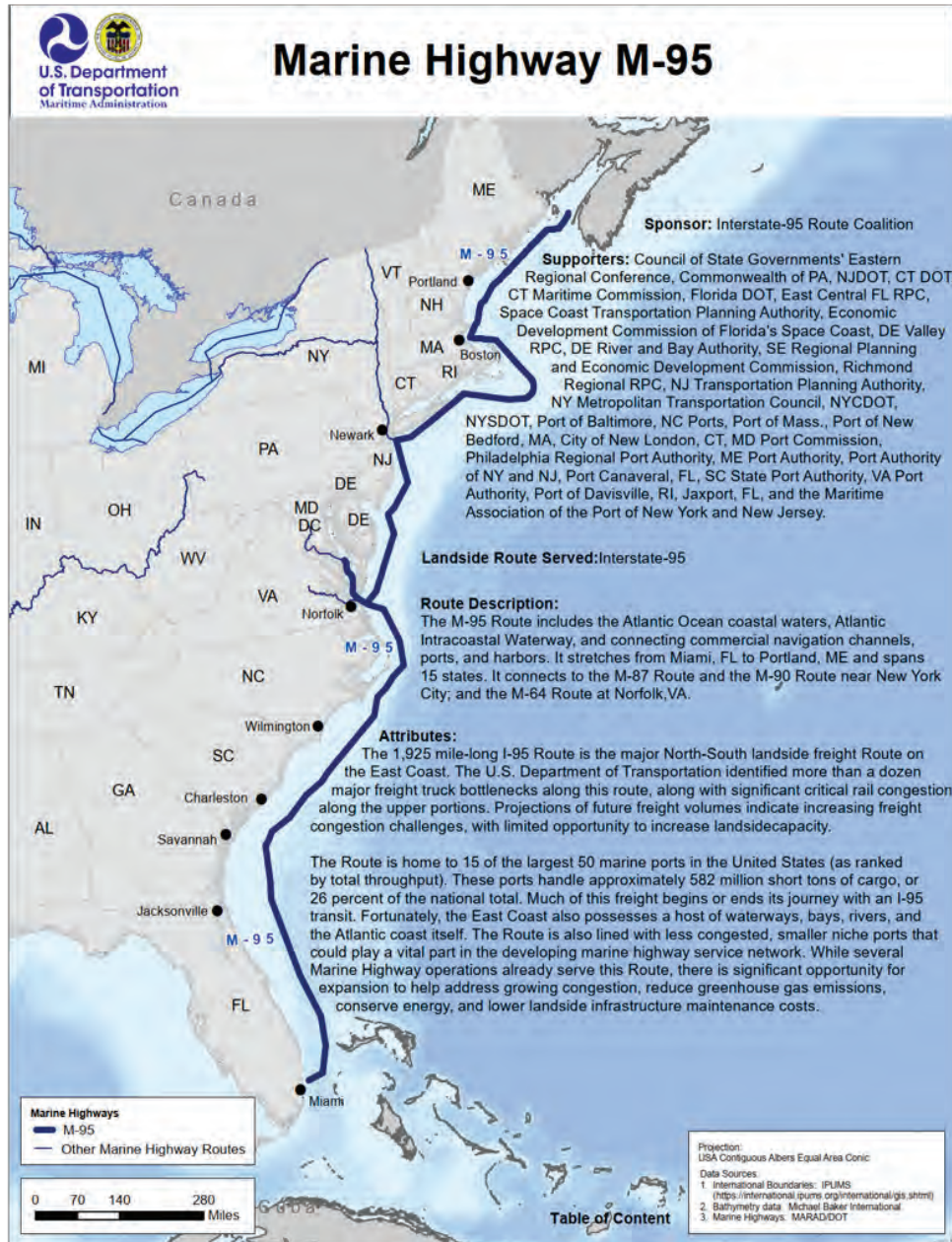
6.7.4 M-95 MARINE HIGHWAY CORRIDOR

The USDOT Marine Highway System includes 28 “Marine Highway Routes” that serve as extensions of the surface transportation system. Each all-water route is comprised of navigable waterways including rivers, bays, channels, coasts, the Great Lakes, open-ocean routes, and the Saint Lawrence Seaway System. MARAD's Marine Highway Program was established in 2007 to reduce landside congestion through better utilization of marine waterways. More information on the program and routes is available at the USDOT MARAD website, <https://www.maritime.dot.gov/grants/marine-highways/marine-highway>.

Marine Highway M-95 is sponsored by TETC, formerly known as the “I-95 Corridor Coalition,” which is supported by the Maryland Port Commission, in coordination with MDOT. M-95 stretches from Miami, FL to Portland, ME spanning 15 states, and connects to M-90 near NY and to M-65 near VA. In Maryland, I-95 carries the majority of the state's freight volumes through the Baltimore and Washington Metropolitan regions, and north and south along the East Coast. MDOT continues supporting multimodal improvement strategies and improvements at the Port of Baltimore to improve multimodal freight mobility.



EXHIBIT 6.31: M-95 MARINE HIGHWAY CORRIDOR SUMMARY⁵¹



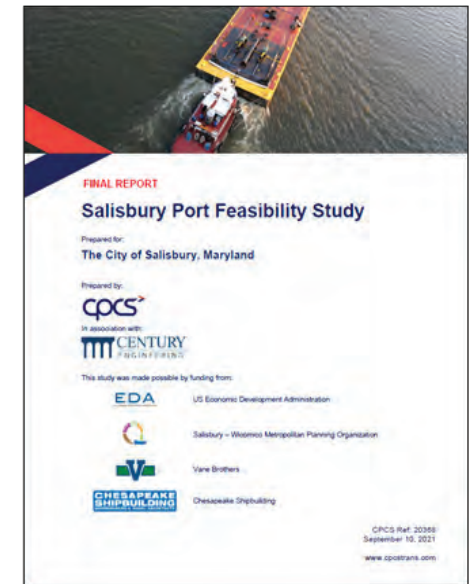
6.7.5 INLAND WATERWAYS

Inland waterways were summarized in **Section 4.3.4** of this freight plan. Summaries covered the Chesapeake & Delaware Canal, rivers on Maryland's Eastern Shore (the busiest of which include the Nanticoke and Wicomico rivers), and other locations such as the Susquehanna, Patuxent, and Potomac rivers (see **Exhibit 4.17**).

Port of Salisbury

Beyond the existing river summaries, stakeholder comments throughout the course of this freight plan update have also highlighted interest in expansion of Wicomico River opportunities relative to activity through the Port of Salisbury on Maryland's Eastern Shore. The Wicomico River's navigable channel is congressionally authorized to be maintained up to a depth of 14 feet with a width of up to 150 feet. The Port of Salisbury marine terminals sit along 2.25 miles of waterfront along the Wicomico River, adjacent to the central business area of downtown Salisbury. The Port of Salisbury is the second largest port in Maryland and is a freight hub for the southern Delmarva peninsula.⁵² The Port of Salisbury is located along the Delmarva Central Railroad network and has easy highway access to US 50 and US 13.

Waterborne freight activities through Salisbury provide links in supply chains for fuel, aggregate, and agricultural products, but have seen a decline in traffic since the early 2000s. The City of Salisbury and its stakeholder partners recently completed the Salisbury Port Feasibility Study, which evaluated the market demand and physical feasibility of a potential multi-user or multi-cargo port terminal in the Salisbury area.⁵³ The plan identifies key development opportunities, implementation recommendations, and a cost/benefit analysis to support a multi-user port terminal.



6.8 Multistate Freight Coordination

Among the new requirements introduced by the IIJA, state freight plans must now include, if applicable, consideration of the findings or recommendations made by any multi-state freight compact to which the state is a party under 49 U.S.C. §70204. Such compacts encompass regionally linked interests in a specific nationally or regionally significant multi-state freight corridor to promote the improved mobility of goods across jurisdictional boundaries. Potential outcomes of such coordination may include identifying projects along a corridor that benefit multiple states, assembling rights-of-way for improvements, or performing capital improvements. Formal multi-state freight compact opportunities (as described in 49 U.S.C. §70204) also extend to the use of multi-state advisory committees to support decision-making and prioritization efforts, serve as a broader freight discussion forum, and promote the sharing of information between private/public sectors. Grant opportunities also are available to help support multi-state freight compacts affecting routes or corridors that are part of the National Multimodal Freight Network.

Focus Areas:

- ✓ Multistate coalitions
- ✓ Multistate MPO coordination
- ✓ Adjoining state perspectives



6.8.1 MULTISTATE COALITIONS

At least four notable coalitions affecting critical multi-state freight connections in Maryland actively contribute to broad-based planning and/or operations and management efforts that influence freight transportation systems in the state.

- **The Eastern Transportation Coalition (TETC)** (<https://tetcoalition.org/>) – TETC is a partnership of 19 states and the District of Columbia focused on connecting public agencies across modes of travel to increase safety and efficiency. Formerly the I-95 Corridor Coalition, TETC has evolved to include more than 200 public agencies working together to address the pressing challenges facing the eastern corridor with a focus on TSMO, freight, and innovation. Freight-specific resources include emphases on freight data, commercial vehicle operations, truck parking, member states' federally compliant freight planning activities, the M-95 Marine Highway corridor, and involvement with the National Freight Fluidity Program.
- **I-81 Corridor Coalition (I-81CC)** (<https://www.i-81coalition.org/>) – The I-81CC is a consortium of stakeholders dedicated to improving the safety, continuity, and efficiency of commercial and personal travel along the I-81 corridor that extends from Tennessee to the Canadian border in New York. The primary focus of the I-81CC is to study and implement innovative solutions to address challenges specific to travel on a freight-intensive highway serving a wide variety of geopolitical regions and users. Areas of focus include incident management, development planning, and truck parking.
- **Delmarva Water Transport Committee (DWTC)** (<https://www.dwtconline.com/>) – DWTC is a non-profit organization with headquarters in Salisbury, MD. Their mission is to encourage the continuation and further development of waterborne commerce on the rivers, bays, and harbors of the Delmarva Peninsula, which consists of 14 counties overall, spanning Maryland's Eastern Shore, Delaware, and portions of Virginia. This mission includes the promotion of adequate dredging, safe navigation, and maintenance and development of harbor and river terminals in such a manner as to protect and conserve the environment.
- **Appalachian Regional Commission (ARC)** (<https://www.arc.gov/>) – ARC is an economic development partnership agency of the federal government and 13 state governments focusing on 423 counties across the Appalachia Region. ARC's mission is to innovate, partner, and invest to build community capacity and strengthen economic growth in Appalachia to help the region achieve socioeconomic parity with the nation. Freight-relevant focus areas include the Appalachian Development Highway System (ADHS) (**see sidebar**), as well as freight management and intermodal transportation initiatives that include regional highway, rail, and port linkages affecting freight travel for Maryland and the Port of Baltimore.

Appalachian Development Highway System (ADHS)

Through the Appalachian Regional Commission (ARC), the ADHS includes 33 distinct corridors than enhance access to the interstate system and a wide range of domestic and global markets. ADHS corridors in Maryland include:

- Corridor E – traverses WV 73 and US 40, from I-79 near Morgantown, WV, to I-70 near Hancock, MD.
- Corridor N – traverses US 219 from Corridor E near Grantsville, MD, to Corridor M at Ebsburg, PA.
- Corridor O – traverses US 220 from Corridor E near Cumberland, MD, to I-80 near Bellefonte, PA.

6.8.2 MULTISTATE MPO COORDINATION

MDOT proactively coordinates with the MPOs that cover metropolitan areas across the state including, for example, regular meetings through Maryland's MPO Roundtable forum. Four of the seven MPOs in Maryland (**Exhibit 6.32**) encompass jurisdictions that cross the Maryland state border into an adjoining state (or the District of Columbia), inherently making any planning efforts or programs run through the MPO "multistate" by default. These multistate jurisdictions include:

- Hagerstown-Eastern Panhandle MPO (HEPMPO) – Maryland and West Virginia.
- National Capital Region Transportation Planning Board (TPB) – Maryland, Virginia, and the District of Columbia.
- Wilmington Area Planning Council (WILMAPCO) – Maryland and Delaware.
- Salisbury/Wicomico MPO (S/WMPO) – Maryland and Delaware.

EXHIBIT 6.32: MARYLAND METROPOLITAN PLANNING ORGANIZATIONS 54



In addition to the Maryland MPOs listed previously, the Delaware Valley Regional Planning Commission (DVRPC) serves as the MPO for the Greater Philadelphia region and portions of Pennsylvania and New Jersey. This jurisdiction is just beyond the northeast corner of Maryland and includes many shared interests that affect the broader region, such as the regional expansion of major warehousing and distribution activities, or critical access to the I-95 corridor. DVRPC's initiatives include active and cooperative freight coordination opportunities via their Delaware Valley Goods Movement Task Force and related quarterly meetings.

6.8.3 ADJOINING STATE PERSPECTIVES

To further garner insights into potential freight issues or activities in Maryland that could influence an adjoining state – or vice versa – MDOT conducted an adjoining state freight survey in February/March 2022 as part of this update to the Maryland State Freight Plan. Survey respondents included the Pennsylvania Department of Transportation (PennDOT), the District Department of Transportation (DDOT), and the Delaware Department of Transportation (DelDOT). Summary insights and potential freight planning overlaps included the following:

- **Vision emphasis areas:** transportation network improvements; truck parking; sustainable and environmentally sound growth; coordination of policies, land use investments, and funding initiatives; coordination of technology and data innovations for information sharing and coordination of enforcement efforts; interstate linkages through Maryland.
- **Multistate needs and opportunities:** infrastructure improvements; work zone coordination; work zone incident communications (e.g., between data sites and commercial vehicles); truck parking initiatives and priority locations; land use decisions and logistical infrastructure related to distribution centers and low emissions mode shifts; alignment of truck routes and restrictions across multiple jurisdictions; OS/OW vehicle escort service programs; freight congestion relief, notably including I-95 corridor bottlenecks; prioritization of port improvements.
- **Multistate planning, data, analytics, and services:** expanded use of central freight data repositories and improved data/analytical tools; freight flow analyses; planning for warehousing and adverse truck impacts along key freight corridors; snow removal materials and methods to reduce infrastructure damage; freight/truck communications among traffic management centers (TMCs); construction vehicle travel patterns and related OS/OW compliance to reduce infrastructure damage.
- **Freight technologies:** work zone data/information sharing with truck drivers; portable WIM technology systems; camera enforcement of truck restrictions; camera enforcement of curbside regulations, potentially including commercial vehicle loading zones; advancements in automation; use of alternative fuels; use of ITS and real-time information; mode-specific grant support for technology advancements.

- **Key freight challenges:** bridge improvement needs; transportation funding availability; labor shortage in transportation industries.
- **Specific Project References:**
 - Howard Street Tunnel Project (CSX double-stack clearance efforts)
 - US 50 and the Baltimore-Washington Parkway
 - DDOT's Bus Priority Program (<https://ddot.dc.gov/page/bus-priority>)
 - DDOT upgrades to existing static scale weigh stations and WIM systems on I-295
 - DDOT redesignation of the 3rd Street tunnel (to I-195 and I-695) to I-395
 - DDOT expansion of Waze beacon GPS extenders within the 9th and 12th Street tunnels, and the Mall and Air Rights tunnels.
 - DDOT citywide sign structure updates
 - DDOT coordination with U.S. Capitol Police (USCP) to reconcile truck routes/restrictions and add LED signage in support of USCP's truck interdiction zone around the Capitol Complex.
 - DDOT updates of the Transportation Online Permitting System (TOPS)



6.9 E-commerce and Related Planning Considerations

E-commerce is an ever-growing market with increasingly challenging freight implications. While already part of a growing logistics chain, the role and criticality of e-commerce activities and fulfillment centers that move retail products directly to consumers also has been vastly accelerated as a result of the COVID-19 pandemic.

At a broad level, e-commerce goods and retail channels in and around Maryland generally rely on major freight entry points such as the Port of Baltimore, Port of Norfolk (Virginia), or Port of Elizabeth (New Jersey). These goods are transferred to major warehouses and distribution centers, typically relying on the interstate system where congestion or bottlenecks can be critical factors that directly affect the efficient movement of warehouse freight. From the warehouses, goods will consolidate to smaller trucks and delivery centers such as UPS or Amazon for final mile delivery to local destinations. In this way, connectivity to and congestion along Maryland's arterial and local road networks are critical to the flow of e-commerce goods.

Focus Areas:

- ☑ Trade, transportation, and warehousing influences (see Section 3.3.6)
- ☑ Local planning and zoning
- ☑ Local consolidation centers
- ☑ Local curb management

6.9.1 TRADE, TRANSPORTATION, AND WAREHOUSING INFLUENCES

Details related to e-commerce considerations, trends, and challenges in Maryland were provided as part of the industry sector profiles in **Section 3** of this freight plan, notably **Section 3.3.6 – Wholesale Trade, Transportation and Warehousing, and Retail Trade**. Those details (refer to **Section 3.3.6**) highlighted relevant e-commerce focus areas involving:

- Distribution and logistics growth;
- Multimodal import/export connections;
- Fulfillment center activities and expansion;
- Omni-channel retailing strategies;
- Reverse logistics challenges;
- Material/packaging waste;
- Logistics network complexities (and needs for qualified support staff);
- Time sensitivity of final mile truck service;
- Congestion and delay influences, including cost and drayage impacts;
- Sensitivity to truck driver shortages, supply chain disruptions, or related factors;
- Impact of freight/passenger rail conflicts/constraints on delivery opportunities;
- Potential conflicts between delivery trucks and other usage of local streets; and
- Policy, regulation, or educational needs for evolving package delivery technologies.

6.9.2 LOCAL PLANNING AND ZONING

Local planning, zoning, and even real estate perspectives can potentially play an important and proactive role in identifying e-commerce delivery solutions and opportunities. Such opportunities can be marketed not just as a way of managing impacts, but also of fostering efficient delivery services for the community members themselves. Potential needs or challenges may include reducing the impact of local road congestion by delivery vehicles, managing the integration of mixed-use development, accounting for smaller consolidation and fulfillment centers (described in **Section 6.9.3**), or enhancing local curb management practices (described in **Section 6.9.4**), particularly in urbanized areas. Enhanced local planning and community outreach or education may also explore ways to potentially pre-position communities to take advantage of new and evolving delivery technology opportunities. Such opportunities may include PDDs, UAVs/drones, or “smart” mailboxes (i.e., technology-enabled containers that open, receive, and store drone-delivered packages in a safe, secure, climate-controlled box accessible only by a homeowner or business owner⁵⁵).

6.9.3 LOCAL CONSOLIDATION CENTERS

As e-commerce demands continue to grow, there must be an efficient means of being able to distribute and deliver goods locally to their final destinations to support that growth. To enhance efficiency, potential opportunities may include expanded use of local consolidation centers for the purpose of light storage and consolidation of goods in facilities or development space that may be smaller than traditional large-scale warehousing and distribution centers. Consolidation center opportunities may include, for example, re-purposing empty big-box storefronts to serve these roles where vacant land/space is not otherwise available. This approach to mixed development may be challenging in areas where such uses may not fit within more traditional land use or zoning codes. However, as community leaders, managers, and planning staff throughout Maryland find opportunities to review their current land use and zoning details, consideration of local consolidation centers may provide another idea to help proactively manage the e-commerce demands and delivery needs of their communities.

6.9.4 LOCAL CURB MANAGEMENT

With increases in e-commerce and related final-mile truck or delivery traffic volumes, particularly in urban settings where accessing individual delivery sites can be more difficult, curb management becomes more important and more challenging. Curb management seeks to inventory, optimize, allocate, and manage the available curb space to maximize mobility, safety, and access for a wide variety of uses or users that include:⁵⁶

- Vehicle storage
- Car sharing
- Pedestrians and crossing infrastructure
- Food trucks and mobile vendors
- Special events
- Emergency services
- Micro-mobility (scooters)
- Trash and trash pickup
- Electric vehicle charging
- Transit and transit infrastructure
- Ride-hailing
- Flex zone
- Bicycles and infrastructure
- Local businesses
- Access for persons with disabilities
- Green infrastructure, parklets, streetscapes
- Freight deliveries

With increasing demands and value associated with package deliveries, curb management becomes even more important for helping to expedite delivery times and ensure access for an increasing number of freight or delivery vehicles. Among efforts in Maryland to explore relevant improvements, Montgomery County Planning is conducting an Urban Loading and Delivery Management Study to identify best practices and policy options to better balance loading and delivery functions with through-movements of people and goods in urbanizing areas.⁵⁷ More general solutions to curb “shortages” may include:⁵⁸

- **Relocation** of curb spaces to better use the curb zone.
- **Conversion** of curb space to different uses to better use the curb zone.
- **Flexibility** to convert curb spaces to flexible time-of-day zones to meet demand-based uses throughout the day.
- **Minimize** time “on the curb” through the use of common delivery locations in large buildings, delivery lockers, or via loading zone apps (e.g., implementing “smart curbs” that can be reserved for a specific purpose and time period).
- **Off-Hour Deliveries** that partner with transporters and receivers to reschedule their deliveries or distribution activities to occur during off-hours (i.e., non-peak hours) to help reduce competing demands where there are high traffic and pedestrian volumes coupled with limited curb space and competing delivery demand. New York City DOT has successfully implemented (and is seeking to expand) off-hour delivery programs with the intent of increasing the number of deliveries between 7 p.m. and 6 a.m.⁵⁹

6.10 Military Freight Considerations

6.10.1 MARYLAND MILITARY INSTALLATIONS

The military industry plays a key role in Maryland's economy with numerous military facilities and aerospace and defense contractors. Collectively, there are 68 federal and state military installations in Maryland (**Exhibit 6.33**), including major installations such as:

- Aberdeen Proving Ground
- Joint Base Andrews
- Fort Detrick
- Fort George G. Meade
- Naval Air Station Patuxent River (NAS Pax River)
- Naval Support Activity South Potomac (NSF Indian Head)
- Walter Reed National Military Medical Center

These installations directly support military personnel and assets, as well as research and development, military intelligence, cybersecurity, and more. Walter Reed National Military Medical Center is the nation's largest of its kind, and Fort George G. Meade is Maryland's largest employer.⁶⁰ As per IIJA, MDOT is evaluating the state's freight network and potential needs in relationship to the military facilities and strategic defense networks in Maryland to better understand and integrate military freight implications.

Focus Areas:

- ✓ Maryland military installations
- ✓ Strategic defense networks
- ✓ Anticipated freight project/program influences



EXHIBIT 6.33: MILITARY FACILITIES IN MARYLAND

BASE / INSTALLATION	MARYLAND LOCATION
ARMY	
Aberdeen Proving Ground	Aberdeen
Fort Detrick	Frederick
Fort George G. Meade	Odenton
Pocomoke City Armory	Pocomoke City
U.S. Army Reserve Center	Annapolis
Walter Reed National Military Medical Center	Bethesda
Maryland Army National Guard	35 readiness centers, armories, or training sites statewide
NAVY	
Naval Air Station Patuxent River (NAS Pax River)	Lexington Park
Naval Support Activity South Potomac (NSF Indian Head)	Indian Head
Naval Research Laboratory, Chesapeake Bay Detachment	Chesapeake Beach
Naval Support Activity Annapolis	Annapolis
Naval Support Activity South Potomac	Indian Head
Naval Support Facility Thurmont (Camp David)	Catoctin Mountain Park
Naval Surface Warfare Center (two sites)	West Bethesda and Indian Head
U.S. Naval Academy	Annapolis
U.S. Naval Operational Support Center	Baltimore
U.S. Naval Research Laboratory - Chesapeake Bay Detachment	Chesapeake Beach
U.S. Naval Reserve Training Center	Hyattsville
Webster Field Annex	St. Inigoes

BASE / INSTALLATION	MARYLAND LOCATION
AIR FORCE	
Joint Base Andrews (JBA)	Camp Springs
Brandywine Defense Reutilization and Marketing Office	Brandywine
Governors Bridge Globecom Annex	Davidsonville
Maryland Air National Guard, 175th Wing, (Warfield Air National Guard Base)	Baltimore (co-located at Martin State Airport)
District of Columbia Air National Guard, 113th Wing	Camp Springs (co-located at Joint Base Andrews)
COAST GUARD	
U.S. Coast Guard Yard	Baltimore
U.S. Coast Guard Surface Forces Logistics Center	Baltimore
U.S. Coast Guard Station (six total)	Annapolis, Crisfield, Ocean City, Oxford, St. Inigoes, and Worton



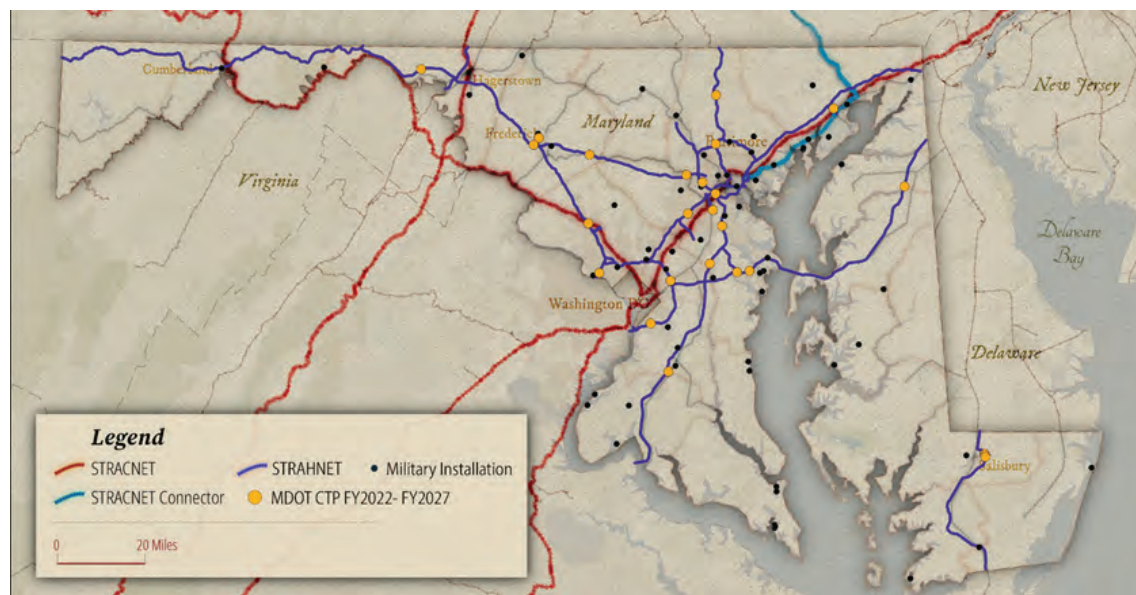
6.10.2 STRATEGIC DEFENSE NETWORKS

Federally and formally designated strategic defense network includes the Strategic Highway Network (STRAHNET) and the Strategic Rail Corridor Network (STRACNET). The STRAHNET and STRACNET networks within Maryland (**Exhibit 6.34**) are both encompassed as part of the state's overall multi-modal freight network.

Strategic Highway Network (STRAHNET)

The STRAHNET is a system of public highways that are a key part of the deployment of the United States armed forces. It provides defense access, continuity, and emergency capabilities for movements of personnel and equipment in both peace time and war. The STRAHNET is included as a subset of the NHS and includes the "last mile" of STRAHNET Connectors that link important military installations and ports to major components of the STRAHNET. Together, these roadways and connectors define the total minimum public highway network necessary to support Defense deployment needs.

EXHIBIT 6.34: STRATEGIC DEFENSE NETWORKS AND MILITARY FACILITIES IN MARYLAND



Map Note: refer to **Exhibit 6.35** for a list of the MDOT CTP projects shown in the map above.

Strategic Rail Corridor Network (STRACNET)

The Railroads for National Defense Program (RND) ensures the readiness capability of the national railroad network to support defense deployment and peacetime needs. The RND program integrates defense rail needs into civil sector planning affecting the nation's railroad system. Rail transportation is extremely important to DOD since their heavy and tracked vehicles will deploy by rail to seaports of embarkation. The RND Program, in conjunction with the FRA, established the STRACNET to ensure DOD's minimum rail needs are identified and coordinated with appropriate transportation authorities.



6.10.3 ANTICIPATED FREIGHT PROJECT/PROGRAM INFLUENCES

The current Consolidated Transportation Program (CTP)⁶¹ identifies 25 projects, ranging from maintenance to major capital improvements, that overlap portions of the strategic defense networks (**Exhibit 6.35**). Additionally, Maryland has been actively delivering transportation improvements to accommodate expansion at military facilities as part of the Base Realignment & Closure (BRAC) program, most notably since its last iteration in 2005. Key BRAC improvements in Maryland include:

- MD 175 corridor improvements to Fort George G. Meade
- MD 355 improvements for Walter Reed National Military Medical Center
- I-97 - I-97 SB from MD 3C to MD 3BU & NB from MD 3BU to MD 174

Understanding the relationship of the strategic military networks, military facilities, and Maryland's multimodal freight network improves MDOT's ability to identify and address considerations of military freight and to leverage funding opportunities from other programs and initiatives.



EXHIBIT 6.35: MARYLAND CTP PROJECTS OVERLAPPING THE STRATEGIC DEFENSE NETWORKS

INDEX #	PROJECT DESCRIPTION
1	MD 3, Robert Crain Highway
2	US 301, South Corridor Transportation Study
3	US 15, Frederick Freeway & US 40, Frederick Freeway
4	I-270, Eisenhower Highway
5	I-695, Baltimore Beltway
6	I-70, Eisenhower Memorial Highway
7	Temple Hill Road - Bridge Deck Replacement: Bridge 1616600 over I-95/495
8	Miscellaneous - Bridge #0322903 & 0322904 over Patapsco River & CSX
9	Cleaning & Painting Bridges - #0304300, 0324400, 0327605, 0327606 & 03417X0
10	Cleaning & Painting Bridges - #1601800,1606500,1614505/06 & 1623903/04
11	Blue Star Memorial Highway - Bridge Rehabilitation: Bridge #1701401 over Chester River
12	US 13 - Bridges #2202100,2203101/02, 2203201/02 & 2203301/02
13	US 13 - Bridges #2202100,2203101/02, 2203201/02 & 2203301/02
14	US 13 - Bridges #2202100,2203101/02, 2203201/02 & 2203301/02
15	John Hanson Highway - Lighting: MD 424 to Severn River Bridge
16	John Hanson Highway - Drainage Improvement IHB: MD 665 to Severn River
17	Landscape - Howard/Baltimore County Line to MD 216 (PHASE 1)
18	Landscape- I-695 Split to MD/PA Line (PHASE 1)
19	Baltimore National Pike - Safety & Resurface: Carroll County Line to East of MD 75
20	Baltimore Beltway & Interstate 95 - Landscape: I-695 (BA/AA County Line-Stevenson Lane), I-95 (BA/HO County Line-BA CO/BA CI)
21	W Belair Avenue - Safety & Resurface: MD 462 to US 40
22	I-495 - I-495 Inner & Outer Loop from Seven Locks Road to Persimmon Tree Road
23	Eisenhower Memorial Highway - Safety & Resurface: 0.44 miles East of Boyd Road to Ashton Road
24	I-195 @ MD 295 & MD 170
25	I-97 - I-97 SB from MD 3C to MD 3BU & NB from MD 3BU to MD 174

6.11 Freight Resilience, Environmental, and Equity Considerations

Infrastructure resilience and environmental protection are key components of Maryland's transportation goals. Freight-specific objectives associated with these goals focus on network resilience, environmental protection and conservation through projects' lifecycles and reduction in fossil fuel consumption in freight activities.

6.11.1 CLIMATE CHANGE VULNERABILITIES

MDOT continues to focus on enhancing the state's multimodal transportation infrastructure resilience as part of a comprehensive approach that includes understanding and assessing transportation system vulnerabilities and integrating climate adaptation and resilience into MDOT's business processes.⁶² MDOT TBUs have been undertaking and completing vulnerability and risk assessments to assess and analyze the impacts of climate change on the infrastructure.

MDOT SHA's Climate Change Vulnerability Viewer (CCVV) is a web application (available <https://www.arcgis.com/apps/webappviewer/index.html?id=86b5933d2d3e45ee8b9d8a5f03a7030c>) showcasing geospatial data products related to climate change and potential impacts to the infrastructure.⁶³ The CCVV is being shared and leveraged across TBUs for supporting vulnerability and risk assessments. The application overlays transportation infrastructure with climate change data including:

- Nuisance tidal inundation/flooding scenarios for 2020, 2050, and 2100, including flood depths for the different scenarios
- Roadway inundation/flooded roadway impacted by 10, 25, 50, 100, and 500-year storm event scenarios for years 2015, 2050, and 2100
- Hurricane model projected impact to Maryland based on Hurricane Florence's impact to North Carolina in 2018

MDTA also included climate change considerations as part of their Chesapeake Bay Crossing Study – Tier 1 National Environmental Policy Act (NEPA) by comparing the amount of land susceptible to sea level rise in each of the different alternatives under consideration.

MDOT MTA is incorporating the resiliency analysis outcome into the Asset Management practices in the agency, including the toolbox to identify solutions to address and protect the identified high-risk locations.

MDOT MAA provided technical documentation and economic impact cost analysis to help inform the approved Project Management Plan for the Baltimore Coastal Storm Risk Management Study.

MDOT MPA completed redevelopment of the Fairfield Marine Terminal Wet Basin and South Locust Point Fruit Slip creating new, elevated cargo space while enhancing storm water management and filtration.

Focus Areas:

- ✓ Climate change vulnerabilities
- ✓ Emergency freight access
- ✓ Alternative and efficient energy initiatives
- ✓ Air quality, community, and equity considerations



EXHIBIT 6.36: MDOT SHA CLIMATE CHANGE VULNERABILITY VIEWER (SAMPLE) 64



- MDOT continues to contribute towards interagency efforts to revise the Adaptation and Resilience Strategic Framework, ensuring that Maryland transportation goals, strategies, and activities were reflected in sections on critical infrastructure, water, public health, environmental justice, local governments activities, working lands, and ecosystems.
- MDOT SHA advanced strategic climate and extreme weather risk and resiliency concepts by drafting the MDOT SHA Climate Resilience Strategy.
- MDOT MPA received a grant of \$10 million in federal funds to help protect the Dundalk Marine Terminal against severe weather, sea-level rise, and other potential climate change impacts. The funds from USDOT's BUILD transportation grant program will help advance MDOT MPA's \$36.7 million Resiliency and Flood Mitigation Improvement Project at Seagirt Marine Terminal.
- In July 2021, the USACE received Congressional approval to reprogram federal funds (\$1.5 million) towards completion of the Baltimore Coastal Storm Risk Management Study. Work on this study has resumed.

6.11.2 EMERGENCY FREIGHT ACCESS

Enhanced freight movements and additional flexibility during emergencies or disasters are critical to ensuring a continuation of safe, efficient, and rapid response freight flows in unusual circumstances or in support of emergency relief efforts. Anecdotally, however, there may be a need to explore additional highway and freight rail coordination to help facilitate opportunities, potentially requiring broader discussion via American Association of State Highway and Transportation Officials (AASHTO) and statutory modifications across multiple states. Additional coordination may be needed to focus on mutually beneficial opportunities for both truck and freight rail services across the freight transportation system as a whole, especially during emergency response scenarios.

6.11.3 ALTERNATIVE AND EFFICIENT ENERGY INITIATIVES

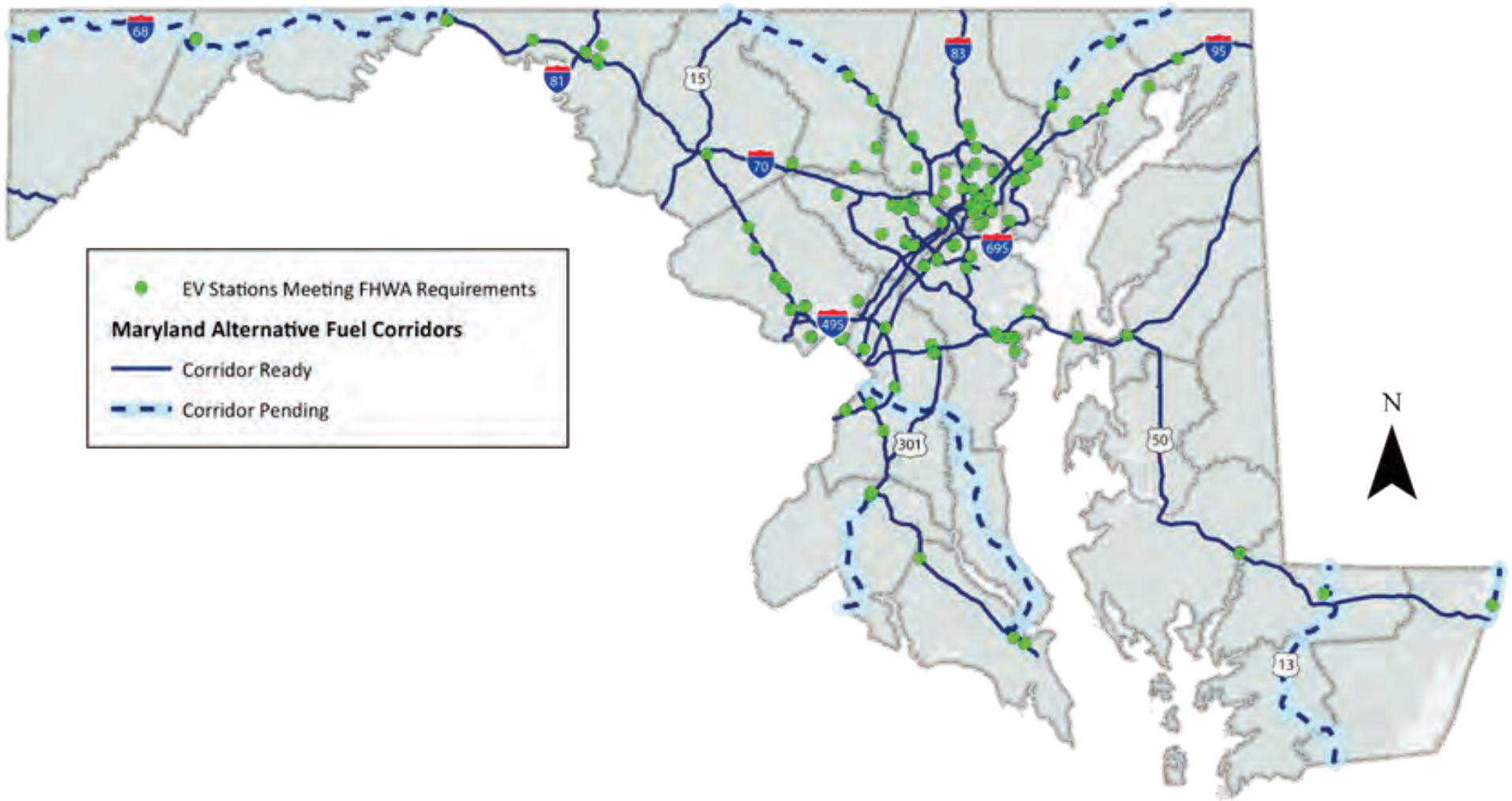
As a member of the Maryland Commission on Climate Change (MCCC), MDOT and other state agencies, elected officials, and experts are charged with advising the Governor and General Assembly "on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change" and with maintaining a comprehensive action plan with five-year benchmarks to achieve reductions in GHG emissions. On-road transportation is the single largest GHG emissions generator in Maryland, making alternative and efficient fuel initiatives a focus area to achieve MDOT's environmental protection and sensitivity goal.

MDOT is responsible for chairing the ZEEVIC and has played a leading role in the adoption of zero emission vehicles (ZEV) and the deployment of ZEV infrastructure. MDOT continues to work with the Maryland Department of the Environment (MDE) and Maryland Energy Administration (MEA) in developing policies and strategies to foster electric vehicle market expansion in Maryland, for both passenger cars and trucks, as well as medium-and heavy-duty vehicles.

MDOT is currently developing the Zero Emission Vehicle Infrastructure Plan (ZEVIP) to leverage funding from the National Electric Vehicle Infrastructure (NEVI) program, which was authorized by the IIJA. Funding through the NEVI program is tied to FHWA's Alternative Fuel Corridors, with state corridors (**Exhibit 6.37**) encompassing most of Maryland's highway freight network. This overlap creates an opportunity to leverage NEVI funding to promote electric vehicle charging infrastructure for freight transport vehicles in Maryland.

Through the IIJA, USDOT also provides flexibility in other formula programs to allow the construction and installation of EV charging infrastructure to support operational, resilience, national energy security, environmental, and community goals for freight transportation. More information on funding opportunities for EV infrastructure is presented in **Section 7**.

EXHIBIT 6.37: MARYLAND ALTERNATIVE FUEL CORRIDORS



Other Alternative and Efficient Energy Initiatives:

- MDOT MAA is in the process of upgrading multiple electric substations to provide both additional capacity and circuit redundancy to the critical airfield navigation and lighting systems to ensure operational resiliency of BWI Marshall Airport for the public air travel and air cargo needs of the state.
- MDOT MPA received a grant from the MEA's Resilient Maryland Program to develop a feasibility study that investigated microgrid options, analyzing wind, solar, batteries, and fuel cells at the Dundalk Marine Terminal.
- MDOT MPA installed new LED lighting inside four sheds at Dundalk Marine Terminal in preparation for use by the Port's tenants. The LED upgrades reduce electricity usage, increase worker safety, and help to lower GHG emissions.
- MDOT SHA is working in partnership with MDOT to identify numerous sites within MDOT SHA right-of-way (i.e., MDOT SHA Park-and-Ride lots, truck parking, weigh stations, and facilities) that are suitable for solar installation. The installation of solar infrastructure on or near MDOT SHA properties will reduce electrical pressure on the grid, reduce GHG emissions and provide a set utility cost for a more than 20-year contract providing a cost saving to the agency.

(MDOT 2022 Annual Attainment Report)

6.11.4 AIR QUALITY, COMMUNITY, AND EQUITY CONSIDERATIONS

MDOT's commitment to environmental initiatives has been demonstrated in the form of policies, programs, initiatives, and project-level actions. Examples include MDOT MPA's renewal and expansion of a voluntary memorandum of understanding (MOU) that calls for a continued committed effort to reduce diesel and GHG emissions and increase energy efficiency at the Port of Baltimore. Elements of the commitment include reduction of diesel emissions, creative reuse of dredged material, and projects like the Howard Street Tunnel expansion, which will increase rail capacity and reduce truck fuel consumption.⁶⁵

The Port of Baltimore focuses on environmental benefits through a number of programs in addition to dray truck replacements. These efforts include a cargo handling equipment replacement and repower program, marine vessels program, dredged material management programs, and a variety of goals pertaining to air, energy, and water quality management detailed in MDOT MPA's Safety, Environment, and Risk Management (SERM) sustainability strategies.⁶⁶

MDOT strives to be recognized as a "good neighbor" to adjacent communities, particularly for major ports such as the Port of Baltimore and BWI Marshall Airport. That implies understanding the extents of the ports' impacts on those who live and work nearby. The land uses in Baltimore, and the communities themselves, have changed over time. Historically, much of the port-related land was adjacent to communities whose residents worked at the terminals or nearby industry. Today, redevelopment has led to a turnover of residents, and many communities are not as directly linked to the benefits of the marine terminals near their neighborhoods.

Similarly, the areas surrounding BWI Marshall Airport continue to be developed, and expansion of airport activities highlight the need to better integrate land use planning around the state-operated facilities. MDOT recognizes the need to articulate and reinforce the economic benefits generated by the ports to nearby communities to provide a better understanding of their value.

Federal policies place renewed focus on equity considerations for community impacts, particularly for disadvantaged communities. The Justice 40 Initiative established by President Joe Biden focuses on delivering at least 40 percent of the overall benefits from federal investment in climate and clean energy to disadvantaged communities. MDOT and its TBUs will continue to engage stakeholders and the greater public to maintain continual and collaborative communications and ensure equity and community impacts are considered as part of their investment decision making processes.

MDOT MPA was awarded an American Association of Port Authorities Award of Excellence for Environmental Mitigation for a demonstration project that removes excess nutrient pollution and increases oxygen content in the Baltimore Harbor.

(MDOT 2022 Annual Attainment Report)

In April 2021, MDOT MAA completed an update of the Airport Noise Zones (ANZ), describing the noise environment around the airport in a 10-year planning horizon, for both BWI Marshall Airport and Martin State Airport. The ANZs are a valuable tool used by the state and counties in promoting compatible land use around these two state-owned and operated airports.

(MDOT 2022 Annual Attainment Report)



ENDNOTES

1. Maryland Open Data Portal, Maryland Statewide Vehicle Crashes – Person Details (Anonymized), including compilation of number of crash reports by type of injury (including possible injury) involving trucks and relative to all truck related crashes, 2016-2020, <https://opendata.maryland.gov/Public-Safety/Maryland-Statewide-Vehicle-Crashes-Person-Details-/py4c-dicf>.
2. Data compilation from multiple sources including: fatality/injury proportion estimates from 2016-2020 Maryland Open Data Portal details (see Endnote 1), and annual fatality estimates from NHTSA, Fatality Analysis Reporting System (FARS): 2005-2018 Final File and 2019 Annual Report File (ARF), <https://cdan.dot.gov/>. Note that 2020 FARS data was not available at the time of summary, so the 2020 fatal count as reported reflects a proportional estimate based on 2019 FARS data relative to a corresponding change in 2019-2020 fatal truck crash report counts recorded separately by MDOT SHA.
3. MDOT SHA, CHART Crash Report Data – Heavy Truck Fatalities (including single unit trucks, single unit trucks with trailers, tractor trailers, and double tractor trailers), dataset for January 1, 2016, through December 31, 2020. Provided by MDOT SHA, August 2021; compiled by freight plan development team, December 2021; and

MDOT SHA, Maryland Roadway Performance Tool (MRPT) – compilation of truck vehicle-miles traveled (VMT) by region or by route for data year 2019, compiled by freight plan development team, March 2022, <https://mrptui.z11.web.core.windows.net/>.
4. Ibid.
5. Ibid.
6. Federal Railroad Administration, *Safety Data and Reporting – Crossing and Inventory Data*, including data compiled for Maryland, <https://railroads.dot.gov/safety-data/crossing-and-inventory-data/crossing-inventory-dashboards-data-downloads>; and

Federal Railroad Administration, *Safety Data and Reporting – Highway/Rail Grade Crossing Incident Dashboard*, including 2016-2020 data compiled for Maryland, <https://railroads.dot.gov/accident-and-incident-reporting/highwayrail-grade-crossing-incidents/highwayrail-grade-crossing>.
7. Ibid.
8. Ibid.
9. Ibid.
10. Pipeline and Hazardous Materials Safety Administration (PHMSA), Oracle BI Interactive Dashboards – Hazmat Incident Report Search (2017-2021), <https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics>.
11. MDOT SHA, Office of Transportation Mobility and Operations (OTMO), <https://www.roads.maryland.gov/mdotsha/Pages/OTMO-Home.aspx?pageid=902>.
12. MDOT SHA 2020 TSMO Master Plan, https://www.roads.maryland.gov/OPPEN/TSMO_Master_Plan.pdf.
13. Emergen Research, Top 10 Companies in the Drone Package Delivery Industry (Report ID: ER_0068), March 2, 2022, <https://www.emergenresearch.com/blog/top-10-companies-in-the-drone-package-delivery-industry>.
14. Lilium, accessed March 30, 2022, <https://lilium.com/>, and

HopFlyt, accessed March 30, 2022, <http://hopflyt.com/>, and

Lift Aircraft, accessed March 30, 2022, <https://www.liftaircraft.com/>.
15. FHWA, SHRP2 Solutions – A strategic roadmap for making better freight investments, accessed March 30, 2022, https://www.fhwa.dot.gov/goshrp2/Solutions/Capacity/C20/Freight_Demand_Modeling_and_Data_Improvement.
16. MDOT SHA, One Maryland One Centerline (OMOC) Program, accessed March 30, 2022, <https://imap.maryland.gov/documents/maryland::one-maryland-one-centerline-omoc-centerlines/explore>, and

MDOT SHA, Highway Performance Monitoring System (HPMS), accessed March 30, 2022, <https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=588>.
17. American Journal of Transportation, “How is technology changing the future of freight forwarders?”, January 12, 2021, <https://ajot.com/news/how-is-technology-changing-the-future-of-freight-forwarders>.
18. Ibid.
19. Ibid.
20. Transmetrics, Top 5 Technologies and Innovation Trends Revolutionizing Truck, May 7, 2018, <https://www.transmetrics.ai/blog/innovation-in-trucking/>.
21. MDOT Strategic Asset Management Plan, https://www.mdot.maryland.gov/OPCP/MdDOT_samp_final.pdf
22. As reported in MDOT’s 2022 Annual Attainment Report (AR) on Transportation System Performance, <https://www.mdot.maryland.gov/tso/pages/Index.aspx?PageId=121>.

23. Ibid.
24. Port of Baltimore, Dredged Material Management Program (DMMP) website, <https://maryland-dmmp.com/>, and related MDOT MPA DMMP Annual Report, 2021, <https://maryland-dmmp.com/wp-content/uploads/2021/12/DMMP-Annual-Report-2021-12.3.21.pdf>.
25. Ibid.
26. MDOT SHA, Annual Mobility Performance (online resources), accessed March 2022, <https://roads.maryland.gov/mdotsha/pages/Index.aspx?PagelD=711>.
27. MDOT SHA, 2020 Maryland State Highway Mobility Report, Figures 9, 10, 21, and 22, for data year 2019, https://roads.maryland.gov/OPPEN/2020_mobility_report.pdf.
28. Ibid.
29. Ibid.
30. Ibid.
31. MDOT SHA, Maryland Roadway Performance Tool, Truck Top 100 Bottleneck Rankings, for data year 2019, <https://mrptui.z21.web.core.windows.net/>.
32. Ibid.
33. Ibid.
34. MDOT SHA, 2020 Maryland State Highway Mobility Report, Table 27-28 and Figure 27-28, for data year 2019, https://roads.maryland.gov/OPPEN/2020_mobility_report.pdf.
35. Ibid.
36. MDOT SHA, Maryland State Highway Mobility Report, compiled from report years 2016-2020 for data years 2015-2019, <https://roads.maryland.gov/mdotsha/pages/Index.aspx?PagelD=711>.
37. See Endnote 31.
38. See Endnote 36.
39. FHWA, Freight Management and Operations: Truck Parking, last modified February 16, 2022, https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/index.htm.
40. MDOT, Maryland Statewide Truck Parking Study – Final Report, 2020, <https://www.mdot.maryland.gov/tso/pages/Index.aspx?PagelD=80>.
41. See Endnote 40.
42. See Endnote 40.
43. See Endnote 40.
44. See Endnote 40.
45. Holguin-Veras, J.; Ramirez-Rios, D.; Ng, J.; Wojtowicz, J.; Haake, D.; Lawson, C.T.; Calderón, O.; Caron, B.; Wang, C. Freight-Efficient Land Uses: Methodology, Strategies, and Tools. *Sustainability* 2021, 13, 3059. <https://doi.org/10.3390/su13063059>
46. Brewster, Rebecca, “*Trucking Workforce Issues Top the List of Industry Concerns*”, ATRI Press Release, October 24, 2021.
47. TETC, Freight Fluidity, accessed September 22, 2021, <https://tetcoalition.org/projects/freight-fluidity/>.
48. Eisele, B, Defining Freight Fluidity: A Framework for Implementation in Maryland and Beyond, Texas A&M Transportation Institute for MDOT SHA, December 23, 2014.
49. Ibid.
50. FHWA, Freight Intermodal Connectors Study (Report No. FHWA-HOP-16-057), April 2017, <https://ops.fhwa.dot.gov/publications/fhwahop16057/fhwahop16057.pdf>.
51. USDOT Maritime Administration, America’s Marine Highway Route Designations, August 2021, <https://cms.marad.dot.gov/sites/marad.dot.gov/files/2021-08/Route%20Designation%20one-pagers%20Aug%202021.pdf>.
52. CPCS, Salisbury Port Feasibility Study, <https://salisbury.md/wp-content/uploads/2021/10/Salisbury-Port-Feasibility-Study-Final-Report.pdf>.
53. Ibid.
54. MDOT, Metropolitan Planning Organizations & Urbanized Areas in Maryland (map), accessed March 10, 2022, https://mdot.maryland.gov/OPCP/MD_MPO_Map.pdf.
55. McKinney, B., “Smart Drone Mailbox Secures the Future of Last Inch Deliveries”, NOW (online) by Northrop Grumman, January 18, 2021, <https://now.northropgrumman.com/smart-drone-mailbox-secures-the-future-of-last-inch-deliveries/>.
56. Institute of Transportation Engineers, Curbside Management, accessed January 26, 2022, <https://www.ite.org/technical-resources/topics/complete-streets/curbside-management-resources/#:~:text=Curbside%20Management%20seeks%20to%20inventory,wide%20variety%20of%20curb%20demands>.
57. Montgomery Planning, Urban Loading and Delivery Management Study (online), accessed March 2022, <https://montgomeryplanning.org/planning/communities/downcounty/urban-loading-and-delivery-management-study/>.
58. Kittelson & Associates, as referenced by Katsikides, N., Texas A&M Transportation Institute, “The Impact of Next-day Deliveries on Our Transportation System”, presentation with MDOT to Montgomery Planning, October 28, 2021.

59. New York City DOT, Off-Hour Deliveries, accessed April 2022, <https://ohdnyc.com/>.
60. Maryland Open for Business website, [https://open.maryland.gov/industries/military-federal/#:~:text=Military%20Leaders&text=Meade%20is%20Maryland's%20biggest%20employer,billion%20in%20output%20\(FY16\)](https://open.maryland.gov/industries/military-federal/#:~:text=Military%20Leaders&text=Meade%20is%20Maryland's%20biggest%20employer,billion%20in%20output%20(FY16).).
61. MDOT FY2022-FR2027 Maryland Consolidated Transportation Program, https://mdot.maryland.gov/OPCP/CTP_2022/CTP_FY2022_2027_Web.pdf.
62. MDOT 2020 Status Report Required Under the Maryland Commission on Climate Change Act, https://mdot.maryland.gov/OPCP/2020-MCCC_Act_MDOT_Report_12-30-2020.pdf.
63. MDOT SHA Climate Change Vulnerability Application, <https://www.arcgis.com/apps/webappviewer/index.html?id=86b5933d2d3e45ee8b9d8a5f03a7030c>.
64. Ibid.
65. MDOT 2022 Annual Attainment Report on Transportation System Performance, https://www.mdot.maryland.gov/OPCP/2022_Attainment_LR.pdf.
66. MDOT MPA, Safety, Environment, and Risk Management Sustainability Strategy 2020-2023, October 1, 2019, <https://mpa.maryland.gov/greenport/Documents/SERMSustainabilityPlan.pdf>.



SECTION 7 FREIGHT PROJECTS AND INVESTMENT PLAN

SECTION TABLE OF EXHIBITS

Exhibit 7.1: NHFP Project Eligibilities and Attributes _____	7-3
Exhibit 7.2: Maryland FY 2022 Estimated Formula Funding _____	7-5

SECTION LIST OF APPENDICES

APPENDIX 7.A: Candidate Freight Projects
APPENDIX 7.B: Maryland Freight Investment Plan
APPENDIX 7.C: Multimodal Freight Eligible Projects

SECTION TABLE OF CONTENTS

7 FREIGHT PROJECTS AND INVESTMENT PLAN _____	7-2
7.1 Candidate Freight Project Identification _____	7-2
7.2 National Highway Freight Program (NHFP) _____	7-3
7.2.1 NHFP Description and Eligibility _____	7-3
7.2.2 Maryland's NHFP Freight Investment Plan _____	7-4
7.3 Other Project Funding and Implementation Opportunities _____	7-5
7.3.1 Formula Funding Programs _____	7-5
7.3.2 Discretionary Grant Funding Programs _____	7-6
7.4 Additional Unfunded Needs/Priorities _____	7-7



7 FREIGHT PROJECTS AND INVESTMENT PLAN

The 2022 Maryland Freight Plan comprehensively addresses the state's freight planning activities and investments to qualify for funding under the National Highway Freight Program (NHFP). The Plan also identifies additional projects and funding opportunities to advance freight goals and strategies. MDOT welcomes the opportunity to invest in freight improvements using additional resources provided by the IIJA. The IIJA will provide Maryland and neighboring state Departments of Transportation (DOTs) approximately 50% more annual transportation spending during the next five years, including 30% more in formula funds. Using these resources, MDOT will continue to diligently apply funds and strategies to alleviate freight bottlenecks and address freight safety, congestion, and mobility.

7.1 Candidate Freight Project Identification

To commence the identification of candidate freight projects, MDOT coordinated with internal and external freight stakeholders to gain an understanding of priority freight needs that could potentially be addressed through the NHFP-focused freight investment plan, as well as other multimodal transportation programming resources. The initial candidate freight projects included a compilation of details from previous planning documents that focused on statewide freight initiatives. This list was refined through information gathered from stakeholder interviews, SFAC meetings, statewide MPO coordination, and feedback from local jurisdictions to further develop an approach that would address a significant amount of existing freight needs, as well as strategic concepts to mitigate future freight needs. Collectively, key sources and activities referenced to establish the initial list included:

- Statewide coordination meetings with the SFAC, MDOT TBUs, and Maryland's MPOs, including milestone survey feedback through the freight plan update process
- Local government and freight stakeholder outreach
- Maryland's FY 2022 – FY 2027 CTP
- 2020 MDOT SHA Highway Needs Inventory (HNI)
- 2022 Maryland Statewide Rail Plan
- 2022 AR
- 2020 Maryland Statewide Truck Parking Study
- 2017 Maryland Strategic Goods Movement Plan

As a result of these efforts, an initial list of candidate freight projects was developed with an emphasis on bottlenecks, congestion along major freight corridors, intermodal chokepoints, and routes where freight-related growth is anticipated, as well as multimodal candidates where available from relevant rail, port, and airport modal plans. Stakeholders were presented the initial list of candidates (**Appendix 7A**) and provided opportunities to share feedback at coordination meetings and via the Milestone #2 survey effort conducted during the freight plan update. Based on this feedback, the list was refined and utilized to help identify candidate projects for the NHFP, other project programming resources, multimodal project resources, and other unfunded freight needs as detailed in the remainder of this section.

IIJA Funding Additions

At a **national** level, IIJA funding increases include an additional \$110 billion for roads and bridges, \$11 billion for safety, \$39 billion for public transit, and \$66 billion for freight and passenger rail (a five-fold increase).



7.2 National Highway Freight Program (NHFP)

7.2.1 NHFP DESCRIPTION AND ELIGIBILITY

Per the IJJA, all states are required to update their state freight plan every four years and develop a freight investment plan to obligate their apportionment of NHFP formula funds. The NHFP formula funds are specifically intended to be used to improve the efficient movement of freight on the NHFN as prescribed in 49 U.S.C. §70202.

The freight investment plans for NHFP freight formula funds must:

- Include a four-year forecast period and be updated not less than every five years;
- Include a list of priority projects and be financially constrained; and
- Describe how funds made available to carry out 49 U.S.C. §167 would be invested and matched.

Funds apportioned to the state from the NHFP must address one or more of the NHFP eligible project attributes (**Exhibit 7.1**). To address this requirement, MDOT established an initial list of potentially eligible projects. This list includes projects of statewide significance that may facilitate the movement of goods to a major freight activity center (e.g., Port of Baltimore) to enhance the mobility of internal and multistate freight flows. Many projects are mid-to long-term improvements that address specific modal priorities or smaller projects that may include geometric or technology investments to improve access to freight generator facilities statewide.

EXHIBIT 7.1: NHFP PROJECT ELIGIBILITIES AND ATTRIBUTES

<ul style="list-style-type: none">■ Limiting states to the use of no more than 10% of apportioned funds on certain non-highway projects, such as governmental costs associated with rail and intermodal connectors■ Project development activities■ Construction, reconstruction rehabilitation, and land acquisition■ ITS, including freight ITS■ Environmental mitigation related to freight impact■ Rail-highway grade separation■ Geometric design improvements■ Truck-only lanes■ Runaway and climbing truck lanes■ Shoulder widening	<ul style="list-style-type: none">■ Truck parking facilities■ Real-time information systems■ Electronic screening and credentialing■ Traffic signals■ Work zone management■ Ramp metering■ ITS and other technologies for intermodal facilities and border crossings■ Additional road capacity for highway freight bottlenecks■ Any project that improves flow of freight to the NHFN■ Diesel retrofits■ Data collection and analysis■ Performance target development
---	--

NHFP Candidate Projects

More than 20 major capital improvement projects were considered for NHFP funding to improve freight related safety, congestion, and mobility.

Relative to NHFP funding availability, the Maryland Freight Plan follows the CTP assumption that Congress will appropriate the IJJA-authorized amounts for Federal Fiscal Years 2022 (FFY22) through 2027 (FFY27). Eligible freight projects and initiatives addressed by NHFP funds (as well as other state funding resources) are included in Maryland's FY 2022 – FY 2027 CTP. Beyond the documentation in the Maryland Freight Plan, a next step toward programming the applicable funds is to submit, update, or revise the Statewide Transportation Improvement Program (STIP)/ Transportation Improvement Program (TIP) to show federally allocated funds with the non-federal match. This list will be reviewed and adjusted annually to ensure projects are strategically identified that address mobility, congestion, and safety, as well as multimodal freight issues. It also will be updated as new opportunities to invest the funding are identified.

7.2.2 MARYLAND'S NHFP FREIGHT INVESTMENT PLAN

Based on the NHFP resources described above, this Maryland Freight Plan updates a five-year fiscally constrained Freight Investment Plan for FY22 through FY26 (**Appendix 7B**). It identifies the programmatic elements specifically required to comply with NHFP funding authorization. As detailed in **Appendix 7B**, Maryland's initial NHFP funding requests for FY22 through FY26 focused on the following major projects and initiatives:

- I-695 TSMO from I-70 to MD 43
- I-695, Baltimore Beltway at I-70 (Triple Bridges)
- MD 4 Suitland Parkway Interchange
- Truck Parking at the I-70 Welcome Center
- Improvements to the Maryland Statewide Transportation Model (MSTM) to advance model calibration and freight-specific enhancements for trucks and freight CAV
- Advancements in mapping and GIS tools related to the freight network, truck parking, and other freight-related data
- CAV/TSMO projects that encompass freight CAV implementation planning, pilot programs for freight EV charging, statewide truck parking technology enhancements, and freight-related data exchange platforms
- Virtual Weigh Station and related static scale and equipment upgrades

Maryland NHFP Projected Funding

Maryland's NHFP funding projections for FY22-FY26 total approximately **\$103.45 million**, allocated initially to:

- **\$75M** for capital improvement projects
- **\$6.9M** for truck parking facility improvements
- **\$0.9M** for freight-related innovative planning and performance management
- **\$11.8M** for CAV/TSMO related technology improvements
- **\$8.85M** for upgrading VWS and other MCD resources



7.3 Other Project Funding and Implementation Opportunities

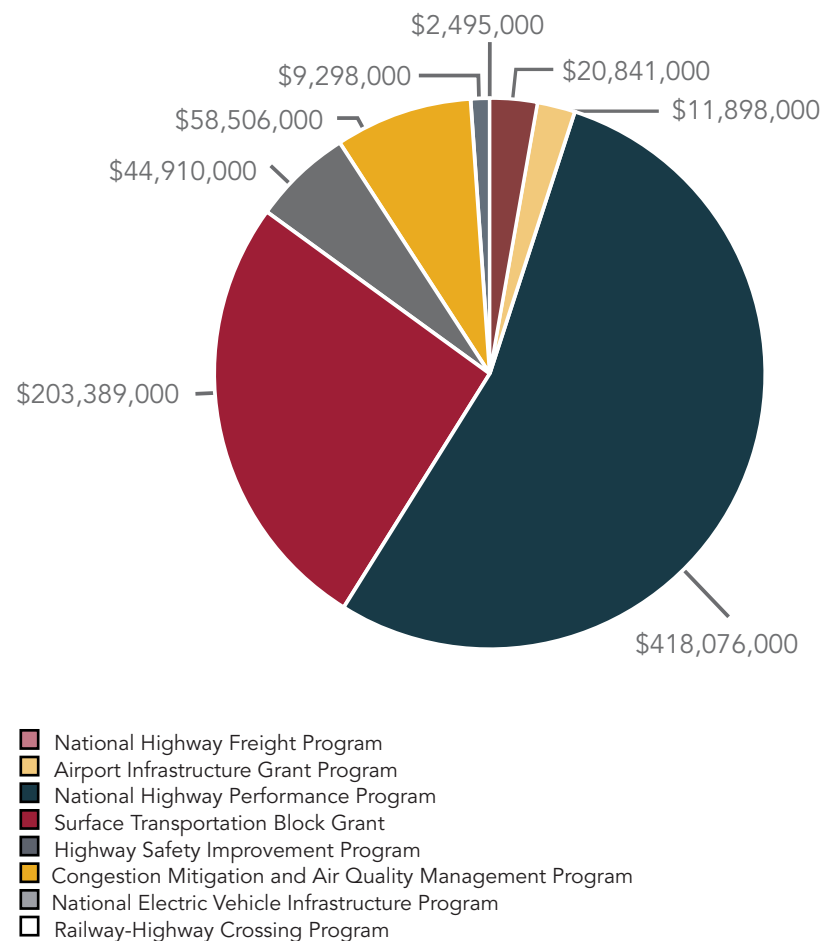
Beyond the NHFP resources, Maryland will continue to pursue other project funding and implementation opportunities through a variety of federal formula programs and discretionary grant opportunities. The IIJA notably expanded eligibility criteria of certain programs to include freight-related improvements, such as truck parking and alternative fuel initiatives. MDOT will continue to pursue funding opportunities to advance freight projects and initiatives, focusing on major formula and discretionary grant programs as listed below.

7.3.1 FORMULA FUNDING PROGRAMS

Based on current federal funding estimates, Maryland is eligible annually to receive approximately \$769.4 million in federal formula funds (**Exhibit 7.2**), which includes the aforementioned NHFP resources plus a wide variety of other formula-based programs that can be leveraged to support the implementation of freight-relevant projects. Notable programs and opportunities are summarized below.

- **Airport Infrastructure Grant Program:** Eligible airports include primary airports, certain cargo airports, and most general aviation/commercial service airports that are not primary airports but in the National Plan of Integrated Airport Systems.
- **National Highway Performance Program (NHPP):** The IIJA continues funding the NHPP to support the National Highway System.
- **Surface Transportation Block Grant Programs:** Promotes flexibility in state and local transportation decisions and provides flexible funding to best address state and local transportation needs.
- **Highway Safety Improvement Program (HSIP):** Provides states with critical safety funding that is used to save lives and prevent serious injuries on all public roads. HSIP is based on a performance-driven process that identifies and analyzes highway safety issues and advances highway safety improvement projects that have the greatest potential to reduce fatalities and serious injuries.
- **Congestion Mitigation and Air Quality management program (CMAQ):** The IIJA continues the CMAQ program to provide a flexible funding source to state and local governments for transportation projects and programs to help them meet the requirements of the Clean Air Act.
- **National Electric Vehicle Infrastructure program (NEVI):** Supports initiatives to strategically deploy electric vehicle charging infrastructure and establish an interconnected network to facilitate data collection, access, and reliability.
- **Railway-Highway Crossing Program:** Supports projects with the goal of reducing the number of fatalities, injuries, and crashes at public railway-highway grade crossings.

EXHIBIT 7.2: MARYLAND FY 2022 ESTIMATED FORMULA FUNDING



7.3.2 DISCRETIONARY GRANT FUNDING PROGRAMS

Discretionary grant funding is awarded on a competitive basis. Thus, estimating discretionary grant funding for freight projects in Maryland is challenging. However, MDOT will continue pursuing discretionary grant funding opportunities to advance freight investments identified in the Maryland Freight Plan. Notable programs and opportunities are summarized below.

- **Nationally Significant Freight and Highway Projects Grant Program (Infrastructure for Rebuilding America [INFRA]):** This program, also known as “INFRA,” awards competitive grants for multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas.
- **Mega Projects (formerly National Infrastructure Project Assistance ([NIPA]):** the Mega Projects program will support large, complex projects that are difficult to fund by other means and likely to generate national or regional economic, mobility, or safety benefits.
- **Reduction of Truck Emissions at Port Facilities Program:** This program will study and award competitive grants to reduce truck idling and emissions at ports, including through the advancement of port electrification.
- **Consolidated Rail Infrastructure and Safety Improvements (CRISI):** This program supports projects that improve the safety, efficiency, and reliability of intercity passenger and freight rail. Eligible projects include a wide range of freight and passenger rail capital, safety technology deployment, planning, environmental analyses, research, workforce development, and training projects.
- **Rural Surface Transportation Grant Program:** This program will support projects to improve and expand the surface transportation infrastructure in rural areas to increase connectivity, improve the safety and reliability of the movement of people and freight, generate regional economic growth, and improve quality of life.
- **Rebuilding American Infrastructure with Sustainability & Equity (RAISE)/ Local and Regional Project Assistance Program:** The RAISE program provides supplemental funding for grants to state and local entities on a competitive basis for projects that will have a significant local and/or regional impact.
- **Railroad Crossing Elimination Grant program:** This program provides competitive grant funds for the mitigation or elimination of hazards at railway-highway crossings.
- **Port Infrastructure Development Program (PIDP):** This program provides grants to invest in the modernization and expansion of U.S. ports to remove bottlenecks, ensure long-term competitiveness, resilience, and sustainability while reducing impacts to the environment and neighboring communities.

- **Motor Carrier Safety Assistance Program:** This program provides financial assistance to states to reduce the number and severity of crashes and hazardous materials incidents involving commercial motor vehicles.
- **Bureau of Transportation Statistics (BTS):** The Bureau of Transportation Statistics is the preeminent source of statistics on commercial aviation, multimodal freight activity, and transportation economics. Through grants, cooperative agreements, and other contracts, BTS provides context to decision makers and the public for understanding statistics on transportation.



7.4 Additional Unfunded Needs/Priorities

Based on the coordination efforts and resources described previously and beyond the projects recommended for NHFP funding (**Appendix 7B**), the Maryland Freight Plan also establishes a broader list of Multimodal Freight Eligible Projects to summarize funded and unfunded project needs from MDTA, MDOT SHA, MDOT MTA, MDOT MPA, and MDOT MAA (**Appendix 7C**).

Despite the increases in federal funding programs, the total freight needs exceed the forecasted funding allotments for Maryland. This list of unfunded projects will be periodically updated through continuous coordination with the SFAC, MDOT TBUs, and other stakeholders to reflect ongoing changes in freight needs and advancement of projects.

Additional projects from the detailed list in **Appendix 7C** will be advanced and prioritized as funding opportunities are identified through other formula programs or discretionary grants.

Maryland Freight Project Needs

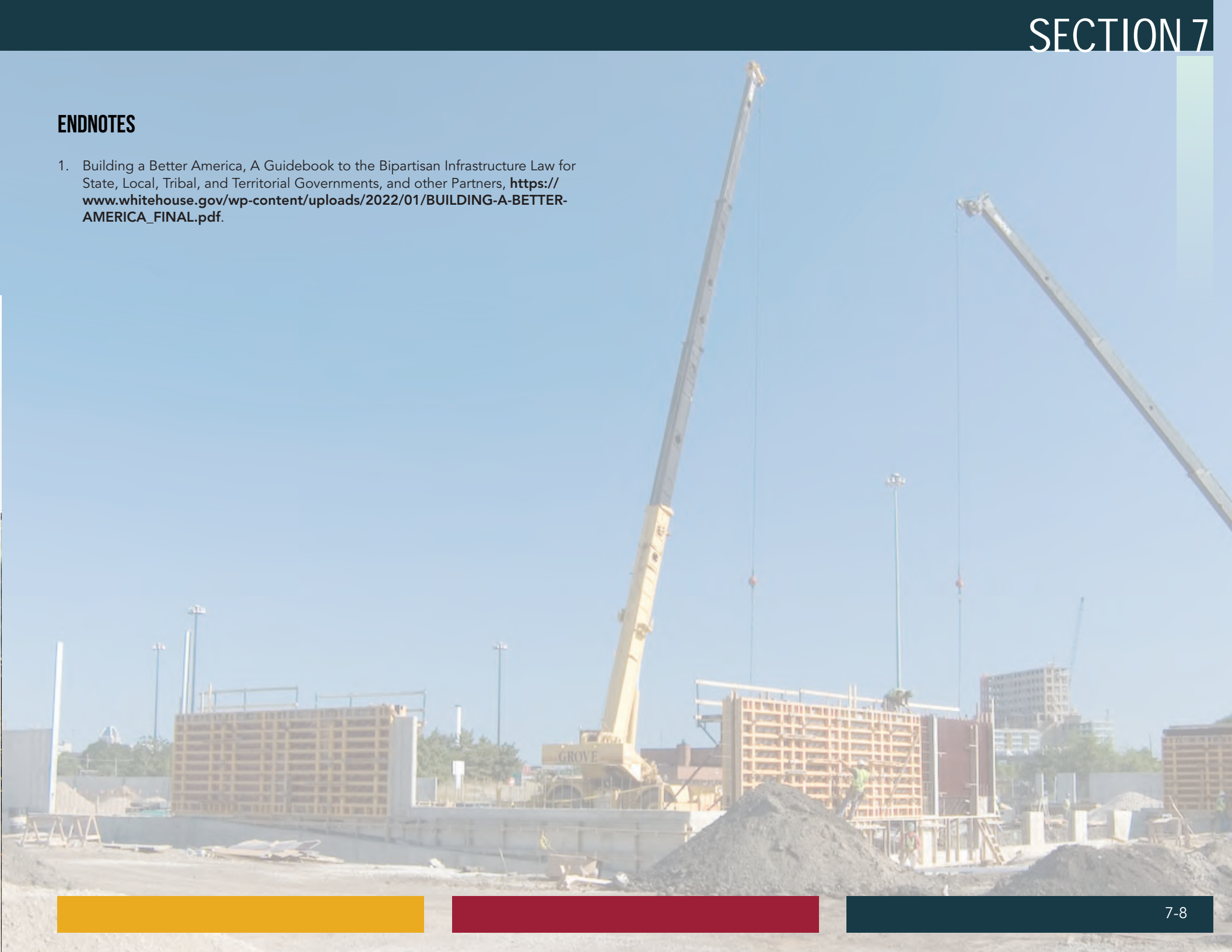
Maryland's Multimodal Freight Eligible Projects list identifies:

- \$4.7B in unfunded highway projects
- \$241M in unfunded Port projects
- \$2.4B in airport projects
- \$46.8B public and private rail projects



ENDNOTES

1. Building a Better America, A Guidebook to the Bipartisan Infrastructure Law for State, Local, Tribal, and Territorial Governments, and other Partners, https://www.whitehouse.gov/wp-content/uploads/2022/01/BUILDING-A-BETTER-AMERICA_FINAL.pdf.



SECTION 8 FREIGHT PLAN IMPLEMENTATION

SECTION TABLE OF EXHIBITS

Exhibit 8.1: Maryland Freight Goals	8-2
Exhibit 8.2: Safety, Security, and Resilience Strategies	8-3
Exhibit 8.3: Economic Opportunity and Efficiency Strategies	8-4
Exhibit 8.4: System Preservation and Modernization Strategies	8-6
Exhibit 8.5: Quality of Service, Efficiency, and Customer Experience Strategies	8-7
Exhibit 8.6: Environmental Protection and Sensitivity Strategies	8-8
Exhibit 8.7: Fiscal Responsibility Strategies	8-9
Exhibit 8.8: Transportation Choices and Connections Strategies	8-10
Exhibit 8.9: Freight Implementation Tactics	8-11

SECTION TABLE OF CONTENTS

8 FREIGHT IMPLEMENTATION PLAN	8-2
8.1 Summary Freight Strategies	8-2
8.1.1 Safety, Security, and Resilience	8-3
8.1.2 Economic Opportunity and Efficiency	8-4
8.1.3 System Preservation and Modernization	8-6
8.1.4 Quality of Service, Efficiency, and Customer Experience	8-7
8.1.5 Environmental Protection and Sensitivity	8-8
8.1.6 Fiscal Responsibility	8-9
8.1.7 Transportation Choices and Connections	8-10
8.2 Implementation Tactics	8-11
8.3 Closing and Next Step Priorities	8-12



8 FREIGHT IMPLEMENTATION PLAN

The implementation of the Maryland Freight Plan builds upon the freight background (**Sections 1-4**), freight focus areas (**Sections 5-6**), and stakeholder feedback obtained throughout the plan's development process. The final overall Freight Implementation Plan consists of the freight projects and funding opportunities presented previously in **Section 7**, as well as overarching strategies and next step action items detailed throughout the remainder of this **Section 8**. The freight strategies identified here support Maryland's freight vision and goals. This section also presents a tactical approach to help advance the freight strategies and action items in the near term, at least until the next update of the Maryland Freight Plan. This implementation plan aligns with strategies identified in the 2040 MTP. It also promotes the continued enhancement of the multimodal freight network and identification of successful freight planning as part of continued efforts to improve freight mobility.

8.1 Summary Freight Strategies

Summary freight strategies are intended as overarching guidance to support the development and execution of freight programs, projects, and related planning efforts throughout MDOT and in collaboration with its public and private partners. Strategies noted on the following pages are derived from data analysis, stakeholder feedback regarding the challenges and needs of private sector freight providers and users, and interagency input. The strategies are organized around the Maryland Freight Plan's seven freight goals (**Exhibit 8.1**). These goals and strategies were presented to the SFAC, MDOT TBUs, MPOs, and other freight stakeholders as part of the Maryland Freight Plan development process, including previously summarized feedback from Milestone #2 (**Appendix 5A**).

EXHIBIT 8.1: MARYLAND FREIGHT GOALS



Safety, Security, and Resilience

Ensure the safe, secure, and resilient movement of goods on Maryland's multimodal freight network.



Economic Opportunity and Efficiency

Enhance economic competitiveness through freight industry opportunities, mobility improvement, and strategic system expansion.



System Preservation and Modernization

Modernize Maryland's multimodal freight network and operations with innovative solutions from origin to destination.



Quality of Service, Efficiency, and Customer Experience

Enhance transportation services and communications for users of Maryland's multimodal freight system.



Environmental Protection and Sensitivity

Support sustainable freight infrastructure, community vitality, and environmental stewardship.



Fiscal Responsibility

Ensure responsible freight system investment and management through performance-based decision making and innovative funding mechanisms and partnerships.



Transportation Choices and Connections

Support alternative transportation choices and goods delivery options by improving multimodal and last-mile connections.








8.1.1 SAFETY, SECURITY, AND RESILIENCE

Maryland’s ultimate long-term safety goal is to achieve zero roadway deaths. This goal aims to enhance the safety and security of Maryland’s multimodal transportation system and provide a transportation system that is resilient to natural disasters or man-made hazards. Strategies under this goal strive to reduce the number of lives lost or injured due to freight activities; secure the movement of people, goods,

and data; provide a resilient multimodal system; and improve roadway clearance to facilitate emergency response.

Exhibit 8.2 summarizes nine strategies serving the primary goal of safety, security, and resilience, while also indicating where secondary benefits are anticipated across the remaining freight goals.

EXHIBIT 8.2: SAFETY, SECURITY, AND RESILIENCE STRATEGIES

ID	SUMMARY FREIGHT STRATEGIES							
1.01*	Infrastructure Safety Improvements Initiate appropriate infrastructure safety improvements with commercial motor vehicles in mind. (MTP)	●		○	○			
1.02	Railroad Crossing Upgrades Install new flashing light signals and replace outdated components at existing active warning device installations at rail-highway grade crossings. (MTP)	●		○				
1.03	Truck/Rail Safety Monitoring Programs Collaborate with partners to maintain truck and rail safety enhancement and monitoring program. (MTP)	●		○	○			
1.04	Airport Zoning Permit Process Continue to work closely with Anne Arundel, Howard, and Baltimore counties in implementing the Airport Zoning Permit process for proposed development within the vicinity of BWI Marshall Airport and Martin State Airport. (MTP)	●	○		○			
1.05	Security Infrastructure Upgrades Continue to upgrade security infrastructure such as CCTV, security cameras, and other technology on the multi-modal transportation system. (MTP)	●		○				
1.06	Vulnerability Assessments and Adaptation Strategies 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. (MTP)	●				○		○
1.07	Incident Management Technologies Invest in technology to facilitate 24/7 roadway clearance and public information of incidents through CHART. (MTP)	●		○				
1.08	Rail Safety, Security, and Resilience Strategies Promote strategies that improve rail safety, security, and resilience identified in the Maryland State Rail Plan.	●		○				
1.09	Truck Parking Improvement Strategies Promote strategies to further develop the truck parking program and improve truck parking issues, including safety, security, facilities, information systems, and capacity, as detailed in the Maryland Truck Parking Study.	●	○		○		○	○
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						

8.1.2 ECONOMIC OPPORTUNITY AND EFFICIENCY

Maryland is open for business and continues to promote economic activity to make the state a better place for businesses. Strategies aligned with this goal invest in and pursue opportunities to promote system improvements that support economic development, reduce congestion, and improve the movement of people and goods. These strategies promote economic opportunity and efficiency by pursuing








capital improvements to improve economic growth opportunities, alleviate major bottlenecks, and reduce overall congestion in the multimodal system.

Exhibit 8.3 summarizes 15 strategies serving the primary goal of economic opportunity and efficiency, while also indicating where secondary benefits are anticipated across the remaining freight goals.

EXHIBIT 8.3: ECONOMIC OPPORTUNITY AND EFFICIENCY STRATEGIES

ID	SUMMARY FREIGHT STRATEGIES							
2.01	Performance Reporting Develop a data supported system for performance reporting and project prioritization. (MTP)		●				○	
2.02	Economic Modeling Use economic modeling to assess productivity benefits through travel cost savings, reliability benefits of industry, delivery logistics and supply chain benefits, and agglomeration effects on access to specialized skills and services to facilitate business opportunities throughout Maryland. (MTP updated)		●				○	
2.03*	Significant Corridor Congestion Reduction Address congestion and bottlenecks on nationally and regionally significant corridors to facilitate access to major employment, freight, and activity centers. (MTP)		●	○	○			
2.04	Supply Chain Congestion Reduction Reduce or mitigate the effects of congestion on industry supply chains where appropriate. (MTP)		●		○			
2.05*	Key Freight Bottleneck Improvements Implement improvements at key freight bottlenecks identified in the state Freight Plan, mobility report, or related resources including the MRPT. (MTP, updated)		●	○	○			
2.06	Property Acquisition for Port/Terminal Expansion Acquire property adjacent to existing Port facilities to preserve opportunities for expanding terminal space. (MTP)		●					○
2.07	Identification of Rail Capacity Constraints Identify locations where projected volume may exceed capacity on key freight rail corridors. (MTP)		●		○			○
2.08	TSMO Improvements Implement TSMO improvements to reduce congestion on highway systems, focusing on integrated freeway and arterial management and operations. (MTP)	○	●	○		○		○
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						

EXHIBIT 8.3: ECONOMIC OPPORTUNITY AND EFFICIENCY STRATEGIES (CONTINUED)

ID	SUMMARY FREIGHT STRATEGIES							
2.09	Air Cargo Facility Expansion Expand air-cargo facilities at BWI Marshall Airport. (MTP)		●					○
2.10	Freight and Logistics Workforce Development Collaborate with public and private sector partners to address freight transportation and logistics needs and workforce development.		●		○			
2.11	Freight and Logistics Educational Programs Provide advice and guidance to Maryland Higher Education Commission, community colleges, and industry partners to define educational programs in freight and logistics.		●		○			
2.12	Truck Industry Career Outreach Support public outreach efforts by the trucking industry promoting careers.		●		○			
2.13	Truck Driver Education Programs Collaborate with independent and small fleet carriers and educational institutions to understand their specific needs and concerns and advise in the development of driver education and development programs.		●		○			
2.14	Heavy Equipment Apprenticeship Programs Consider instituting heavy equipment apprenticeship programs to provide on-the-job training.		●					
2.15	Port Growth Strategies Promote strategies to grow cargo volumes at the Port of Baltimore – including containers, automobiles, RoRo, breakbulk, and other opportunities – as detailed in the Maryland Port Strategic Plan.		●				○	○
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						



8.1.3 SYSTEM PRESERVATION AND MODERNIZATION

Maintaining and modernizing Maryland’s roads and bridges requires continuous and significant investment in MDOT’s asset management program. The system preservation and modernization goal focuses on preserving, maintaining, and modernizing the state’s freight transportation infrastructure and assets. Strategies under this goal focus on maintaining state of good repair, leveraging new and

innovative technologies and practices, and optimizing public investment to ensure a sustainable transportation system.

Exhibit 8.4 summarize 10 strategies serving the primary goal of system preservation and modernization, while also indicating where secondary benefits are anticipated across the remaining freight goals.

EXHIBIT 8.4: SYSTEM PRESERVATION AND MODERNIZATION STRATEGIES

ID	SUMMARY FREIGHT STRATEGIES							
3.01	Truck Size and Weight Studies Study the effects of truck size and weight for permitted and non-permitted loads on safety, infrastructure, and the economy. (MTP)	○	○	●				
3.02	Airport Facility and Runway Maintenance Maintain the state’s aviation facilities and runways in a state of good repair to support the vitality of aviation statewide. (MTP)		○	●				○
3.03	Navigation Channel Maintenance Maintain the navigation channel depth and width to allow safe, two-way traffic to and from the Port of Baltimore. (MTP)		○	●				○
3.04	State-Owned Rail Asset Maintenance Maintain, rehabilitate, and improve state-owned rail assets as identified in the MDOT Freight Lines Strategic Plan. (MTP)		○	●				○
3.05	CAV Deployment Support CAV technology to build experience and attract partners, integrate the technology and investments, and explore/expand deployment opportunities in Maryland. (MTP, updated)	○	○	●		○		
3.06	Truck Platooning Opportunities Assess opportunities for implementing truck platooning. (MTP)	○	○	●		○		
3.07*	Rural Freight Needs and Funding Opportunities Understand the unique needs of rural freight transportation and ensure equitable consideration for freight funding opportunities.			●			○	
3.08	PDD/UAV/Future Technology Assessments Evaluate the impact of PDD, UAV/drones, and similar technologies to the multimodal freight network.		○	●				○
3.09*	Rail Infrastructure Modernization Promote strategies to modernize rail infrastructure identified in the Maryland State Rail Plan.			●			○	
3.10	Planning to Support Technology Work with local jurisdictions on planning-related needs required to support or facilitate innovative freight technology opportunities.			●	○	○		○
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						








8.1.4 QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE

The quality of service, efficiency, and customer experience goal aims to increase the use of technologies and operational improvements to enhance transportation services and communication to customers of Maryland’s transportation system.

Strategies under this goal focus on improving the transportation system’s reliability and predictability through enhanced communications relaying real-time information.

Exhibit 8.5 summarizes 10 strategies serving the primary goal of quality of service, efficiency, and customer experience, while also indicating where secondary benefits are anticipated across the remaining freight goals.

EXHIBIT 8.5: QUALITY OF SERVICE, EFFICIENCY, AND CUSTOMER EXPERIENCE STRATEGIES

ID	SUMMARY FREIGHT STRATEGIES							
4.01*	Traffic Signal Optimization Continue to perform Traffic Signal Synchronization and installation of “smart signals” to provide an efficient flow or prioritization of traffic, increasing the efficient operations of a corridor and reducing unwarranted idling at intersections. (MTP)			○	●	○		
4.02*	ITS and Corridor/Systems Management Expand CHART and other ITS and operation tools to better manage peak-hour congestion on Interstate and regionally significant corridors. (MTP)		○	○	●	○		
4.03	Truck Parking Information Systems Implement current state-of-the-practice in truck parking availability technology systems where appropriate and feasible. (MTP)	○	○	○	●			
4.04	State-Owned Rail Asset Benefit Assessments Identify the competitive and strategic redundancy benefits that all could gain from more effective use of state-owned rail assets.		○		●			
4.05	Statewide Truck Route Mapping Updates Release an updated truck route map and establish a process for periodic review and updates utilizing stakeholder outreach, asset conditions, and motor carrier safety data collection.				●			○
4.06	Local/MPO Truck Route Mapping Coordination Partner with MPOs and municipalities to establish localized truck routing and mapping.				●			○
4.07	Truck Route Planning and Education Promote trucking companies to educate drivers on truck routing and plan trips that avoid nonfreight routes.		○		●			○
4.08	Truck Route Information and Communication Systems Implement current and reliable truck routing that is communicated to all truck drivers in various ways. (e.g., maps, GPS systems, and road signs).			○	●			○
4.09*	Maryland Rail Service Efficiencies Promote strategies to increase efficiency, predictability, and customer satisfaction of Maryland rail services as detailed in the Maryland State Rail Plan.				●			
4.10	Truck Parking Committee and Outreach Convene a standing truck parking committee and conduct further outreach on truck parking issues to advance initiatives detailed in the Maryland Truck Parking Study.				●			○
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						

8.1.5 ENVIRONMENTAL PROTECTION AND SENSITIVITY

Rising sea levels, flooding, and warmer temperatures will stress infrastructure in the future differently than today. The environmental protection and sensitivity goal seeks to deliver sustainable transportation infrastructure improvements that protect and reduce impacts to Maryland’s natural, historic, and cultural resources. Strategies under this goal focus on understanding the infrastructure risks associated with

climate change, employing conservation and innovative use/reuse/recycle materials, and promoting initiatives to reduce fossil fuel consumption.

Exhibit 8.6 summarizes eight strategies serving the primary goal of environmental protection and sensitivity, while also indicating where secondary benefits are anticipated across the remaining freight goals.

EXHIBIT 8.6: ENVIRONMENTAL PROTECTION AND SENSITIVITY STRATEGIES

ID	SUMMARY FREIGHT STRATEGIES							
5.01	Infrastructure Vulnerability, Risk, and Adaptation Studies Prepare for future climate impacts on transportation infrastructure through: Site and Stressor Identification, risk assessment, and adaptation development. (MTP)	○		○		●		○
5.02	Sustainable Seaport Strategies Develop and implement a “Green Port Strategy” consistent with industry trends and initiatives including US EPA’s Strategy for Sustainable seaports. (MTP)		○	○		●		○
5.03	Dredging Program Management and Priorities Promote state dredging and dredged material placement priorities for inclusion in Federal appropriations and authorization bills. (MTP)			○		●		○
5.04	Dredging Program Outreach and Education Increase public knowledge, understanding, and support of Maryland’s DMMP through strategic outreach to the communities, businesses, and schools in the vicinity of project sites. (MTP)					●		○
5.05*	Fuel Efficient Truck Technologies Promote and/or incentivize fuel-efficient technologies for medium and heavy-duty trucks. (MTP)			○		●		
5.06	Rail Diesel Engine Retrofits/Replacements Encourage and incentivize retrofits and/or replacements of old, diesel-powered non-highway engines, such as switchyard locomotives, with new hybrid locomotives. (MTP)				○	●		
5.07	Port Environmental, Energy, and Social Responsibility Goals Advance actions related to the Port of Baltimore’s environmental and energy sustainability goal, and social responsibility goal, as detailed in the Maryland Port Administration’s Strategic Plan.				○	●		
5.08*	Alternative Energy Applications Explore and expand the use of alternative energy sources (e.g., electric, solar) for freight applications, including freight commercial vehicles, multimodal support equipment, or related applications.			○	○	●		○
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						








8.1.6 FISCAL RESPONSIBILITY

The purpose of this goal is to ensure responsible investment and management of taxpayer resources to add value and deliver quality transportation improvements through performance-based decision making and innovative funding mechanisms and partnerships. As such, fiscal responsibility strategies focus on accelerating

project completion through alternative project delivery methods, strategic partnerships, and identifying consistent revenue or funding opportunities.

Exhibit 8.7 summarizes six strategies serving the primary goal of fiscal responsibility, while also indicating where secondary benefits are anticipated across the remaining freight goals.

EXHIBIT 8.7: FISCAL RESPONSIBILITY STRATEGIES

ID	SUMMARY FREIGHT STRATEGIES							
6.01	TSMO Program Coordination Coordinate TSMO activities across MDOT with regional and local agencies with clear, common objectives. (MTP)		○				●	○
6.02*	Collaboration for Double Stack Rail-Port Connectivity Collaborate with rail providers, public, and private partners to create a double-stack rail network into and out of the Port of Baltimore. (MTP)		○				●	○
6.03	Partnerships/Funding to Expand Truck Parking Increase truck parking facilities in key locations through innovative project delivery solutions and partnerships with public and private travel service providers. (MTP)		○				●	
6.04*	Partnerships/Funding to Enhance Short Line Rail 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.	○	○				●	
6.05	Partnerships/Funding to Maximize Rail Investment Benefits Promote alternative project delivery methods and strategic partnerships to maximize value in rail investments as identified in the Maryland State Rail Plan.		○				●	○
6.06	Discretionary Grant Funding Seek freight-relevant opportunities for discretionary grant funding, to include new or revised programs under the IIJA.	○	○	○	○	○	●	○
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						

8.1.7 TRANSPORTATION CHOICES AND CONNECTIONS

Changes in emerging technologies and mobility services, continued expansion of e-commerce, and recent disruptions in the supply chain due to COVID-19 underscore the importance of transportation choices and connections within the multimodal transportation system. As such, the transportation choices and connections goal connections goal seeks to improve transportation

connectivity and support alternative transportation options for the movement of people and goods.

Exhibit 8.8 summarizes eight strategies serving the primary goal of transportation choices and connections, while also indicating where secondary benefits are anticipated across the remaining freight goals.

EXHIBIT 8.8: TRANSPORTATION CHOICES AND CONNECTIONS STRATEGIES

ID	SUMMARY FREIGHT STRATEGIES							
7.01*	Multimodal Connectivity and Access Improvements Coordinate infrastructure improvements to facilitate multimodal connectivity and access. (MTP)		○	○				●
7.02	Inland Transportation Capabilities for Port Operations Expand inland transportation capabilities at the Port of Baltimore. (MTP)		○					●
7.03	Landside and Freight Rail Capabilities for Port Access Improve landside and freight rail access to the Port of Baltimore, including to the Intermodal Container Transfer Facility in the vicinity of the Port of Baltimore. (MTP, updated)		○					●
7.04*	Freight Transportation and Land Use Planning Guidance Provide transportation and land use planning guidance to local and regional agencies for economic development and freight efficiencies that support community goals.		○		○			●
7.05	Public/Private Sector Plan Coordination Coordinate freight-related plans and programs of the private sector and local agencies with MDOT's plans for integrated and informed decision making.						○	●
7.06	Last Mile Logistics Considerations Consider emerging last mile logistics trends in planning, project development, and design processes.		○		○			●
7.07	Curb Management Strategies Incorporate innovative curb management strategies into freight and land use design considerations to decrease curbside congestion and ensure safety of all road users.	○	○		○			●
7.08	Land Use Planning/Zoning for Truck Parking Integrate truck parking into local land use, zoning, and planning to advance initiatives detailed in the Maryland Truck Parking Study.				○		○	●
(MTP) = strategy from the 2040 Maryland Transportation Plan * = most favored strategy based on stakeholder feedback		● Primary Goal ○ Secondary Goal						

8.2 Implementation Tactics

Reaching the Maryland Freight Plan's desired outcomes will require the implementation of projects and programs by MDOT and public and private stakeholders. Each of MDOT's TBUs will help to advance the strategic direction of the plan through the planning and development of freight projects and programs in their own freight-relevant planning documents and related operations. Public and private sector freight stakeholders, freight providers, and system owners should also reference the Maryland Freight Plan to better understand MDOT's intended strategic direction as they develop programs and projects.

Successful implementation of the Maryland Freight Plan will rely, in part, on three overarching sets of implementation actions or tactics that emphasize (1) planning and programming, (2) data and analysis, and (3) communication. Within this framework, **Exhibit 8.9** summarizes activities that MDOT and its TBUs may undertake to implement and meet the goals of the Maryland Freight Plan. As MDOT takes these steps, they will continue to participate in studies, collaborative efforts, and pilot programs that advance the state's understanding of freight and how it moves in and around Maryland.

EXHIBIT 8.9: FREIGHT IMPLEMENTATION TACTICS

PLANNING AND PROGRAMMING
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.
Centralize short line rail technical expertise within MDOT MTA for efficiency and expediency of projects. Policy guidance and program oversight should be provided by MDOT TSO.
Identify alternative sources of public and private funding for freight projects and seek to leverage available resources with private investments.
DATA AND ANALYSIS
Monitor economic, trade and logistics, environment, technology, energy, and land use trends and assess implications, especially for MDOT capital investment programs.
Continue to share information within the Freight Data Workgroup to identify data and analysis capability gaps, and to develop data and analysis tool concepts that meet the needs of member agencies.
Continue developing freight modeling capabilities that account for potential changes in economic conditions, logistics patterns, transportation infrastructure or funding, and land use scenarios. Collaborate with the private sector to better understand industry supply chains and incorporate their impact into freight modeling and data analysis.
COMMUNICATION AND PARTNERSHIPS
Continue ongoing communication with freight stakeholders and MPOs, keeping them engaged in MDOT plans and studies, and participating in their plans and studies to ensure that the goals of all agencies are mutually supportive and avoid potential conflicts.
Engage the private sector to identify and map supply chains to help identify nodes, modes, and routes that are critical to the state.
Continue communication and coordination with neighboring states to address freight needs one-on-one and seek multi-state engagement opportunities.
Ensure all information regarding safety and security regulations on MDOT's websites are maintained and up-to-date, and provide customer service to answer technical questions and referencing to appropriate resources.
Explore opportunities to increase coordination and collaboration with Class I railroads in freight activities.
Monitor new and pending legislation that support and align with freight plan goals and strategies.

8.3 Closing and Next Step Priorities

Completion of the 2022 Maryland Freight Plan should not be construed as an end, or even a pause, in MDOT's freight planning efforts. Rather, the compilation of projects (**Section 7**), strategies (**Section 8.1**), implementation tactics (**Section 8.2**), and other details within this Plan should serve as a resource to help MDOT, in cooperation with other state agencies and private stakeholders, continue efforts that will manage and enhance Maryland's multimodal freight transportation systems and related opportunities.

To help support the continuation of the state's freight planning efforts, there are several near-term "next steps" that could be prioritized for completion as time and resources become available. Notable efforts that would continue to advance the vision, goals, and objectives of the Maryland Freight Plan include, but are not limited to, the following specific actions:

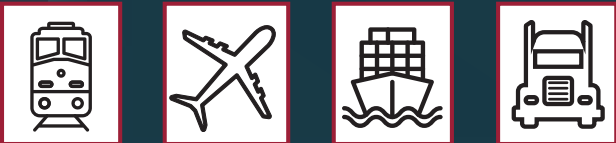
1. **CUFC/CRFC Expansion:** Evaluate expansion opportunities for additional mileage authorized by the IIJA and coordinate the nomination and approval process with MDOT SHA and Maryland's MPOs.
2. **Intermodal Connectors:** Review Intermodal Connector designations on the NHS, PHFS, or other facilities throughout Maryland to leverage opportunities that support critical first/last-mile links between major port, rail, airport, and intermodal freight facilities, including potential refinement or expansion of Maryland's designated connections in coordination with FHWA and with reference to FHWA's 2017 Freight Intermodal Connectors Study.
3. **Project Implementation Opportunities:** Prioritize freight-related capital project programming efforts, as well as the pursuit of discretionary grant opportunities for notable candidate freight projects.
4. **SFAC Coordination:** Continue to convene the SFAC to examine freight system challenges, monitor evolving freight influences, and recommend near-term and long-term freight projects or initiatives.
5. **Freight Data Insights** Continue utilizing freight data to help decision-makers and the public better understand the connection between freight transportation observed in communities and the economic activity that transportation is supporting.
6. **Alternative Fuel Funding** Coordinate with the Maryland Department of the Environment and the Maryland Department of Energy to explore and leverage alternative fuel funding opportunities.
7. **Truck Parking Improvements** Improve truck parking throughout Maryland by continuing to implement recommendations from the 2020 Maryland Statewide Truck Parking Study, including advanced data analysis to identify parking needs and promote sharing of parking information and additional collection of data.

8. **Technology Integration** Continue developing frameworks and guidance to manage impacts or opportunities related to new, evolving, innovative, and disruptive technologies that influence freight transportation, such as truck platooning, freight CAV, personal delivery devices, or drone/UAV deliveries.
9. **Technology Integration** Continue to coordinate multi-state opportunities that may influence major freight corridors.
10. **Environmental Performance Measures** Review/refine MDOT's performance measurement approach related to GHG emissions and/or other environmental justice details in coordination with the implementation of the federal government's Justice40 Initiative and future updates to MDOT's annual Attainment Report or other applicable plans.
11. **Rail Studies** Complete the High-Speed Intercity Passenger Rail Studies, which address rail capacity and operations issues in Maryland, particularly along the Northeast Corridor.

The 2022 Maryland Freight Plan supports national freight goals and complies with the requirements established by IIJA. With federal approvals of the Plan anticipated by late 2022, the next (four-year) formal update of the Maryland Freight Plan will be required by the end of 2026. Prior to the 2026 update, MDOT will continue monitoring and evaluating freight needs and investment priorities, and may periodically update the NHFP-focused Freight Investment Plan (**Appendix 7B**), as needed.

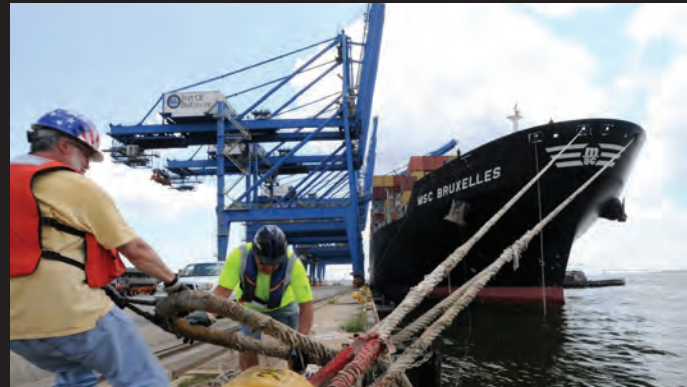


Maryland State Freight Plan



JUNE 3, 2022 DRAFT

APPENDICES





APPENDIX 2A

Milestone #1 Survey Feedback

Milestone #2 Survey Feedback

Survey Approach

As part of the development of the 2022 Maryland Freight Plan, Milestone #1 focused on development and refinement of the Plan's Vision, Goals, and Objectives. This effort included outreach opportunities that directly solicited feedback on these proposed elements. Opportunities included targeted planning discussions and live polling exercises during meetings with the MDOT Freight Transportation Business Unit (TBU) Roundtable and the Maryland State Freight Advisory Committee (SFAC). Broader efforts included an online survey in April 2021 (closed May 14, 2021) to expand beyond the TBUs and the SFAC to include other agency, stakeholder, and public participants. This Appendix summarizes the Milestone #1 survey results.

- As part of the survey, participants were provided an opportunity to:
- Provide feedback on the Freight Vision
- Rate the importance of each Freight Objective
- Provide additional input on proposed goals and/or objectives, or suggest strategies to ensure success
- Enter map markers and comments related to freight needs and opportunities in Maryland
- Sign up for the Maryland Freight Plan website to stay up to date on news and updates



The collective efforts resulted in over 130 separate comments received through live polling during the MDOT TBU and SFAC meetings, plus over 190 participants in the separate online public survey including members from local/state/federal government agencies, MPOs, businesses and non-profits, and the general public. Results generally showed that over 85% of the participants responded favorably to the proposed goals with “importance” ratings of at least 3 (out of 5) stars. Feedback reflected strong alignment with the proposed Vision, Goals, and Objectives with recurring themes and priorities centered around:

- Consideration for the Environment
- Safety
- Technology and Modernization
- Congestion and Travel Time Reliability
- Economic Cost/Opportunity
- Communities and Quality of Life

Vision Discussions

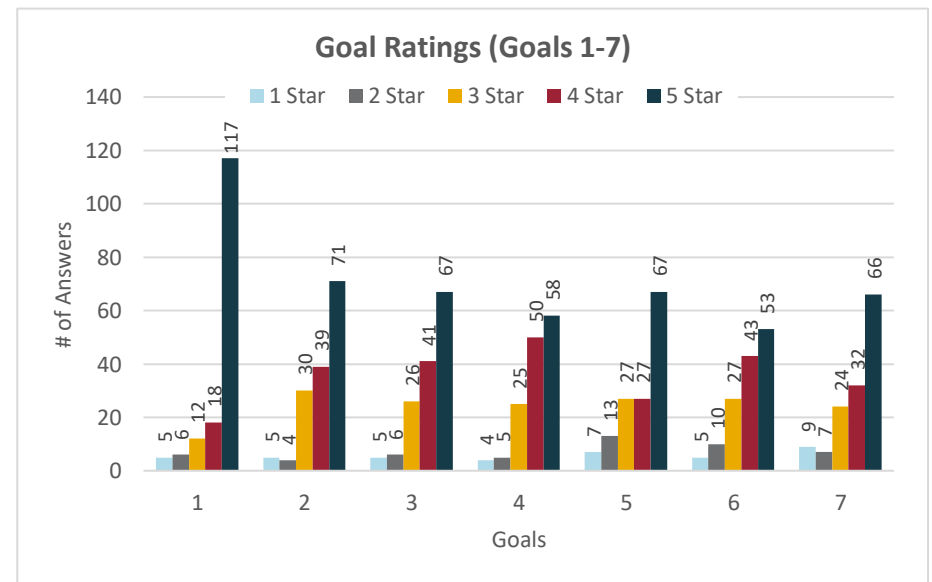
Specific feedback regarding the draft freight Vision highlighted the following:

- Environment: Consider environmental impacts, clean environment, environmental sustainability, environmental responsibility, climate impact of freight movement
- Technology
- Safety
- Remove "Sustainable" (buzz word; would much rather have safety)
- Reliable and consistent travel times
- Economic: economic liability, reduce freight transportation cost
- Improve system
- Quality of life
- Updated and modern
- Resilient: Disaster risk reduction
- Equitable community

Goal Ratings

Participants were asked to rate the importance of the draft Goals using a 5-star scale that ranged from 1-star ("Don't Include") to 5-Stars ("Most Important to Include"). Comments were requested for each of seven draft goals (listed below) with summary ratings as shown below.

1. Safety, Security, and Resilience
2. Economic Opportunity and Efficiency
3. Preservation and Modernization
4. Quality of Service, Efficiency, and Customer Experience
5. Environmental Protection and Sensitivity
6. Fiscal Responsibility
7. Transportation Choices and Connections



Objective Ratings

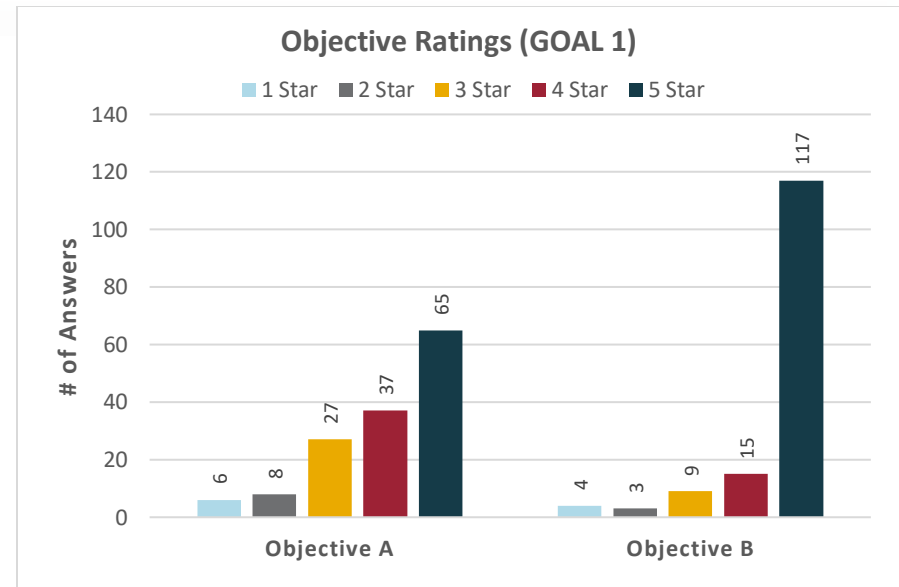
Participants were asked to rate the importance of each Objective included with each Goal using the same 5-star scale that ranged from 1-star (“Don’t Include”) to 5-Stars (“Most Important to Include”). Summary ratings for the draft Objectives included under each goal are shown below.

GOAL 1: Safety, Security, and Resilience

Ensure the safe, secure, and resilient movement of goods on the Maryland’s multimodal freight network.

Objectives:

- A. Develop a resilient freight network through enhanced redundancy and targeted mitigation
- B. Reduce incidents involving freight carriers, especially on the highways and railroads.

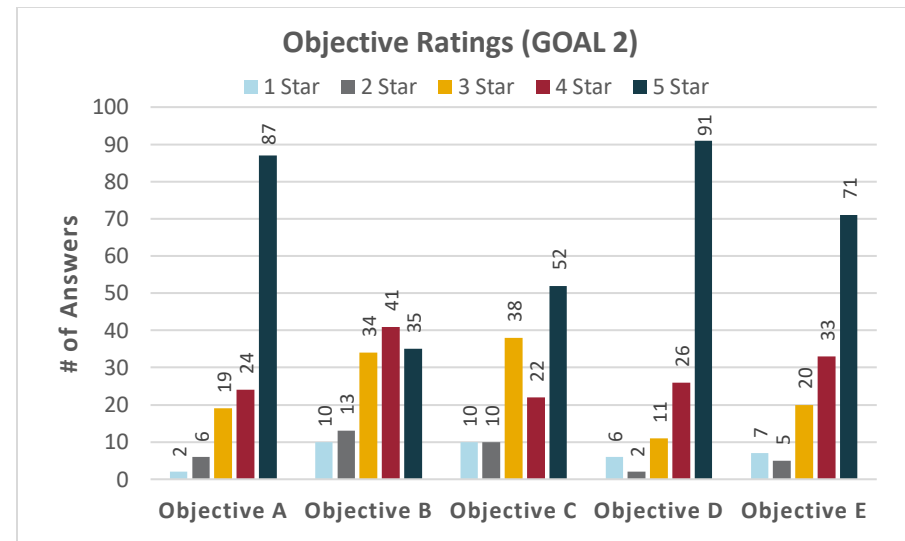


GOAL 2: Economic Opportunity and Efficiency

Enhance economic competitiveness through freight industry opportunities, mobility improvement, and strategic system expansion.

Objectives:

- A. Ensure the rail network can meet freight demand now and in the future.
- B. Incentivize a higher rate of driver recruitment and retention in the trucking industry.
- C. Increase availability and enrollment of the freight services degree and continuing education programs.
- D. Reduce freight bottlenecks along the multimodal transportation system through expansion and operational improvements.
- E. Improve intermodal connections to diversify freight movement alternatives and redundancy.

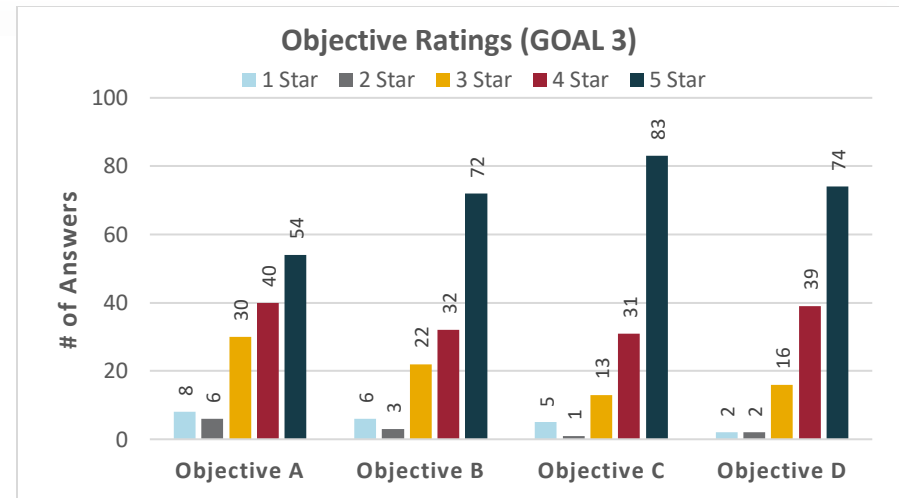


GOAL 3: System Preservation and Modernization

Modernize Maryland’s multimodal freight network and operations with innovative solutions from origin to destination.

Objectives:

- A. Support effective dredging programs that maintain and improve shipping channels to the Ports in Maryland.
- B. Establish formal policy on truck size and weight for permitted and non-permitted loads based on statewide engineering and operational information.
- C. Strategically modernize infrastructure through innovative technology and practices to facilitate the movement of goods.
- D. Ensure state of good repair of State-owned freight infrastructure and facilities through performance-based asset management practices.

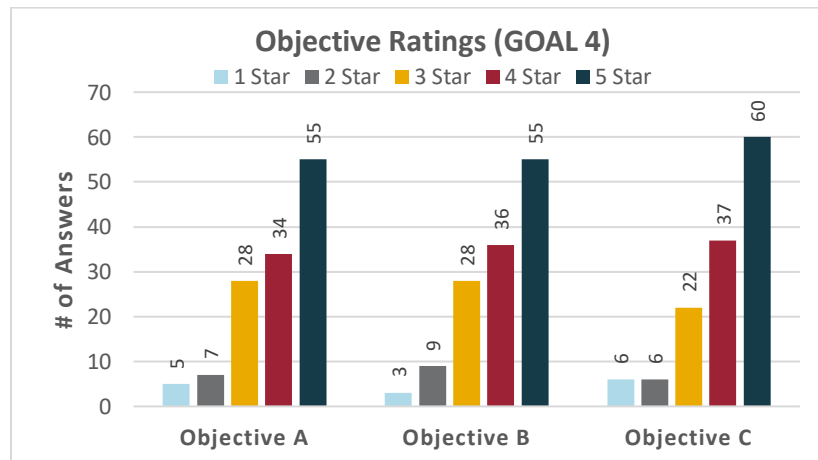


GOAL 4: Quality of Service, Efficiency, and Customer Experience

Enhance transportation services and communications for users of Maryland's multimodal freight system.

Objectives:

- A. Identify investment opportunities on the State-owned short line rail system that yield return on investment or public benefits.
- B. Improve the reliability and predictability of travel times along the multimodal Freight Network.
- C. Enhance mobility, reliability and system operations that positively impact supply chain costs associated with driver and truck delay.

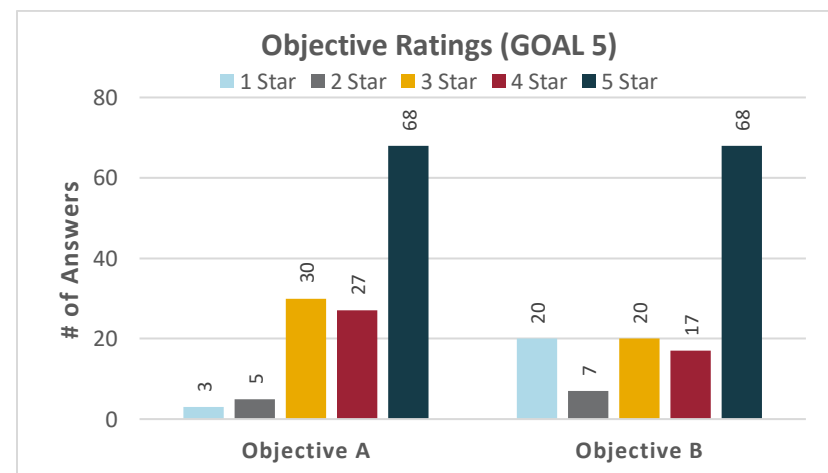


GOAL 5: Environmental Protection and Sensitivity

Support sustainable freight infrastructure, community vitality, and environmental stewardship.

Objectives:

- A. Promote protection and conservation practices in project development, construction, operations, and maintenance of freight transportation assets.
- B. Advance policies and initiatives to reduce fossil fuel consumption in freight related activities.

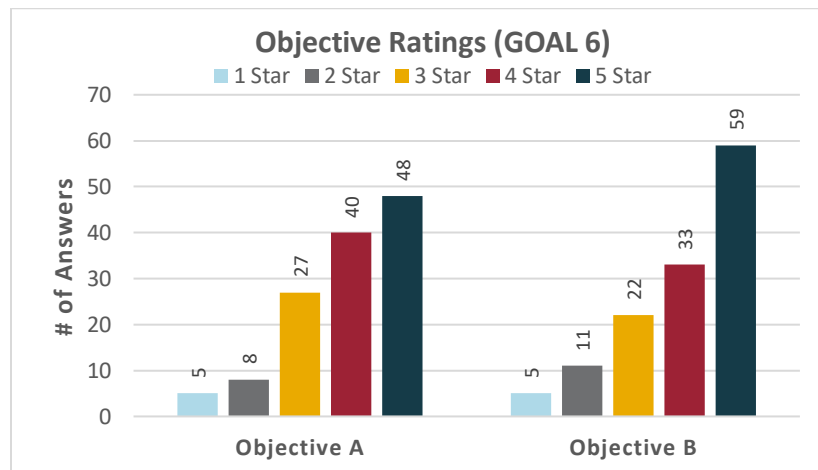


GOAL 6: Fiscal Responsibility

Ensure responsible freight system investment and management through performance-based decision-making and innovative funding mechanisms and partnerships.

Objectives:

- A. Accelerate freight related project completion through improved and efficient use of alternative project delivery methods and strategic partnerships.
- B. Strengthen the short line railroad system through transportation and economic development, and agriculture partnerships that could lead to innovative programs.

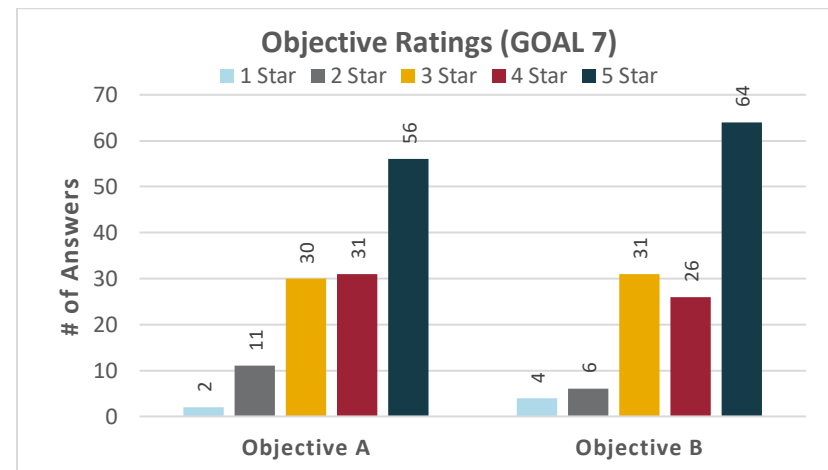


GOAL 7: Transportation Choices and Connections

Support alternative transportation choices and goods delivery options by improving multimodal and last-mile connections.

Objectives:

- A. Develop technical guidance for planning agencies that informs planners about the specific needs of pickup/delivery trucking operations in urban and densely developed areas.
- B. Enhance multimodal and intermodal connections to improve access to the Ports in Maryland.



Other Goal/Objective Comments

Additional open-ended feedback on the goals and objectives was also gathered via write-in comments as part of the public survey exercise. A summary of this feedback is listed below.

Access:

- Redundant networks to ensure a strong supply chain during a disaster
- Support Port of Salisbury and other ports/hubs as well, not just the Port of Baltimore

Permits:

- Simplify the permitting process and escort requirements
- Issue yearly blanket permits for oversize loads identical to previous years
- Like PA and WV, refuse to permit divisible loads
- Minimize damage to our roads and bridges (truck weight and sizes)

Technology/Innovation:

- Encourage freight electrification / alternative fuels
- Consider cargo bikes, tiny vehicles

Environment:

- Climate impacts
- Impact to surrounding communities (e.g., noise pollution, quality of life)
- Environmental and historical agricultural and wildlife preservation
- Water quality control

Rail:

- Rail freight should continue to increase/ encourage shifting from truck to rail
- Move all freight via rail - Small trucks should only be used for local deliveries

Design:

- Use more efficient interchange designs rather than the traditional "clover-leaf" design
- Increase the load capacity on bridges

Policy/Legislative:

- Electric infrastructure is in place to support these new models
- Primary users/freight haulers pay their fair share
- Make/enforce regulations to protect the environment
- Incentive alternative fuels/ renewable natural resources
- No more Public-Private Partnerships (P3s)
- Freight movement education/ certification

Local Jurisdictions:

- Preserve and prioritize short rail line use for freight
- Interest of rail-to-trail initiatives/ needs of residents

Modernization:

- New bridge US 301 over Potomac River
- Upgrade US 15 for all vehicles
- Upgrade I-270 to be 3 continuous lanes south of Frederick
- Encourage NPS to sell BW Pkwy to support freight service
- Improve Broening Highway
- Replace Howard Street Tunnel
- Future Belvedere Road corridor on I-95 interchange project

- I-81 needs to be modernized to meet high traffic volume & speed (accidents)
- Widen I-70
- Upgrade Route 522 Bridge in Hancock to add a pedestrian/bicycle lane
- Add an interchange on I-70 into Hancock's new industrial location
- Open the train for public transit from Hagerstown to Frederick (like it used to be)

Economic Local Opportunity:

- State & CSX should coordinate and address the rail line future connecting the Morgantown plant in Charles County
- Freight opportunities in Cambridge, MD & Buckeystown
- Look at micro mobility options in College Park
- Extend DC Metro from Shady Grove to Frederick
- Need freeway in Northern Maryland for economic opportunity

Public Safety Need:

- I-695 is dangerous, consider another loop
- Improve safety along highway network
- I-70 too many truck related accidents
- US 40 too many accidents
- I-81 needs to be widened to 3 lanes each direction at Leakin Park

Multimodal Access Opportunity:

- North of Frankfurst Ave. infrastructure needs to be provided - double stack clearance for rail, vertiports, air control, curb space, non-vehicular pathways for personal delivery devices or bike/scooter messengers, etc.
- Need in Riverdale, Chestnut Hill Cove, east of Marley Neck Road, Broening Hwy, Impero Food & Meat
- Commuter Rail from Hagerstown to Frederick
- Create truck and rail interchange to relieve construction from Baltimore to Norfolk

Freight Innovation Opportunity:

- At Bear Creek
- Seagirt Marine terminal – breakbulk transfer center for more localized deliveries
- Opportunity near Riviera Beach
- South mountain (Western MD) is often foggy or icy
- Innovative freight toll needed on I-81
- Hagerstown City Park

Environmental Need:

- Protect all waterways, not just the Chesapeake Bay/Protect all watersheds
- Reconsider coastal areas that receive and transfer freight due to rising water tables

- I-97 needs more EV charging infrastructure connecting Baltimore and the Port
- At Seagirt Marine Terminal
- Address air pollution from trucks

Goods Movement Need:

- Double stack in Howard Street Tunnel
- Keith Avenue and Broening Highway should be widened and repaired to handle the amount of cargo being shipped through the Port of Baltimore
- Widen I-81 & I-70
- Western and Eastern MD produces goods and raw products that need a safe, secure, efficient, and timely transport mode in order to provide a positive contribution to the local economies.
- Ferndale

Quality of Service/Performance Need:

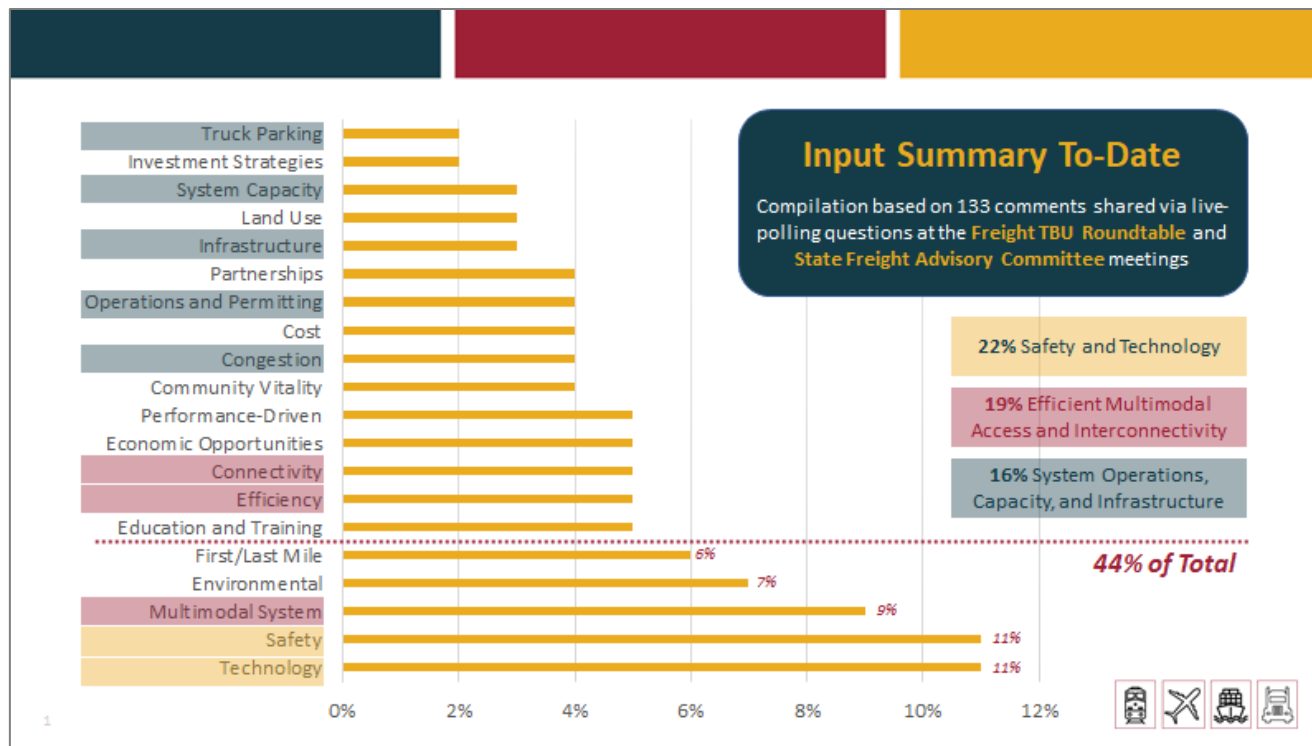
- Work with freight operators to encourage more frequent/better-quality rail service between DC, Frederick, and West Virginia
- I-70 between Indian Springs and Hancock

Maintenance:

- C&D Canal Dredging
- Dredge by the Port of Baltimore

Freight TBU Roundtable and SFAC Polling

Independent of (but related to) the survey exercise, the Milestone #1 visioning efforts also included direct coordination meetings with the MDOT Freight TBU Roundtable and the Maryland SFAC. Direct polling exercises were conducted during each meeting to further gather feedback relative to potential freight emphasis areas, needs, or similar ideas that would influence the refinement of the Plan’s overall freight Vision, Goals, and Objectives. A topical summary of the feedback and interests from the Freight TBU Roundtable and the SFAC polls is compiled below:





APPENDIX 5A

Milestone #2 Survey Feedback

Milestone #2 Survey Feedback

Survey Approach

As part of the stakeholder outreach effort, MDOT launched an online survey with Milestone # 2 to solicit feedback on freight related needs, eligible projects, and strategies being considered as part of the Maryland Freight Plan update. The survey was made available to members of the MDOT Transportation Business Units (TBUs) Freight Roundtable, Maryland's State Freight Advisory Committee (SFAC), the state's Metropolitan Planning Organizations (MPOs), and other agency/industry stakeholders, as well as the general public. It was conducted in January through February 2022 and gathered 189 total responses.

Survey Results

The Milestone #2 survey questions and responses are summarized on the pages that follow. These summaries include a breakdown of content by region across the state in a manner consistent with regions listed in the 2040 Maryland Transportation Plan, including:

- Western Maryland
- Eastern Shore
- Southern Maryland
- Baltimore Metro Region
- Baltimore City/Harbor Area
- Washington Metro Region



Survey results include a summary of regional needs and interests, input on unfunded projects by region, freight strategies by goal area, and other input on state freight planning focus areas. These insights were used alongside other plan development efforts to refine subsequent content for the final freight action plan, freight project assumptions, and freight strategy lists. Supplemental details are available in other sections of the Maryland Freight Plan including Regional Needs Mapping (**Section 5 / Appendix 5B**), Freight Projects and Investment Plan (**Section 7**), and Freight Plan Implementation Strategies (**Section 8**).

Western Maryland

1	Would you like to comment on the Western Maryland Region?	Count			
	Yes	78			
	No	111			
2	Do the locations shown in the NEEDS map above generally cover the most critical freight needs in the Western Maryland region?	Count			
	Strongly Agree	11			
	Agree	34			
	Disagree	7			
	Strongly Disagree	1			
3	If you answered disagree or strongly disagree, please elaborate in the comment box below.	Count			
	<i>Answered</i>	12			
	<i>Skipped</i>	177			
	Common themes: US 210, I-70, I-81, MD 51, parking, alternative modes.				
4	Identify up to three unfunded projects from the list below for the Western Maryland region that you consider most favorable in the Western Maryland region?	Count			
	WE-50: US 219 (Old Salisbury Road to PA State Line)	14			
	WE-51: US 220 (Allegany County)	10			
	WE-52: I-81 Phase II, III, and IV (Washington County)	43			
	WE-53: I-70 Interchange (MD 65)	36			
	Other (please list/describe in the question below)	7			
5	Please provide other comments for the Western Maryland region.	Count			
	<i>Answered</i>	20			
	<i>Skipped</i>	169			
	Common themes: I-70, I-81, I-68, MD 63, truck safety, congestion, alternative modes.				

Eastern Shore

6	Would you like to comment on the Eastern Shore Region?	Count	9	Please identify if you agree with the unfunded project need and/or add comments below.	Count
	Yes	51		E-50: US 50 (Ocean Gateway)	31
	No	102		Other (please list/describe in the question below)	6
7	Do the locations shown in the NEEDS map above generally cover the most critical freight needs in the Eastern Shore region?	Count	10	Please provide other comments for the Eastern Shore region.	Count
	Strongly Agree	4		<i>Answered</i>	11
	Agree	30		<i>Skipped</i>	178
	Disagree	5		Common themes: US 50, US 13, IS 113, parking, alternative modes, Port of Salisbury, climate change	
	Strongly Disagree	1			
8	If you answered disagree or strongly disagree, please elaborate in the comment box below.	Count			
	<i>Answered</i>	6			
	<i>Skipped</i>	183			
	Common themes: truck parking, alternative modes, Port of Salisbury				

Southern Maryland

11	Would you like to comment on the Southern Maryland Region?	Count	14	Identify up to three unfunded projects from the list below for the Southern Maryland region that you consider most favorable.	Count
	Yes	27		S-50: US 301 (Interchange at MD 5)	16
	No	111		S-51: US 301 (Intersection at MD 228/ MD 5 Business)	17
12	Do the locations shown in the NEEDS map above generally cover the most critical freight needs in the Southern Maryland region?	Count		S-52: MD 4 (Patuxent Beach Road and Solomons Island Road)	15
	Strongly Agree	6		Other (please list/describe in the question below)	0
	Agree	14	15	Please provide other comments for the Southern Maryland region.	Count
	Disagree	2		<i>Answered</i>	<i>1</i>
	Strongly Disagree	0		<i>Skipped</i>	<i>188</i>
13	If you answered disagree or strongly disagree, please elaborate in the comment box below.	Count		Common themes: Nice Bridge	
	<i>Answered</i>	<i>2</i>			
	<i>Skipped</i>	<i>187</i>			
	Common themes: MD 5, US 301, alternative modes				

Baltimore Metro Region

16	Would you like to comment on the Baltimore Metro Region?	Count	19	Identify up to three unfunded projects from the list below for the Baltimore Metro region that you consider most favorable.	Count
	Yes	60		B-50: MD 32 (Carroll County)	14
	No	69		B-51: I-70 (Howard County)	28
17	Do the locations shown in the NEEDS map above generally cover the most critical freight needs in the Baltimore Metro region?	Count		B-52: MD 295 (Hanover Road Extended)	21
	Strongly Agree	9		B-53: I-95 (Howard County)	25
	Agree	40		B-54: MD 175 (Anne Arundel County)	30
	Disagree	6		Other (please list/describe in the question below)	4
	Strongly Disagree	0	20	Please provide other comments for the Baltimore Metro region.	Count
18	If you answered disagree or strongly disagree, please elaborate in the comment box below.	Count		<i>Answered</i>	7
	<i>Answered</i>	6		<i>Skipped</i>	182
	<i>Skipped</i>	183		Common themes: Port of Baltimore, alternative modes, I-97, MD 2, US 50, pavement conditions	
	Common themes: US 29, I-70, US 50, I-195, parking				

Baltimore City/Harbor Area

21	Would you like to comment on the Baltimore City/Harbor Area?	Count	24	Identify up to three unfunded projects from the list below for the Baltimore City/Harbor Area that you consider most favorable.	Count
	Yes	48		BH-50: BWI Air Cargo Related Improvements (multiple projects)	15
	No	75		BH-51: Replace Cruise Terminal Wharf at SLP Berth 9	12
22	Do the locations shown in the NEEDS map above generally cover the most critical freight needs in the Baltimore City/Harbor Area?	Count		BH-52: Fairfield Masonville Stormwater Management Phases 2 - 5	19
	Strongly Agree	14		BH-52: FMT Kurt Iron Slip Terminal Development	14
	Agree	29		BH-53: DMT Berth 1 & 2 Reconstruction	17
	Disagree	2		BH-54: Renovate DMT Berths 7 & 8	10
	Strongly Disagree	0		BH-54: Renovate DMT Berth 9 & 10	9
23	If you answered disagree or strongly disagree, please elaborate in the comment box below.	Count		BH-55: DMT Berth 13 Berth Rehabilitation	10
	<i>Answered</i>	3		BH-55: DMT Berth 11 & 12 Deck and Beam Replacement	7
	<i>Skipped</i>	186		Other (please list/describe in the question below)	6
	Common themes: Port of Baltimore, land use, BWI, I-97		25	Please provide other comments for the Baltimore City/Harbor Area.	Count
				<i>Answered</i>	8
				<i>Skipped</i>	181
				Common themes: Hanover Bridge, noise, Port of Baltimore, Keith Ave, Broening Hwy, rail.	

Washington Metro Region

26	Would you like to comment on the Washington Metro Region?	Count	29	Identify up to three unfunded projects from the list below for the Washington Metro region that you consider most favorable.	Count
	Yes	41		WA-50: US 15 & US 40 (Frederick County)	21
	No	77		WA-51: I-70 (Mount Phillip Road to east of MD 144FA)	16
27	Do the locations shown in the NEEDS map above generally cover the most critical freight needs in the Washington Metro region?	Count		WA-52: US 50 (Prince Georges County)	17
	Strongly Agree	8		WA-53: US 301 (north of Mount Oak Road to US 50)MD 197 (US 301 to Mitchellville Road)	11
	Agree	26		WA-54: MD 4 (MD 223 to I-95 / I-495)	6
	Disagree	5		WA-55: MD 5 (I-95 / I-495 to US 301 at TB)	13
	Strongly Disagree	0		WA-56: MD 210 (I-95 / I-495 to MD 228)	10
28	If you answered disagree or strongly disagree, please elaborate in the comment box below.	Count		Other (please list/describe in the question below)	2
	<i>Answered</i>	6	30	Please provide other comments for the Washington Metro region.	Count
	<i>Skipped</i>	183		<i>Answered</i>	4
	Common themes: US 301, I-70, US 340, parking, rail.			<i>Skipped</i>	185
				Common themes: Shady Grove to Frederick, congestion, rail	

Strategies (Goal #1)

31	Select up to three strategies for Goal #1 (Safety, Security, and Resilience) that you consider most favorable?	Count
	<i>No Preference</i>	11
	1.01 Infrastructure Safety Improvements	62
	1.02 Railroad Crossing Upgrades	30
	1.03 Truck/Rail Safety Monitoring Programs	20
	1.04 Airport Zoning Permit Process	7
	1.05 Security Infrastructure Upgrades	16
	1.06 Vulnerability Assessments and Adaptation Strategies	22
	1.07 Incident Management Technologies	21
	1.08 Rail Safety, Security, and Resilience Strategies	27
	1.09 Truck Parking Improvement Strategies	47

Strategies (Goal #2)

32	Select up to three strategies for Goal #2 (Economic Opportunity and Efficiency) that you consider most favorable?	Count
	<i>No Preference</i>	12
	2.01 Performance Reporting	2
	2.02 Economic Modeling	12
	2.03 Significant Corridor Congestion Reduction	52
	2.04 Supply Chain Congestion Reduction	26
	2.05 Key Freight Bottleneck Improvements	35
	2.06 Property Acquisition for Port/Terminal Expansion	15
	2.07 Identification of Rail Capacity Constraints	19
	2.08 TSMO Improvements	13
	2.09 Air Cargo Facility Expansion	2
	2.10 Freight and Logistics Workforce Development	22
	2.11 Freight and Logistics Educational Programs	8
	2.12 Truck Industry Career Outreach	7
	2.13 Truck Driver Education Programs	13
	2.14 Heavy Equipment Apprentice Programs	11
	2.15 Port Growth Strategies	18

Strategies (Goal #3)

33	Select up to three strategies for Goal #3 (System Preservation and Modernization) that you consider most favorable?	Count
	<i>No Preference</i>	12
	3.01 Truck Size and Weight Studies	32
	3.02 Airport Facility and Runway Maintenance	16
	3.03 Navigation Channel Maintenance	28
	3.04 State Owned Rail Asset Maintenance	18
	3.05 CAV Deployment	12
	3.06 Truck Platooning Opportunities	10
	3.07 Rural Freight Needs and Funding Opportunities	35
	3.08 PDD/UAV/Future Technology Assessments	10
	3.09 Rail Infrastructure Modernization	49
	3.10 Planning to Support Technology	26

Strategies (Goal #4)

34	Select up to three strategies for Goal #4 (Quality of Service, Efficiency, and Customer Experience) that you consider most favorable?	Count
	<i>No Preference</i>	13
	4.01 Traffic Signal Optimization	40
	4.02 ITS and Corridor/Systems Management	31
	4.03 Truck Parking Information Systems	23
	4.04 State-Owned Rail Asset Benefit Assessments	15
	4.05 Statewide Truck Route Mapping Updates	27
	4.06 Local/MPO Truck Route Mapping Coordination	25
	4.07 Truck Route Planning and Education	23
	4.08 Truck Route Information and Communication Systems	24
	4.09 Maryland Rail Service Efficiencies	30
	4.10 Truck Parking Committee and Outreach	9

Strategies (Goal #5)

35	Select up to three strategies for Goal #5 (Environmental Protection and Sensitivity) that you consider most favorable?	Count
	<i>No Preference</i>	13
	5.01 Infrastructure Vulnerability, Risk, and Adaptation Studies	33
	5.02 Sustainable Seaport Strategies	27
	5.03 Dredging Program Management and Priorities	27
	5.04 Dredging Program Outreach and Education	6
	5.05 Fuel Efficient Truck Technologies	42
	5.06 Rail Diesel Engine Retrofits/Replacements	24
	5.07 Port Environmental, Energy, and Social Responsibility Goals	26
	5.08 Alternative Energy Applications	38

Strategies (Goal #6)

36	Select up to three strategies for Goal #6 (Fiscal Responsibility) that you consider most favorable?	Count
	<i>No Preference</i>	17
	6.01 TSMO Program Coordination	27
	6.02 Collaboration for Double Stack Rail-Port Connectivity	44
	6.03 Partnerships/Funding to Expand Truck Parking	36
	6.04 Partnerships/Funding to Enhance Short Line Rail	39
	6.05 Partnerships/Funding to Maximize Rail Investment Benefits	37
	6.06 Discretionary Grant Funding	33

Strategies (Goal #7)

37	Select up to three strategies for Goal #7 (Transportation Choices and Connections) that you consider most favorable?	Count
	<i>No Preference</i>	12
	7.01 Multimodal Connectivity and Access Improvements	47
	7.02 Inland Transportation Capabilities for Port Operations	26
	7.03 Landside and Freight Rail Capabilities for Port Access	25
	7.04 Freight Transportation and Land Use Planning Guidance	38
	7.05 Public/Private Sector Plan Coordination	33
	7.06 Last Mile Logistics Considerations	27
	7.07 Curb Management Strategies	16
	7.08 Land Use Planning/Zoning for Truck Parking	33

New Emphasis Areas

38	To help explore new state freight planning requirements recently released by USDOT, please provide any additional input you might have on critical needs, opportunities, or priorities specifically related to any of the following new emphasis areas:	Count
	<ul style="list-style-type: none"> • truck parking facilities • supply chain flows • commercial port activities • multi-state freight coordination needs • e-commerce impacts • military freight considerations • freight resilience and environmental impacts 	
	<i>Answered</i>	18
	<i>Skipped</i>	171

Common themes: Truck parking, safety, electric/ alternative fuel, noise, military freight, urban delivery, investment/ funding, rail



APPENDIX 5B

Regional Needs Maps

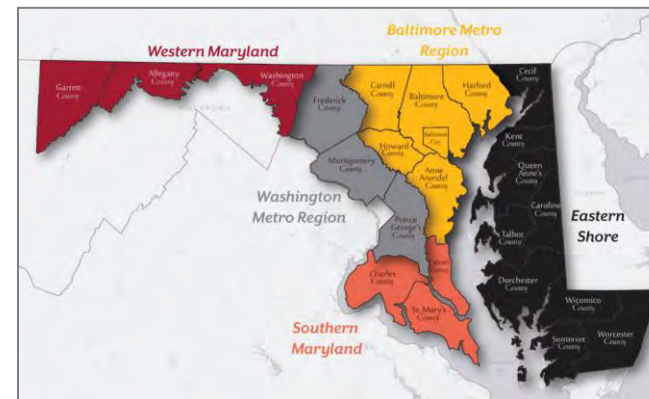
Regional Needs Maps

The Freight Plan aims to assess key freight needs in a way that reflects the uniqueness of the different regions across Maryland and balances the broader statewide priorities alongside regional relevancy and interests.

- **Truck Parking Need** – based on Priority Clusters of Undesignated Truck Parking per the Maryland Statewide Truck Parking Study (2020)
- **Congested Routes** – based on congested roadways per the Maryland State Highway Mobility Report (2019/2020)
- **Congested Areas** – based on clusters of congested roadways per the Maryland State Highway Mobility Report (2019/2020)
- **Truck Bottlenecks** – based on compilation of top freight bottlenecks per FHWA’s Freight Mobility Trends Resource, the Maryland Roadway Performance Tool (MRPT), or related data resources
- **Stakeholder Input** – based on compilation of agency, stakeholder, and public comments received through previous Milestone #1 of the freight plan update, gathered from live polls, online surveys, and related discussions
- **Rail Crossing Incidents** – based on FRA highway-rail crossing incident data, filtered to identify crossings with two or more incident occurrences from 2016-2020.

These types of summary freight needs and interests were organized by region across the state. Five specific regions were defined to match assumptions in the 2040 Maryland Transportation Plan (MTP), plus a sixth detail area for the Baltimore City/Harbor area that nests within the Baltimore Metro Region. The following pages include summary maps/tables of regional freight needs for:

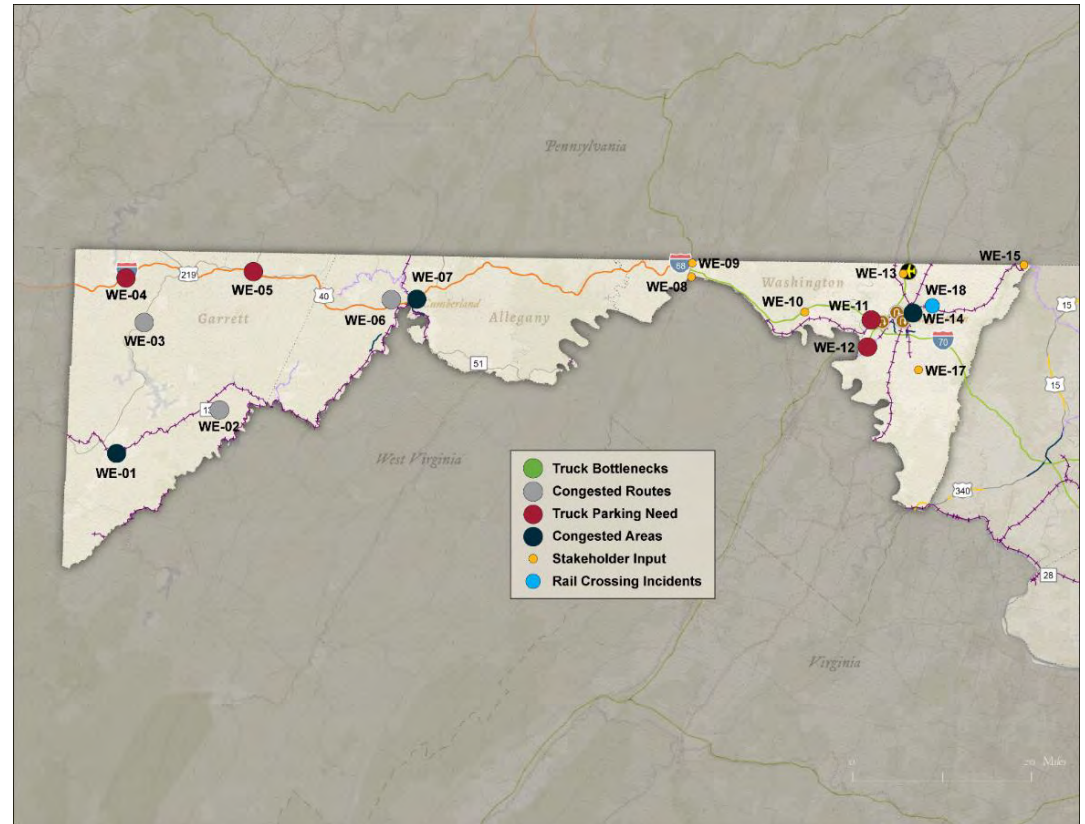
- Western Maryland (WE)
- Eastern Shore (E)
- Southern Maryland (S)
- Baltimore Metro Region (B)
- Baltimore City/Harbor Area (BH)
- Washington Metro Region (WA)



Supplemental details are available in other sections of the Maryland State Freight Plan including Milestone #2 Survey Feedback (**Section 5 / Appendix 5A**), Freight Projects and Investment Plan (**Section 7**), and Freight Plan Implementation Strategies (**Section 8**).

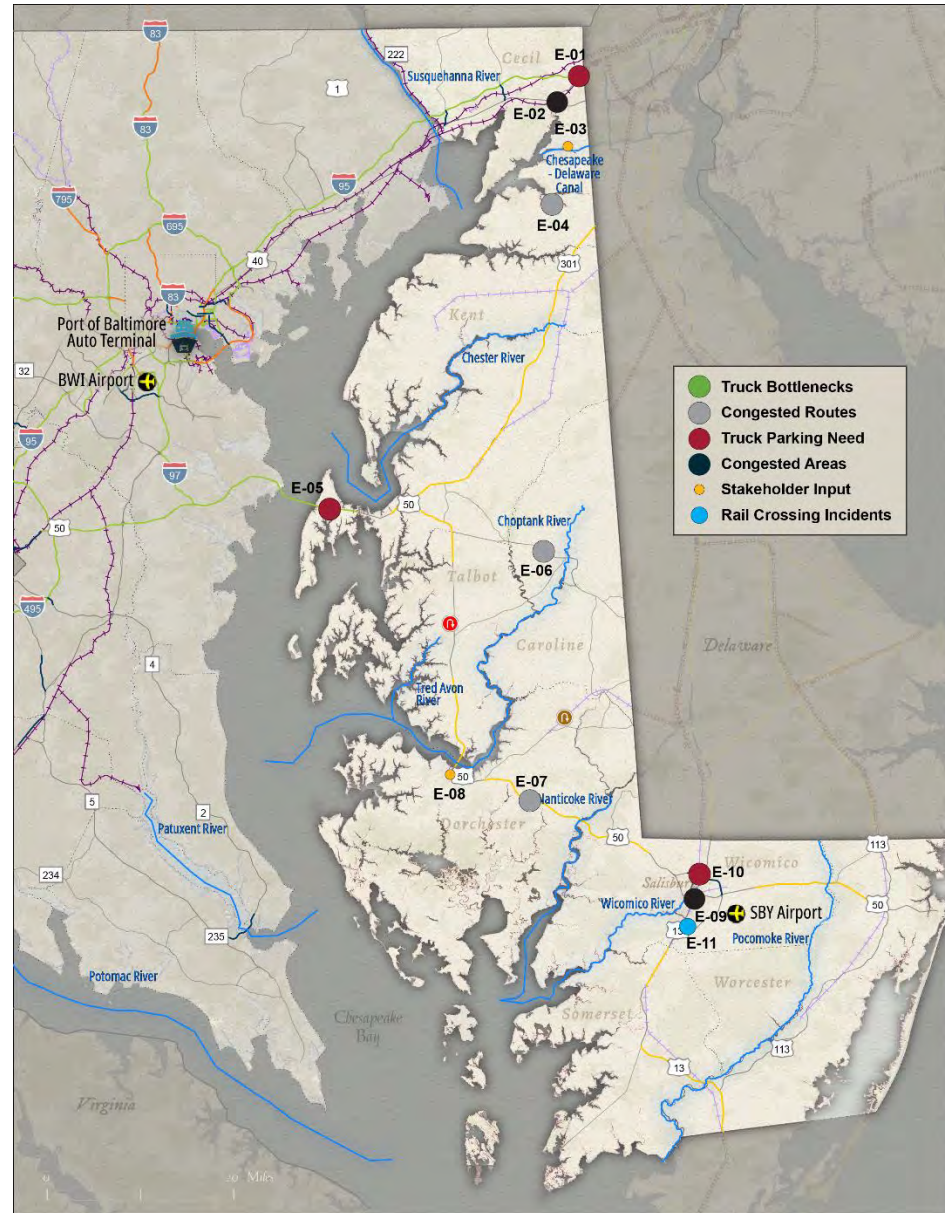
Western Maryland

Index #	Regional Freight Needs/Interests
WE-01	Mountain Lake Park
WE-02	MD 135
WE-03	US 219
WE-04	Truck Parking in I-68 (Youghiogheny Overlook Welcome Center)
WE-05	Truck Parking in I-68 / US 40 (National Freeway Grantsville)
WE-06	US 40 Alt
WE-07	Cumberland
WE-08	Route 522 Bridge in Hancock Improvements
WE-09	Additional I-70 Interchange in Hancock
WE-10	I-70 Improvements
WE-11	Truck Parking in I-70 (Hagerstown)
WE-12	Truck Parking in I-81 (Williamsport)
WE-13	I-81 Improvements
WE-14	Hagerstown
WE-15	South Mountain Safety
WE-17	Public Transport from Hagerstown to Frederick
WE-18	Crossing ID 831836N - Hagerstown



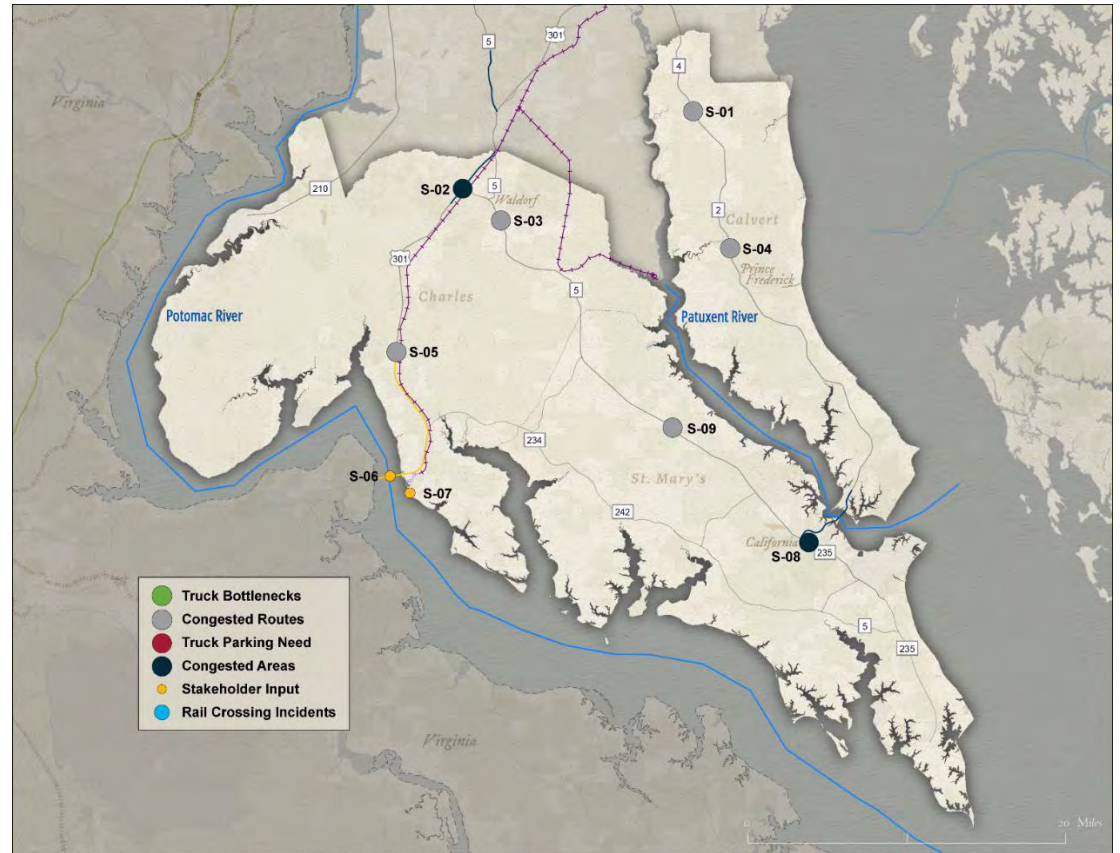
Eastern Shore

Index #	Regional Freight Needs/Interests
E-01	Truck Parking in I-95 / MD 279 (Elkton)
E-02	Elkton
E-03	C&D Canal Dredging
E-04	US 213
E-05	Truck Parking in US 50 / US 301 (Stevensville)
E-06	MD 404
E-07	US 50
E-08	Freight opportunities in Cambridge
E-09	Salisbury
E-10	Truck Parking in US 50 (Salisbury)
E-11	Crossing ID 530224K - Fruitland



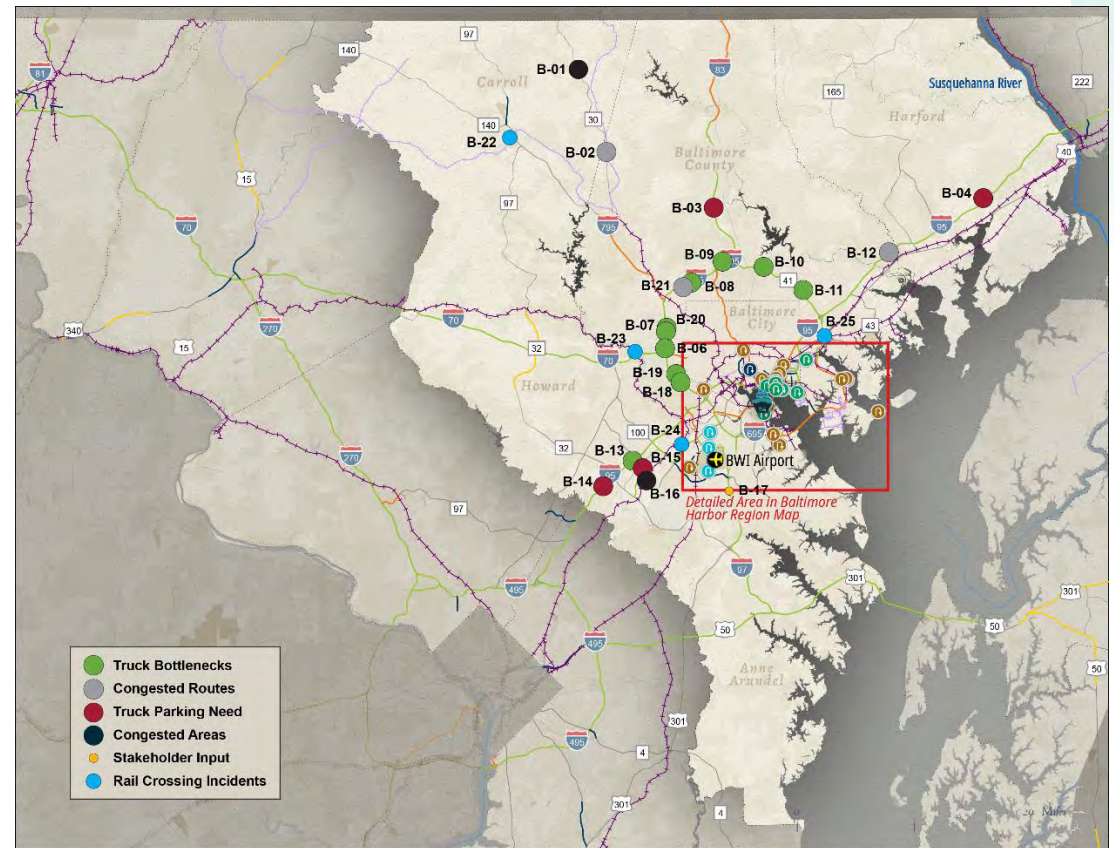
Southern Maryland

Index #	Regional Freight Needs/Interests
S-01	MD 4
S-02	Waldorf
S-03	MD 5
S-04	MD 2
S-05	MD 301
S-06	MD 301 Bridge (Potomac River)
S-07	Coordination between MD & CSX
S-08	California
S-09	MD 235



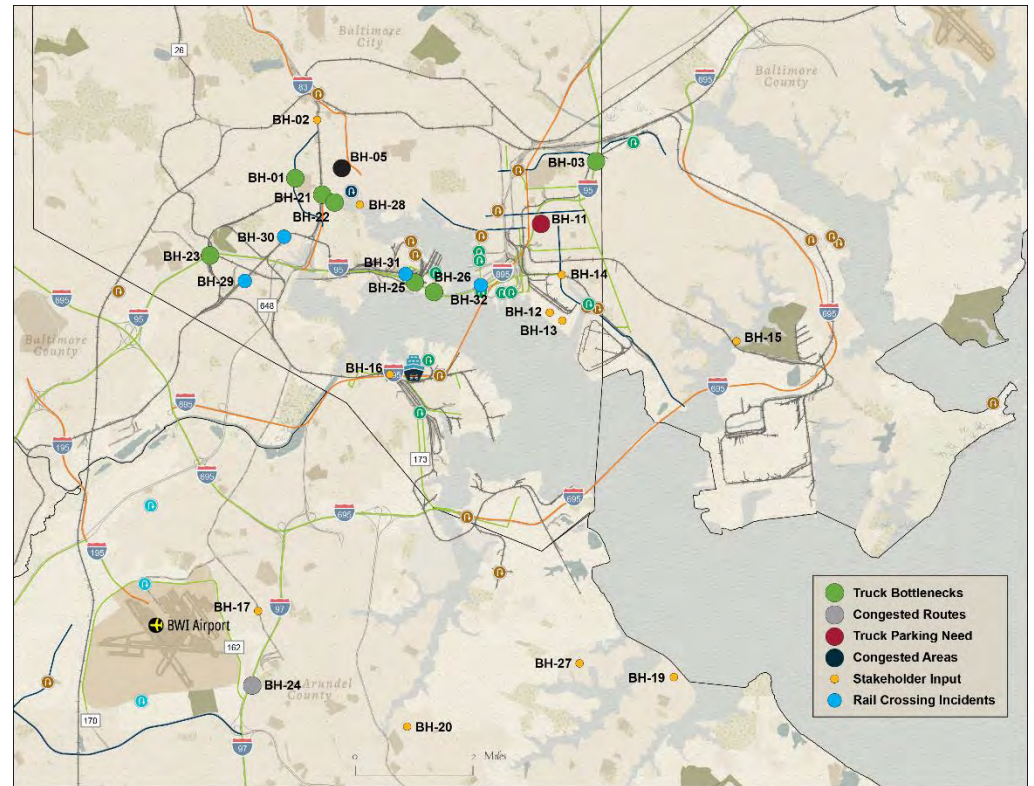
Baltimore Metro Region

Index #	Regional Freight Needs/Interests
B-01	Manchester
B-02	MD 30
B-03	I-83 (Cockeysville)
B-04	I-95 (Maryland House Rest Area Aberdeen)
B-06	I-695 Inner Loop @ MD 122
B-07	I-695 (I-70 / I-795)
B-08	I-695 (I-795 / I-83)
B-09	I-83 (MD 25 / MD 25 A & I-83)
B-10	I-695 (I-83 / MD 41)
B-11	I-695 (MD 41 / I-95)
B-12	I-95
B-13	I-95 (MD 32 / MD 100)
B-14	I-95 (Welcome Center Laurel)
B-15	US 1/ MD 175 (Jessup)
B-16	Jessup
B-17	I-97 EV charging infrastructure
B-18	I-695 (I-895 / I-70)
B-19	I-695 Outer Loop (Edmonson Ave)
B-20	I-695 (I-95 / I-795)
B-21	I-695
B-22	Rail Crossing ID 831697V – Westminster
B-23	Rail Crossing ID 140409P – Ellicott City
B-24	Rail Crossing ID 140883M – Hanover
B-25	Rail Crossing ID 140828M - Rosedale



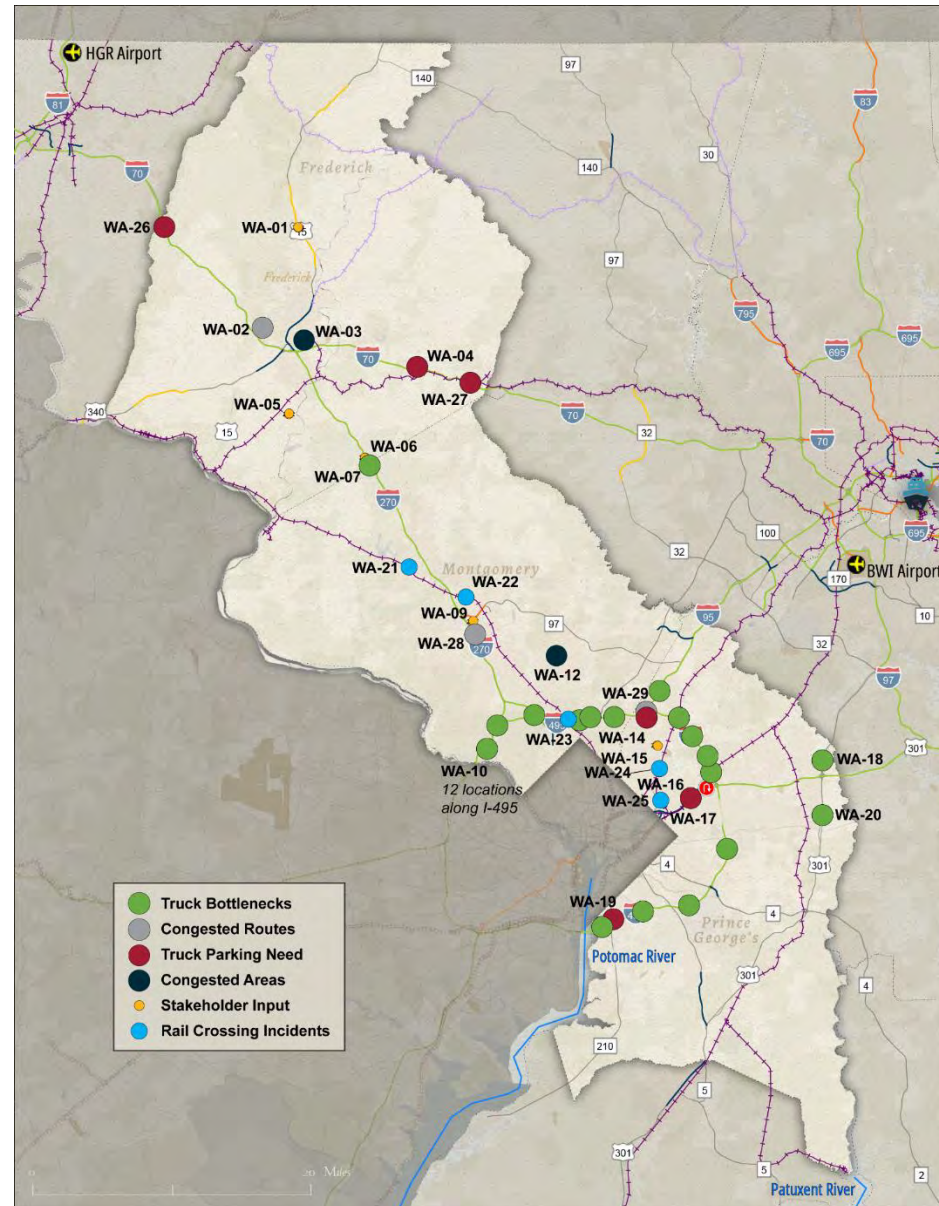
Baltimore City/Harbor Area

Index #	Regional Freight Needs/Interests
BH-01	MU 6020 / Martin L King Blvd (MD 295 & MU 1703 / N Howard St)
BH-02	Double Stack in Howard St Tunnel
BH-05	City of Baltimore
BH-06	I-695 Outer Loop (Edmonson Ave)
BH-07	I-695 (I-895 / I-70)
BH-11	City of Baltimore Connecting to Port / Ind. Clusters
BH-12	Environmental need at Seagirt Marine Terminal
BH-13	Freight Innovation Opportunity Seagirt Marine terminal
BH-14	Keith Avenue and Broening Highway Improvements
BH-15	Freight Innovation Opportunity at Bear Creek
BH-16	Multimodal Access Improvements North of Frankfurst Ave
BH-17	Goods movement need in Ferndale
BH-19	Freight Innovation Opportunity near Riviera Beach
BH-20	Multimodal Access need east of Marley Neck Road
BH-21	MU 1700 / I-395 (MU 4295 / Camden St & MU 1395 / E Lombard St)
BH-22	MU 5875 / Conway St (MD 2 / I-395)
BH-23	I-95 (I-695 / I-395)
BH-24	I-97
BH-25	I-95 (I-895 / MU 1280 / Newkirk St & I-895 / City Line)
BH-26	I-95 (I-395 / I-895)
BH-27	Multimodal Access need in Chestnut Hill Cove
BH-28	Dredge the Port of Baltimore
BH-29	Rail Crossing ID 140869S – Baltimore
BH-30	Rail Crossing ID 140866W – Baltimore
BH-31	Rail Crossing ID 140393V – Baltimore
BH-32	Rail Crossing ID 961382A – Baltimore



Washington Metro Region

Index #	Regional Freight Needs/Interests
WA-01	Upgrade US 15
WA-02	US 40
WA-03	Frederick
WA-04	I-70 (Monrovia)
WA-05	Freight Opportunities (Buckeystown)
WA-06	Upgrade I-270 (South of Frederick)
WA-07	I-270 SB (MD 109)
WA-09	Extend DC Metro (Shady Grove to Frederick)
WA-10	I-495 (12 locations)
WA-11	I-270 (I-495)
WA-12	Aspen Hill
WA-14	I-95 / I-495 (Weigh Station in Adelphi)
WA-15	Micro mobility options (College Park)
WA-16	Multimodal Access Improvements (Riverdale)
WA-17	US 50 (Landover)
WA-18	MD 3 (I-595/ US 50 & MD 242)
WA-19	I-495 (Emergency Vehicle Lot 3)
WA-20	US 301 (MD 214 & I-595/ US 50)
WA-21	Rail Crossing ID 643756C – Germantown
WA-22	Rail Crossing ID 140507F - Gaithersburg
WA-23	Rail Crossing ID 140488D – Silver Spring
WA-24	Rail Crossing ID 140905K - Riverdale
WA-25	Rail Crossing ID 14026S - Hyattsville
WA-26	Truck Parking in I-70 (S. Mountain Welcome Center)



APPENDIX 7A

Candidate Freight Projects

Regional Project Candidates

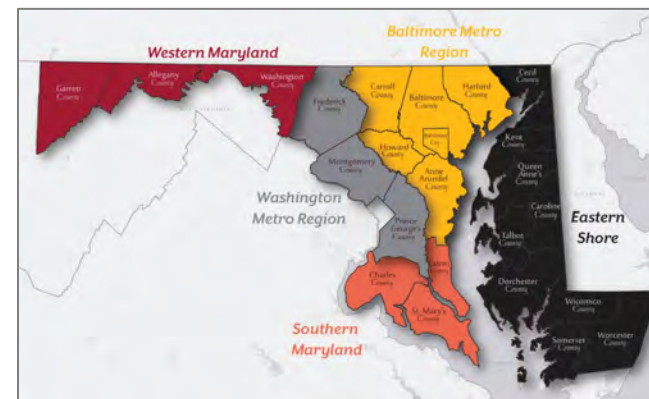
This appendix to the Maryland Freight Plan summarizes regional freight project candidates initially considered for the Freight Investment Plan. Locations and projects identified here are based on a compilation of relevant insights and plan development efforts that include the Milestone #2 Survey Feedback (**Section 5/ Appendix 5A**), insights from Regional Freight Needs (**Section 5/ Appendix 5B**), and the overall Freight Projects and Investment Plan (**Section 7**). Projects are identified as:

- **Funded Projects** – based on projects currently programmed for funding per MDOT’s Consolidated Transportation Program (CTP) or other known funding sources.
- **Unfunded Projects** – based on project concepts/needs identified through MDOT’s Freight Transportation Business Units (TBU) or related long-range plans that are not currently programmed for funding.

The site-specific project insights included in this appendix are not intended to be all-inclusive. The regional project maps, for example, do not include other freight-relevant programs and funded efforts that may encompass multiple locations statewide, such as the Highway Safety Facilities and Equipment program, Railroad Crossing program, public-private partnership (P3) program, Traffic Relief Plan (Phase 2) Smart Traffic Signals, or similar.

Regional project maps were organized across five specific regions to match assumptions in the 2040 Maryland Transportation Plan (MTP), plus a sixth detail area for the Baltimore City/Harbor area that nests within the Baltimore Metro Region. The following pages include summary maps/tables of regional freight project candidates for:

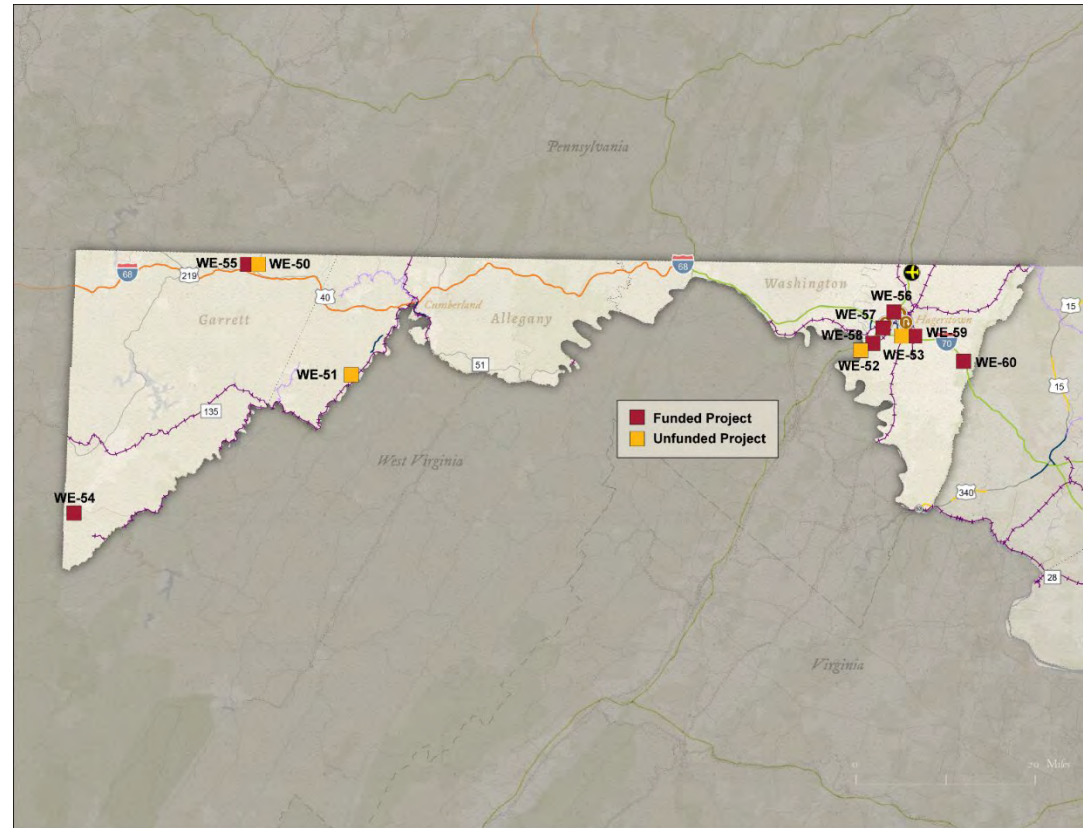
- Western Maryland (WE)
- Eastern Shore (E)
- Southern Maryland (S)
- Baltimore Metro Region (B)
- Baltimore City/Harbor Area (BH)
- Washington Metro Region (WA)



Additional projects based on stakeholder coordination, as well as other details, including cost, funding, and programmatic perspectives for specific freight-related project designations for Maryland’s apportionment of the National Highway Freight Program (NHFP) funds, are compiled in separate appendices (**Section 7/ Appendix 7B and 7C**).

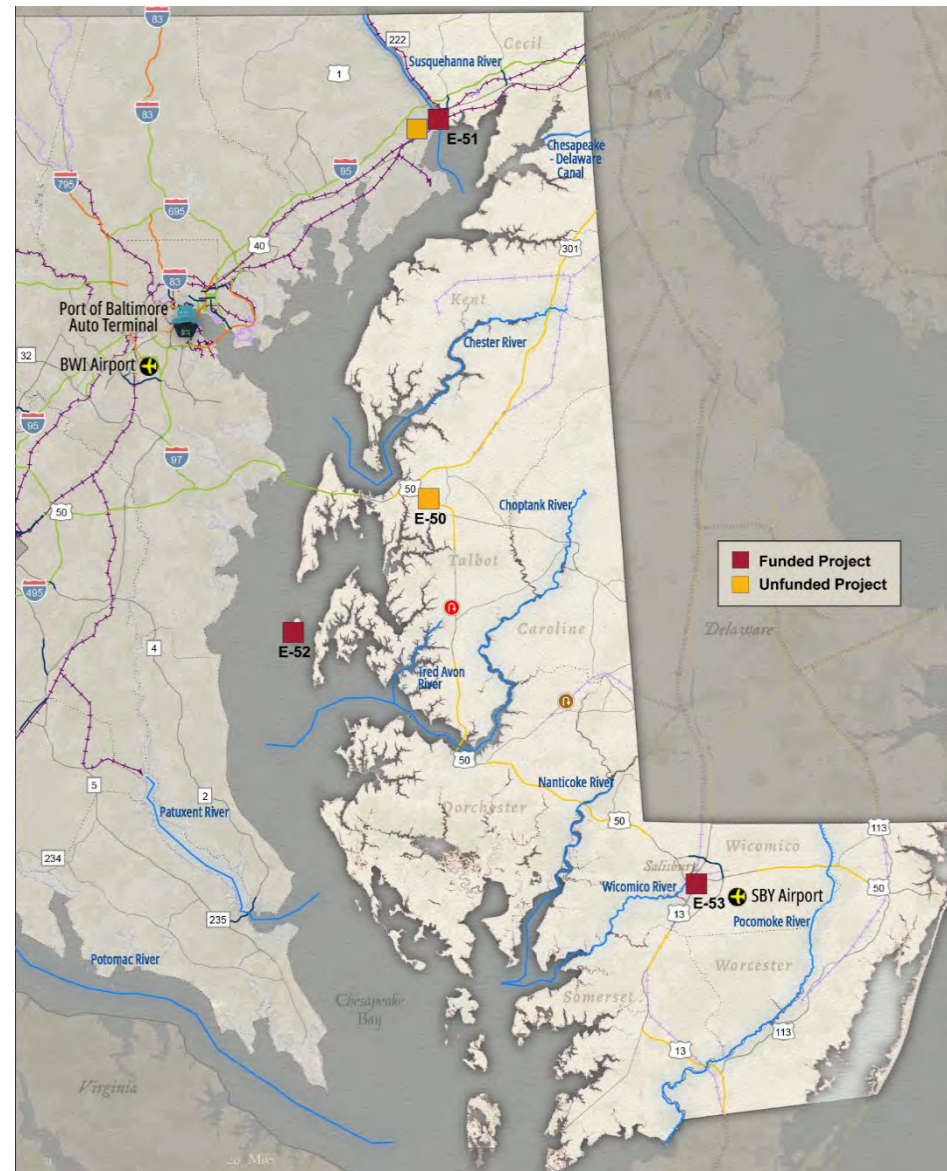
Western Maryland

Index #	Regional Freight Project Candidates
WE-50	US 219 (Old Salisbury Road to PA State Line)
WE-51	US 220 (Allegany County)
WE-52	I-81 Phase II, III, and IV (Washington County)
WE-53	I-70 Interchange (MD 65)
WE-54	US 219 Bridges (over Youghiogheny River)
WE-55	US 219 (I-68/US 40 to Old Salisbury Road)
WE-56	I-81 Phase I (Washington County)
WE-57	I-70 Bridges (over I-81 & the Winchester and Western Railroad)
WE-58	I-81 (US 11 to West Virginia State Line)
WE-59	I-70 Bridges (over CSX Hagerstown Branch)
WE-60	I-70 Bridges (over Crystal Falls Drive)



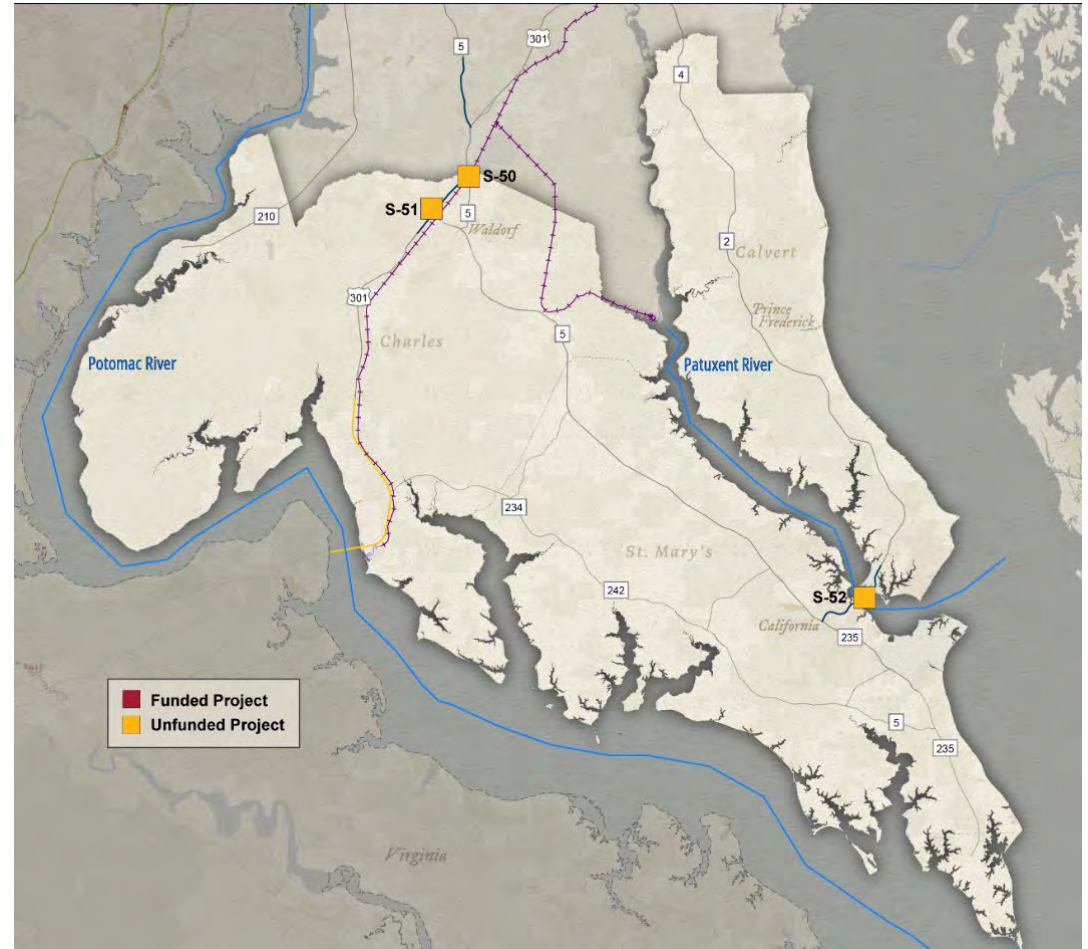
Eastern Shore

Index #	Regional Freight Project Candidates
E-50	US 50 (Ocean Gateway)
E-51	Susquehanna River Bridge Replacement - Rail
E-52	Poplar Island Expansion/ Operations & Maintenance
E-53	US 13BU - Bridge (over East Branch Wicomico River)



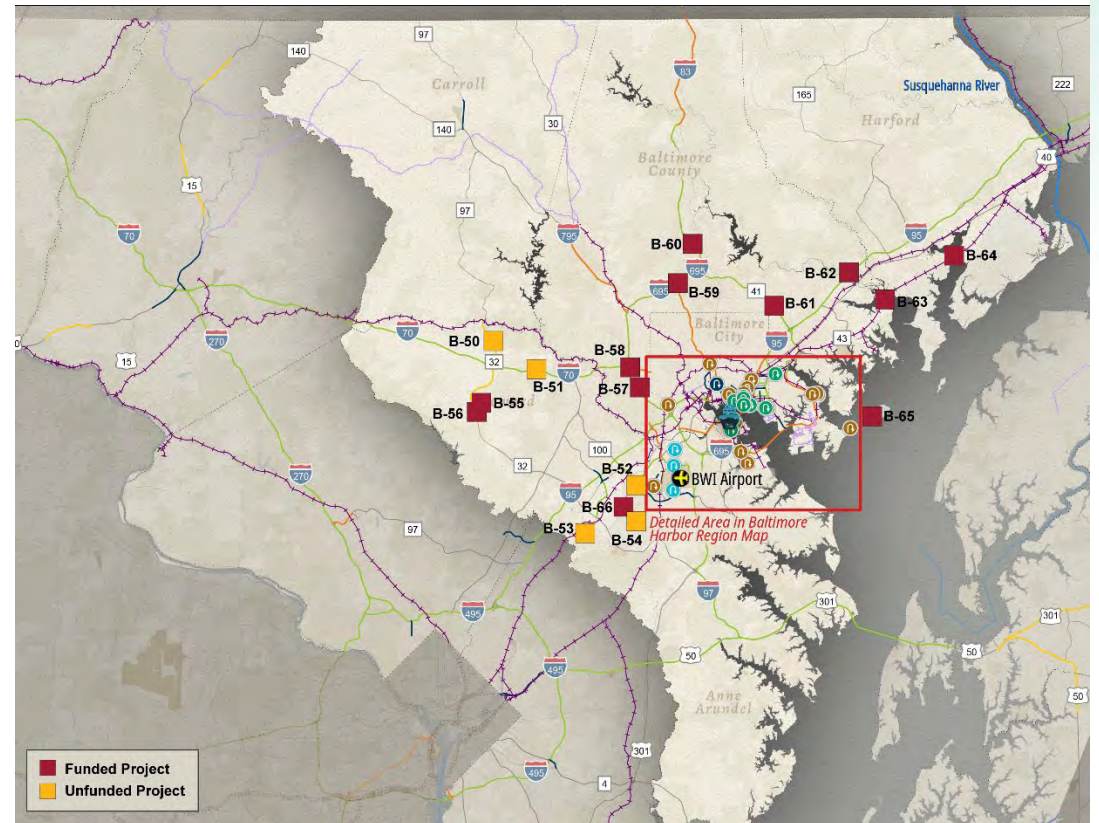
Southern Maryland

Index #	Regional Freight Project Candidates
S-50	US 301 (Interchange at MD 5)
S-51	US 301 (Intersection at MD 228/ MD 5 Business)
S-52	MD 4 (Patuxent Beach Road and Solomons Island Road)



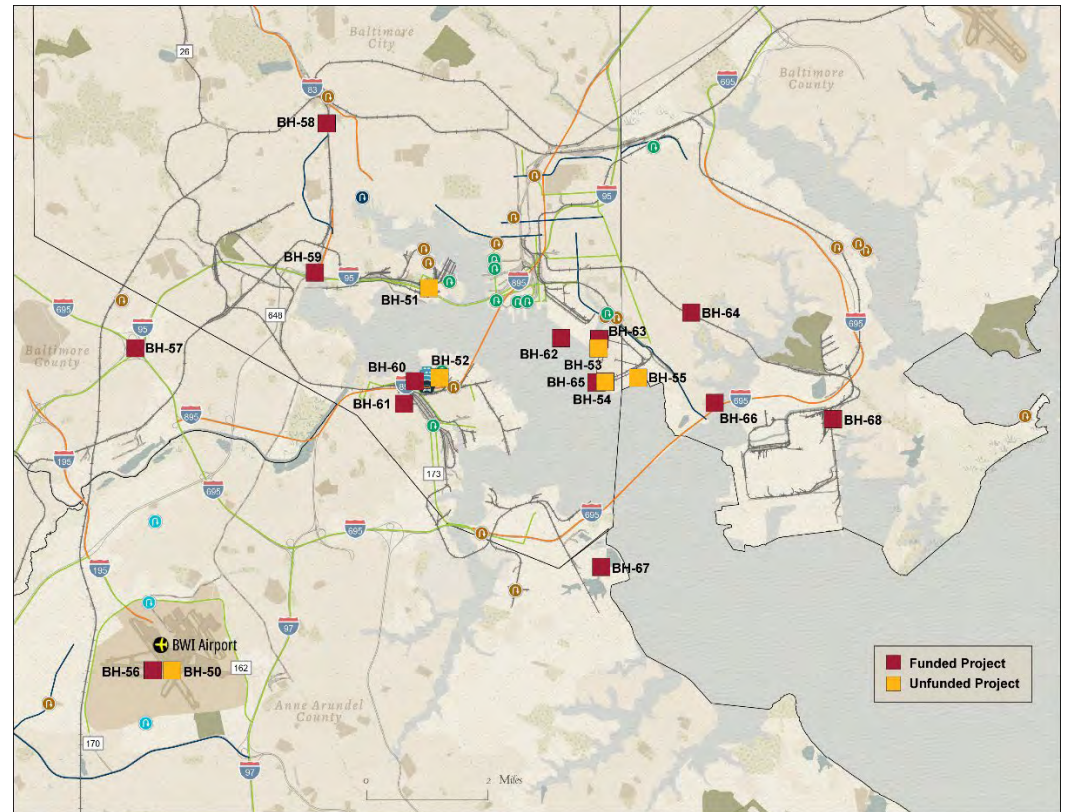
Baltimore Metro Region

Index #	Regional Freight Project Candidates
B-50	MD 32 (Carroll County)
B-51	I-70 (Howard County)
B-52	MD 295 (Hanover Road Extended)
B-53	I-95 (Howard County)
B-54	MD 175 (Anne Arundel County)
B-55	MD 32 (north of Linden Church Rd to I-70)
B-56	MD 32 (Linden Church to I-70)
B-57	I-695 (US 40 to MD 144)
B-58	I-695 Interchange (I-70)
B-59	I-695 (Baltimore County)
B-60	I-83 Bridge (over Padonia Road)
B-61	I-695 (Bridge on Putty Hill Avenue)
B-62	US 40 (Bridges over Little and Big Gunpowder)
B-63	Gunpowder River Bridge Replacement - <i>Rail</i>
B-64	Bush River Bridge Replacement - <i>Rail</i>
B-65	Hart/Miller Island Operations
B-66	MD 175 (National Business Parkway to McCarron Court)



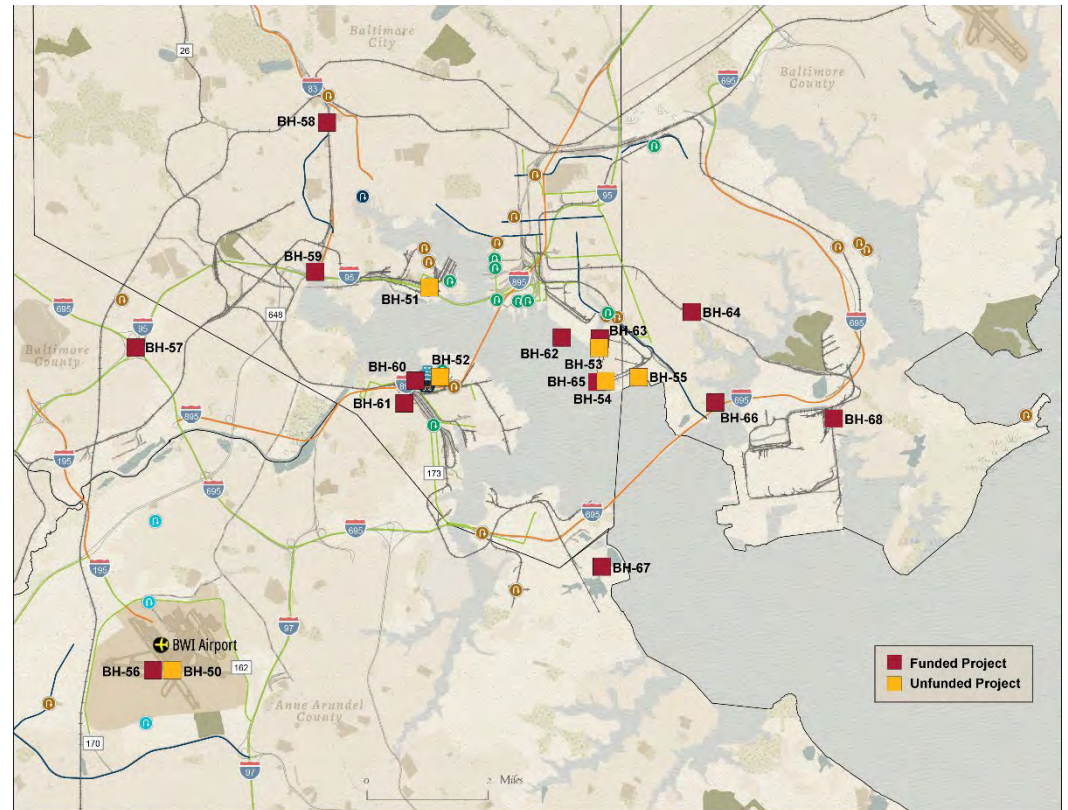
Baltimore City/Harbor Area

Index #	Regional Freight Project Candidates (PORTS)
BH-51	Replace Cruise Terminal Wharf at SLP Berth 9
BH-52	Fairfield Masonville Stormwater Management Phases 2 - 5
BH-52	FMT Kurt Iron Slip Terminal Development
BH-53	DMT Berth 1 & 2 Reconstruction
BH-54	Renovate DMT Berths 7 & 8
BH-54	Renovate DMT Berth 9 & 10
BH-55	DMT Berth 13 Berth Rehabilitation
BH-55	DMT Berth 11 & 12 Deck and Beam Replacement
BH-59	Mid-Bay Island Option
BH-59	Innovative Use
BH-59	Innovative Use Projects RFP solicitation
BH-60	Fairfield Masonville Stormwater Mgmt. Phase I
BH-60	Fairfield Pier 4 Repairs
BH-61	Masonville Dredge Placement Facility
BH-61	Masonville Construction Management
BH-61	Masonville Operations & Maintenance
BH-62	Seagirt Loop Channel
BH-62	50' Berth at Seagirt Marine Terminal
BH-63	DMT Berth 3 Reconstruction
BH-64	Dundalk Marine Terminal Operations and Maintenance
BH-64	DMT Resiliency and Flood Mitigation BUILD
BH-65	Dundalk Dredging Energy Ports
BH-66	Innovative Use Fleming Park Grant
BH-67	Cox Creek Operations and Maintenance
BH-67	Cox Creek Expansion Feasibility/EIS Study
BH-67	Cox Creek Expansion Construction
BH-67	Cox Creek Expansion Construction Stage 2



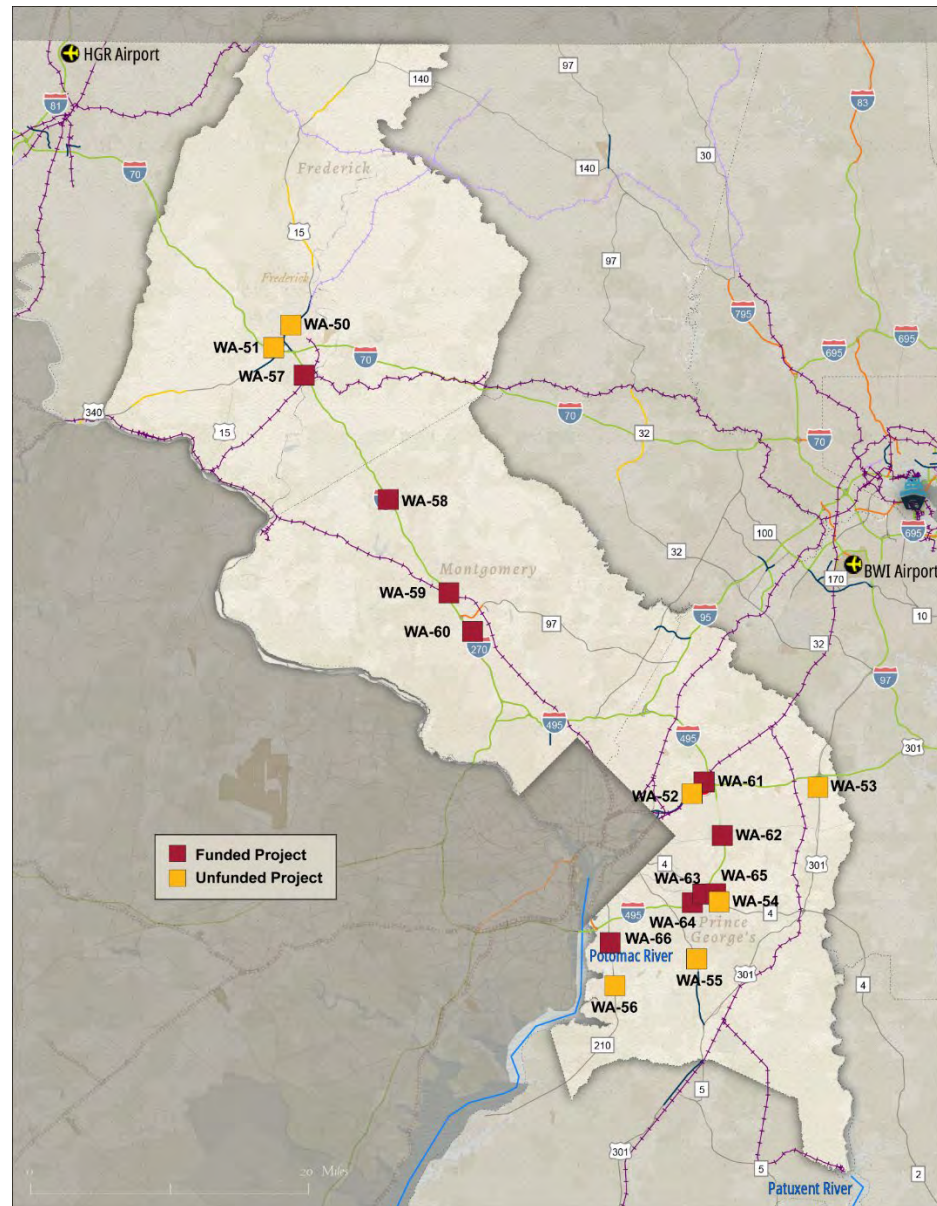
Baltimore City/Harbor Area (Continued)

Index #	Regional Freight Project Candidates (AIRPORT)
BH-50	BWI North Cargo Electrical Substation Replacement
BH-50	BWI North Cargo Road and Parking, Mill & Overlay (23-01)
BH-50	BWI Southwest Quadrant Development Planning
BH-50	BWI Cargo Building #107, Install Oil Water Separator
BH-50	BWI Cargo Complex Expansion/Relocation
BH-50	BWI Cargo Ramp ACC Sections Mill & Overlay (22-01)
BH-50	BWI Cargo Ramp PCC Restoration (23-03)
BH-50	BWI Cargo Service Road Mill & Overlay (19-02)
BH-50	BWI Runway 15R-33L Extension
BH-50	BWI New Parallel Runway Development
BH-56	Midfield Cargo Area Improvements at BWI Marshall Airport
BH-56	Airfield Lighting Vault Relocation at BWI Marshall Airport
Index #	Regional Freight Project Candidates (OTHER)
BH-57	I-95 and I-695 (Concrete Deck Overlays)
BH-58	Frederick Douglas Tunnel (Replacement B&P Tunnel) - Rail
BH-68	MD 151/MD151B



Washington Metro Region

Index #	Regional Freight Project Candidates
WA-50	US 15 & US 40 (Frederick County)
WA-51	I-70 Phase 4 (Mount Phillip Road to east of MD 144FA)
WA-52	US 50 (Prince Georges County)
WA-53	US 301 (north of Mount Oak Road to US 50)
WA-54	MD 197 (US 301 to Mitchellville Road)
WA-55	MD 5 (I-95 / I-495 to US 301 at TB)
WA-56	MD 210 (I-95 / I-495 to MD 228)
WA-57	MD 85 Phase 1 (Frederick County)
WA-58	I-270 Eisenhower Memorial Highway, Phase 1
WA-59	I-270 Innovative Congestion Management (ICM)
WA-60	I-270 Eisenhower Statewide, P3
WA-61	New Carrollton Station Track 1 Platform - Rail
WA-62	I-95 Bridges (over MD 214)
WA-63	I-95 / I-495 (over Suitland Road)
WA-64	I-95 / I-495 (over Suitland Parkway)
WA-65	MD 4 New Interchange (Suitland Parkway)
WA-66	MD 210 (New Interchange at Kerby Hill)





APPENDIX 7B

Maryland Freight Investment Plan



National Highway Freight Program (NHFP) Freight Investment Plan

This appendix to the Maryland Freight Plan summarizes the anticipated National Highway Freight Program (NHFP) funding allocation for FY22 thru FY 26 to Maryland. Funding for freight projects and initiatives are presented by major categories and by year, and then further broken down by projects or initiatives. NHFP candidate projects and those recommended for funding are shown in Exhibit 7B.6.

Exhibit 7B. 1: Maryland National Highway Freight Program (NHFP) Funding Allocation FY 22 thru FY 26

Major Category	Costs in \$ millions					
	Total Cost	FY 22	FY 23	FY 24	FY 25	FY 26
CTP Construction Projects Major capital improvement projects included in Maryland's Consolidated Transportation Program (FY22 – FY27).	\$75.00	\$15.00	\$15.00	\$15.00	\$15.00	\$15.00
Park and Ride Fund 81 initiatives to improve Truck Parking Facilities.	\$6.90	\$0.40	\$1.70	\$4.00	\$0.80	\$0.00
Travel Forecasting and Innovative Planning and Performance Management Fund 70 planning activities for travel forecasting and analysis and innovative planning and performance measures analysis efforts.	\$0.90	\$0.68	\$0.13	\$0.10	\$0.00	\$0.00
CAV/TSMO Fund 86 planning, design, and construction activities for technology deployment efforts including CAV, ITS, and TSMO.	\$11.80	\$1.30	\$2.50	\$4.00	\$4.00	\$0.00
Motor Carrier Division Fund 23 planning, design, and construction activities related to the Virtual Weigh Station program, including upgrades to static scales and associated equipment.	\$8.85	\$0.67	\$2.17	\$2.17	\$2.17	\$1.67
TOTAL REQUEST	\$103.45	\$18.05	\$21.50	\$25.27	\$21.97	\$16.67

Exhibit 7B. 2: NHFP CTP Construction Projects Funding (\$M)

CTP Construction Projects	Project Description	Status	Cost	FY 22	FY 23	FY 24	FY 25	FY 26
I 695 TSMO from I-70 to MD 43	Using shoulder and dynamic lane controls to create a new lane of traffic during peak hours	Construction	\$20.0	\$10.00	\$10.00	-	-	-
I-695, Baltimore Beltway at I-70	Reconstruct Interchange at I-695 and I-70 (Triple Bridges)	D&E	\$30.0	-	-	\$10.00	\$10.00	\$10.00
MD 4 Suitland Parkway	Construct a new interchange at MD 4 at Suitland Parkway	Construction	\$25.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
CTP Construction Projects Total Funding Request			\$75.0	\$15.0	\$15.0	\$15.0	\$15.0	\$15.0

Exhibit 7B. 3: Park and Ride Funding (\$M)

Park and Ride (Fund 81)	Project Description	Status	Cost	FY 22	FY 23	FY 24	FY 25	FY 26
Truck Parking - I-70 Welcome Center, Finish PE	Build out I-70 Welcome Center to accommodate more trucks parking.	D&E	\$0.6	\$0.40	\$0.20	-	-	-
Truck Parking - I-70 Welcome Center, Construction		Construction	\$6.3	-	\$1.50	\$4.00	\$0.80	-
Park and Ride Total Funding Request			\$6.90	\$0.40	\$1.70	\$4.00	\$0.80	\$0.00

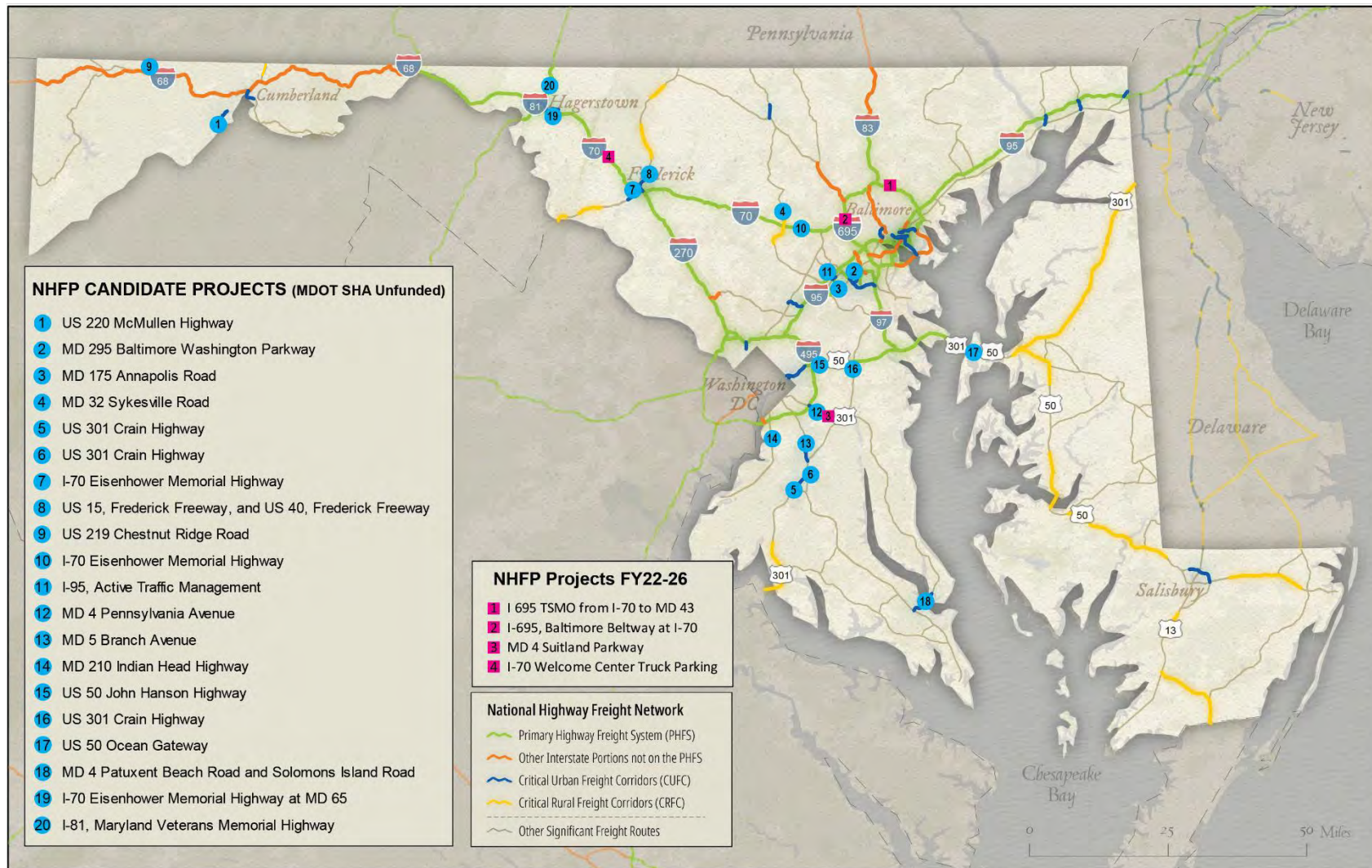
Exhibit 7B. 4: Travel Forecasting and Innovative Planning and Performance Management Funding (\$M)

Travel Forecasting and Innovative Performance Management (Fund 70)	Project Description	Status	Cost	FY 22	FY 23	FY 24	FY 25	FY 26
1) C20 Model Calibration/ Validation Enhancements	The Maryland Statewide Transportation Model (MSTM) was developed in 2009, and over the years, FHWA has invested in MDOT and BRTB to improve on the model for freight using the FHWA C20 program. The MSTM has been a leader for states in freight modeling, but now newer data, model updates, tools, and scenario applications are needed for Freight Model Calibration and Validation Enhancements, Truck Specific Enhancements, and Freight CAV Enhancements.	Planning						
Staffing			\$0.25	\$0.25	-	-	-	-
Data			\$0.375	\$0.375	-	-	-	-
2) MSTM Truck Specific Enhancements								
Staffing			\$0.075	-	\$0.075	-	-	-
3) MSTM Freight CAV Enhancements								
Staffing	\$0.10	-	-	\$0.10	-	-		
Additional Freight Planning Support	MDOT SHA OPPE needs additional funding to support mapping upgrades for GIS tools available to all users (i.e., freight network mapping, truck parking mapping, and other freight-related data).	Planning	\$0.10	\$0.05	\$0.05	-	-	-
Travel Forecasting and Innovative Performance Management Total Funding Request			\$0.90	\$0.68	\$0.13	\$0.10	\$0.0	\$0.0

Exhibit 7B. 5: NHFP CAV/ TSMO Funding (\$M)

CAV/TSMO (Fund 86)	Project Description	Status	Cost	FY 22	FY 23	FY 24	FY 25	FY 26
Freight AV Implementation Plan	This will focus on tangible implementation strategies that MDOT SHA could deploy to support new CAV technology and accelerate adoption of life-saving, emissions reducing, and economic driving technology.	Planning	\$0.2	\$0.20	-	-	-	-
Freight EV Charging Pilot	Test the ability of private freight carriers to use freight EV charging stations to develop recommended specifications for installation across Maryland.	Planning	\$0.25	\$0.25	-	-	-	-
Statewide Truck Parking Technology Enhancements	Deploy technology to enhance freight/truck parking by monitoring in real time, space availability and pushing this information to truck drivers so that they can find safe parking in Maryland. This is from the Maryland Statewide Truck Parking Study and 2017 Maryland Statewide Freight Plan.	D&E and Construction						
Preliminary Engineering			\$0.35	\$0.35	-	-	-	-
Full Design and Bid			\$2.00	-	\$2.00	-	-	-
Construction/Install			\$4.00	-	-	\$4.00	-	-
Finish and install			\$4.00	-	-	-	\$4.00	-
Data Exchange Platform	Develop a single digital data exchange platform to support investing in and hosting of freight related real-time transportation information. This data exchange will not "push" data out, rather it will offer a single point of focus for stakeholders to pull information needed for their respective initiatives.	Planning and D&E	\$1.00	\$0.50	\$0.50	-	-	-
CAV/ TSMO Total Funding Request			\$11.80	\$1.30	\$2.50	\$4.00	\$4.00	\$0.0

Exhibit 7B. 6: NHFP Eligible Projects





APPENDIX 7C

Multimodal Freight Eligible Projects

Regional Project Candidates

This appendix to the Maryland Freight Plan summarizes list of unfunded and funded candidate freight projects for highway, rail, port, and airport projects. Tables 7C.1-7C.5 present the unfunded projects from MDOT SHA, MDTA, MDOT MPA, MDOT MAA, and MDOT MTA. Tables 7C.6-7C.10 in the appendix present funded freight projects from MDOT SHA, MDTA, MDOT MPA, MDOT MAA, and MDOT MTA.

Exhibit 7C. 1: MDOT SHA Unfunded Freight Highway Projects.....	3
Exhibit 7C. 2: MDTA Unfunded Freight Port Projects (TBD).....	4
Exhibit 7C. 3: MDOT MPA Unfunded Freight Port Projects	5
Exhibit 7C. 4: MDOT MAA Unfunded Freight Airport Projects.....	6
Exhibit 7C. 5: MDOT MTA and Private Section Unfunded Freight Rail Projects	7
Exhibit 7C. 6: MDOT SHA Funded Freight Projects.....	9
Exhibit 7C. 7: MDTA Funded Freight Projects.....	11
Exhibit 7C. 8: MDOT MPA Funded Freight Port Projects	14
Exhibit 7C. 9: MDOT MAA Funded Freight Airport Projects.....	15
Exhibit 7C. 10: MDOT MTA Funded Freight Rail Projects (TBD)	16

Exhibit 7C. 1: MDOT SHA Unfunded Freight Highway Projects

#	Project Name	Jurisdiction	Description	Estimated Cost (millions)
1	US 220, McMullen Highway	Allegany		\$9.5
2	MD 295, Baltimore Washington Parkway	Anne Arundel	Hanover Road Extended	\$178.4
3	MD 175, Annapolis Road	Anne Arundel		\$89.2
4	MD 32, Sykesville Road	Carroll	Short and Mid-Term Improvements	\$12.7
5	US 301 Crain Highway	Charles	Study to upgrade US 301 intersection at MD 228/MD 5 Business	\$237.9
6	US 301 Crain Highway	Charles/Prince George's	Construct a new flyover from southbound US 301 to MD 5 (Mattawoman Beantown Road)	\$41.3
7	I-70, Eisenhower Memorial Highway	Frederick	Phase 4	\$89.5
8	US 15, Frederick Freeway, and US 40, Frederick Freeway	Frederick	Roadway widening	\$134.1
9	US 219, Chestnut Ridge Road,	Garrett	Study to upgrade and/or relocate US 219 from Old Salisbury Road to PA State Line	\$59.0
10	I-70, Eisenhower Memorial Highway	Howard		\$554.4
11	I-95, Active Traffic Management	Howard		\$31.0
12	MD 4, Pennsylvania Avenue	Prince Georges	Upgrade existing MD 4 to a multilane freeway from MD 223 to I-95/I-495	\$368.7
13	MD 5, Branch Avenue	Prince Georges	Upgrade between I-95/I-495 to US 301 at TB	\$531.1
14	MD 210, Indian Head Highway	Prince Georges	Improve mobility along MD 210 and improve intersections from I-95/I-495 to MD 228	\$438.7
15	US 50, John Hanson Highway	Prince Georges		\$22.2
16	US 301, Crain Highway	Prince Georges	Upgrade and widen US 301 from north of Mount Oak Road to US 50 and MD 197 from US 301 to Mitchellville Road	\$415.0
17	US 50, Ocean Gateway	Queen Anne's		\$530.8
18	MD 4, Patuxent Beach Road and Solomons Island Road Includes the Thomas Johnson Bridge	Saint Mary's		\$668.3
19	I-70 Eisenhower Memorial Highway, project to upgrade the I-70 interchange at MD 65	Washington		\$59.0
20	I-81, Maryland Veterans Memorial Highway	Washington		\$273.1

Exhibit 7C. 2: MDTA Unfunded Freight Port Projects (TBD)

#	Project Name	Jurisdiction	Description	Estimated Cost
1	Chesapeake Bay Crossing	AA/ QA	Capacity, safety, and access improvements	TBD

Exhibit 7C. 3: MDOT MPA Unfunded Freight Port Projects

#	Project Name	Jurisdiction	Description	Estimated Cost (millions)
1	Dundalk Marine Terminal (MPA3167)	Baltimore City	DMT Berth 11 & 12 Deck and Beam Replacement	\$20.0
2	Fairfield Marine Terminal (MPA8001)	Baltimore City	FMT Kurt Iron Slip Terminal Development	\$5.0
3	Dundalk Marine Terminal (MPA8004)	Baltimore City	DMT Berth 1&2 Reconstruction	\$108.0
4	Dundalk Marine Terminal (MPA8011)	Baltimore City	Renovate DMT Berths 7&8	\$31.0
5	Dundalk Marine Terminal (MPA8012)	Baltimore City	Renovate DMT Berth 9&10	\$6.0
6	Dundalk Marine Terminal (MPAPRJ000194)	Baltimore City	DMT Berth 13 Berth Rehabilitation	\$21.0
7	South Locust Point (MPAPRJ000195)	Baltimore City	Replace Cruise Terminal Wharf at SLP Berth 9	\$17.0
8	Fairfield/ Masonville Marine Terminal (MPAPRJ000196)	Baltimore City	Fairfield Masonville Stormwater Management Phases 2 - 5	\$33.6

Exhibit 7C. 4: MDOT MAA Unfunded Freight Airport Projects

#	Project	Jurisdiction	Description	Estimated Cost (millions)
1	BWI North Cargo Electrical Substation Replacement	Anne Arundel	Electrical capacity and circuit reliability/resiliency improvements	\$20.0
2	BWI North Cargo Road and Parking, Mill & Overlay (23-01)	Anne Arundel	Pavement Management Program	\$0.75
3	BWI Southwest Quadrant Development Planning	Anne Arundel	Land use and site planning to provide for planned relocation of air cargo from north field and allow for expansion of terminal, cargo services and airport support facilities	\$1.0
4	BWI Cargo Building #107, Install Oil Water Separator	Anne Arundel	Environmental compliance and utility improvements	\$0.92
5	BWI Cargo Complex Expansion/Relocation	Anne Arundel	Planned relocation of air cargo from north field to allow for expansion of terminal, cargo services and airport support facilities	\$289
6	BWI Cargo Ramp ACC Sections Mill & Overlay (22-01)	Anne Arundel	Pavement Management Program	\$9.2
7	BWI Cargo Ramp PCC Restoration (23-03)	Anne Arundel	Pavement Management Program	\$2.1
8	BWI Cargo Service Road Mill & Overlay (19-02)	Anne Arundel	Pavement Management Program	\$0.45
9	BWI Runway 15R-33L Extension	Anne Arundel	To provide sufficient runway length to support international cargo operations	\$585.0
10	BWI New Parallel Runway Development	Anne Arundel	To ensure operational resiliency, maintenance of operations, and long-term airfield capacity and efficiency by providing a parallel commercial service runway	\$1,500

Exhibit 7C. 5: MDOT MTA and Private Section Unfunded Freight Rail Projects

#	Project	Jurisdiction	Description	Estimated Cost (million)
1	Frederick Douglas Tunnel (Replacement B&P Tunnel)			\$4,500
2	Susquehanna River Bridge Replacement			\$1,100
3	Gunpowder River Bridge Replacement			\$614
4	Bush River Bridge Replacement			\$447
5	Amtrak Signal Project			TBD
6	New Carrollton Station Track 1 Platform			\$36
7	BWI Airport Platform Expansion and 4 th Track			\$600
8	Express MARC Service between DC and Baltimore			TBD
9	Additional 4 th Track, between DC and Baltimore			TBD
10	Capacity Projects North of Baltimore			TBD
11	MARC Run Through Service to Northern Virginia			\$3,000
12	SEPTA-MARC Connection			\$21
13	Fare Integration and Other Operational Integration			TBD
14	Rolling Stock Overhauls			\$142
15	Rolling Stock Replacements			\$1,500
16	Penn-Camden Connector			\$40
17	Storage and Maintenance Facilities			\$177
18	Frederick Branch Improvements			\$10
19	PRIIA Penn Line cost-sharing			\$480
20	CSX Joint Benefits – Brunswick and Camden Lines			\$108
21	Baltimore Penn Station Renovation, Platform Expansion			\$90
22	Baltimore Penn Station Developments with private partner(s)			\$500
23	Station Access Improvements			\$104
24	Penn Line Station Renovations			\$90
25	Camden Line Station Renovations			\$80
26	West Baltimore Station			\$58
27	Eliminate At-Grade Pedestrian Crossings			\$370
28	Brunswick Line Station Renovations			\$22
29	Aberdeen MARC Station TOD			\$70

#	Project	Jurisdiction	Description	Estimated Cost (million)
30	Bayview MARC and Intermodal Station			\$73
31	North East Transit Hub/Train Station			TBD
32	Perryville Train Station Parking and TOD			TBD
33	Other TOD			TBD
34	Expanded MARC Brunswick Service			\$720
35	Expanded MARC Brunswick Service-Frederick			\$620
36	Expanded MARC Camden Line Services			\$660
37	Expanded MARC Penn Line Service North of Baltimore			TBD
38	Pope's Creek Line Passenger Rail			TBD
39	Service to Eastern Shore			TBD
40	MARC Expansion to Western Maryland			TBD
41	I-270 Monorail			\$3,700
42	Maglev (Baltimore-Washington)			\$13,000
43	Seagirt Terminal Operating Improvements			TBD
44	Separation of NEC Freight and Passenger Operations (between Perryville and Baltimore) with Unrestricted Double Stack Access			TBD
45	New CXS Domestic Intermodal Terminal			TBD
46	Shuttle Train: Baltimore to Perryville, Inland Port			TBD
47	Intermodal Terminal in Cecil County			TBD
48	Crossing Improvement			\$0.3
49	Industrial Access			\$10.1
50	Rail Capacity-Upgrade to accommodate 286,000 railcars			\$12.0
51	Re-establish Connection(s)			\$0.1
52	Track Rehabilitation			\$30.6
53	Transload			\$1.7
54	NS Hagerstown Bypass (Vardo Yard)			\$13
55	CSX Capacity Projects (from 2015 Rail Plan, includes connections, SGR, potential MARC benefits)			\$329

Exhibit 7C. 6: MDOT SHA Funded Freight Projects

#	Project Name	Jurisdiction	Description	Estimated Cost (millions)
1	MD 175, Annapolis Rd	Anne Arundel	Md 175 from Brick Ridge to MD 295	\$78.7
2	I-83, Harrisburg Expressway	Baltimore	Bridges over Padonia Road	\$25.9
3	I-695, Baltimore Beltway	Baltimore	Bridge on Putty Hill Avenue	\$17.1
4	I-695, Baltimore Beltway	Baltimore	US 40 to MD 144	\$133.4
5	I-695, Baltimore Beltway	Baltimore	Traffic Management	\$173.7
6	I-695, Baltimore Beltway	Baltimore	Interchange Reconstruction at I-70	\$195.0
7	US 219, Chestnut Ridge Road	Garrett	Relocation of US 219 from I-68/US 40 to Old Salisbury Road	\$64.4
8	I-270, Eisenhower Highway	Montgomery	Innovative Congestion Management (ICM)	\$131.7
9	I-95/I-495, Capital Beltway	Prince George's	Bridges over Suitland Road	\$36.4
10	I-95/I-495, Capital Beltway	Prince George's	Bridges over Suitland Parkway	\$41.4
11	MD 210, Indian Head Highway	Prince George's	New Interchange at Kerby Hill	\$131.1
12	Highway Safety Facilities and Equipment	Statewide		\$45.4
13	Railroad Crossing	Statewide		\$22.6
14	Traffic Relief Plan	Statewide	(Phase 2) Smart Traffic Signals	\$50.3
15	I-81 Maryland Veterans Memorial Highway	Washington	Phase 1	\$105.7
16	I-95	Prince George's	Replace Bridge 1615305 and 1615306 over MD 214	\$32.9
17	MD 4	Prince George's	Construct new interchange at Suitland Pkwy (BRAC Related-capacity improvements)	\$208.3
18	I-95 and I-695, Baltimore Beltway	Baltimore	Concrete Deck Overlays	\$25.3
19	MD 151/MD151B	Baltimore	Sparrows Point Boulevard	\$30.6
20	US 40, Pulaski Highway	Baltimore	Bridges over Little and Big Gunpowder	\$32.0
21	MD 85, Buckeystown Pike	Frederick	Phase 1	\$88.9
22	MD 32 Patuxent Freeway	Howard	Linden Church to I-70	\$126.9
23	I-270 Eisenhower Memorial Highway	Statewide	Phase 1	\$99.0
24	I-270 Eisenhower Statewide	Statewide	P3 Program	\$128.7

#	Project Name	Jurisdiction	Description	Estimated Cost (millions)
25	I-70, Eisenhower Memorial Highway	Washington	Bridge deck and superstructure replacement and widening of I-70 dual bridges 21118 over MD 65 and I-70 dual bridges 21119 over CSX Hagerstown Branch.	\$32.3
26	I-70, Eisenhower Memorial Highway	Washington	Replace bridges 2113503 and 2113504 over Crystal Falls Drive	\$26.2
27	I-70 Eisenhower Memorial Highway	Washington	Rehabilitation of bridges 2107303 and 2114100 over I-81 and bridges 2111303 and 2111304 over the Winchester and Western Railroad	\$38.5
28	US 13 Business, Salisbury Boulevard	Wicomico	Funded for design, right-of-way and utilities in the FY 22-FY27 Draft CTP. Construction cost not reflected	\$4.4

Exhibit 7C. 7: MDTA Funded Freight Projects

#	Project	Jurisdiction	Description	Estimated Cost (millions)
1	I-95 Northbound Auxiliary Lane from MD 152 to MD 24 and MD 24 Ramp Modifications	Harford	I-95 Northbound Auxiliary Lane from MD 152 to MD 24 and MD 24 Ramp Modifications - This additional travel lane provides better traffic operations and a safer transition for vehicles entering and exiting from these interchange ramps.	\$21.2
2	I-95 ETL Northbound Extension - Reconstruction of NB I-95 from MD 43 to south of MD 152	Harford	I-95 ETL Northbound Extension - Reconstruction of NB I-95 from MD 43 to south of MD 152 - MDTA is reconstructing I-95 NB and extending the two northbound Express Toll Lanes from MD 43 to south of MD 152.	\$175.3
3	I-95 ETL Northbound Extension Reconstruction of the MD 152 Interchange	Harford	I-95 ETL Northbound Extension Reconstruction of the MD 152 Interchange - MDTA is reconstructing the MD 152 interchange to allow for the extension of the express toll lanes.	\$196.2
4	I-95 ETL Northbound Extension from HaHa Branch to Bynum Run	Harford	I-95 ETL Northbound Extension from HaHa Branch to Bynum Run - MDTA is reconstructing I-95 NB to extend NB express toll lanes north of the MD 24 interchange and transition back to the general-purpose lanes.	\$53.0
5	I-95 ETL Northbound Extension Reconstruction of the MD 24 Interchange	Harford	I-95 ETL Northbound Extension Reconstruction of the MD 24 Interchange - MDTA is reconstructing the MD 24 interchange to allow for the extension of the express toll lanes.	\$214.0
6	Interim Highway Speed AET	Cecil	All Electronic Toll Conversion at JFK is underway. Removal of Toll Plaza and Installing Gantries with electronic toll collection equipment.	\$8.0
7	I-95 - Structural Rehabilitation of the Millard E. Tydings Memorial Bridge	Harford/Cecil	Structural Rehabilitation of the Tydings Bridge - Priority repairs to the Bridge found during conditional inspections	\$10.0
8	I-95 - Superstructure Repairs to Various Bridges North and South of Tunnel	Baltimore City	Superstructure repairs i.e., fatigue retrofits to steel box girders, drainage system improvements, etc. on multiple bridges along I-95 in Baltimore City.	\$5.0
9	I-95 Ramps South of Tunnel - Deck Rehabilitation and Joint Modifications of Bridges	Baltimore City	Deck rehabilitation of ramps that includes joint replacement, Latex Modified Concrete overlay, etc.	\$8.2
10	I-95 - Fort McHenry Tunnel AET Conversion	Baltimore City	Total removal of existing toll plaza elements, installation of AET gantries and reconfiguration of existing lanes.	\$22.8

#	Project	Jurisdiction	Description	Estimated Cost (millions)
11	William Preston Lane Jr. Memorial Bridge Emergency AET Conversion	Anne Arundel / Queen Annes	Total removal of existing toll plaza elements, installation of AET gantries and reconfiguration of existing lanes, etc.	\$51.4
12	US 301 - Bay Bridge Crossover Automated Lane Closure System	Queen Annes	Installation of Automated Lane Closure System consisting of a series of integrated Intelligent Transportation System devices to advise motorists of closed lanes approaching the eastern shore two-way traffic crossover.	\$18.2
13	US 40 - Hatem Bridge Toll Plaza Pavement Rehabilitation and AET Conversion	Harford/Cecil	Reconstruct pavement, removal of toll plaza and installation toll gantries for electronic toll collections.	\$12.6
14	US 301 - Harry W. Nice/Mac Middleton Bridge Replacement - DB contract	Charles Co. / VA	Replace exiting bridge with new structure, campus improvements and removal of existing bridge.	\$635.8
15	I-95 SB Hard Shoulder Running	Harford	Part-time shoulder use along I-95 SB from Maryland House Travel Plaza to MD 24	\$53.0
16	I-95 Resurface - Phase II from MD 24 to Tydings Bridge	Harford	Resurface I-95 Phase II from MD 24 to Tydings Bridge	\$28.7
17	I-95 South of Fort McHenry Tunnel	Baltimore City	Congestion and safety relief for I-95 between I-695 (South) and the Fort McHenry Tunnel	\$47.0
18	I-95/Belvidere Road Interchange	Cecil	New Interchange on I-95	\$73.3
19	I-95 - AET - with Frankfurt Ave Underpass Profile Adjustment	Baltimore City	Toll Plaza Demolition, interchange and Roadway Modification	\$112.0
20	I-95 - Resurface North and South of BHT	Baltimore City	System Preservation Resurfacing	\$8.0
21	I-95 - Deck Sealing and Misc. Deck Repairs on 19 Bridges on BHT	Baltimore City & County	System Preservation	\$6.0

#	Project	Jurisdiction	Description	Estimated Cost (millions)
22	I-95 - Sub- and Superstructure Rehab to Various Bridges	Baltimore City	System preservation repairs to various bridges on the FMT facility	\$14.9
23	EB Span Deck Rehabilitation, Phase 1	Queen Anne's and Anne Arundel Counties	Replacement of EB WPL Deck from T1-T13, T14-T22	\$228.8
24	FSK (BCZ472) Deck and Superstructure Replacement	Baltimore City	Replacement of concrete deck and parapets of BCZ472001	\$85.8
25	Repair and/or Overlay Decks - FMT Facility wide	Baltimore City	System preservation to various bridges at FMT facility	\$13.4
26	I-695 Subgrade Improvements at Bear Creek	Baltimore County	Repair and rehabilitate the subgrade of I-695 on Sparrows Point near Bear Creek and perform backwall repairs of adjacent bridges.	\$58.8

Exhibit 7C. 8: MDOT MPA Funded Freight Port Projects

#	Project Name	Jurisdiction	Description	Estimated Cost (millions)
1	Dundalk Marine Terminal (MPA1011)	Baltimore City	Dundalk Marine Terminal O&M	\$72.9
2	Fairfield/ Masonville Marine Terminal (MPA2714)	Baltimore City	Fairfield Masonville Stormwater Mgmt. Phase I	\$6.4
3	Dundalk Marine Terminal (MPA3181)	Baltimore City	DMT Berth 3 Reconstruction	\$34
4	Hart/Miller Island (MPA5002)	Baltimore City	Hart/Miller Island Operations	\$99.2
5	Poplar Island (MPA5103)	Baltimore City	Poplar Island Operations and Maintenance	\$125.4
6	Poplar Island (MPA5105)	Baltimore City	Poplar Island Expansion	\$32.4
7	MPA5231	Baltimore City	Mid-Bay Island Option	\$76.4
8	Masonville Marine Terminal (MPA5232)	Baltimore City	Masonville Dredge Placement Facility	\$250.4
9	Masonville Marine Terminal (MPA5235)	Baltimore City	Masonville - Construction Management	\$18.0
10	Masonville Marine Terminal (MPA5237)	Baltimore City	Masonville Operations & Maintenance	\$50.1
11	MPA5241	Baltimore City	Innovative Use	\$11.1
12	Dundalk Marine Terminal (MPA5245)	Baltimore City	Dundalk Dredging Energy Ports	\$21.2
13	Dundalk Marine Terminal (MPA5251)	Baltimore City	50' Berth at Seagirt Marine Terminal	\$34.0
14	Cox Creek (MPA5305)	Baltimore City	Cox Creek Operations and Maintenance	\$65.4
15	Cox Creek (MPA5308)	Baltimore City	Cox Creek Expansion Feasibility/EIS Study	\$5.2
16	Cox Creek (MPA5309)	Baltimore City	Cox Creek Expansion Construction	\$144.2
17	Cox Creek (MPA5311)	Baltimore City	Cox Creek Expansion Construction Stage 2	\$23.9
18	MPAGRT000182	Baltimore City	Innovative Use Fleming Park Grant	\$0.5
19	MPAPRJ000177	Baltimore City	Upgrades to Howard Street Tunnel	\$466
20	Seagirt Marine Terminal (MPAPRJ000179)	Baltimore City	Seagirt Loop Channel	\$1.3
21	MPAPRJ000181	Baltimore City	Innovative Use Projects RFP solicitation	\$2.0
22	Fairfield Marine Terminal (MPAPRJ000193)	Baltimore City	Fairfield Pier 4 Repairs	\$19.0
23	Dundalk Marine Terminal (MPAPRJ000190)	Baltimore City	DMT Resiliency and Flood Mitigation BUILD	\$38.2

Exhibit 7C. 9: MDOT MAA Funded Freight Airport Projects

#	Project Name	Jurisdiction	Description	Estimated Cost (millions)
1	Midfield Cargo Area Improvements at BWI Marshall Airport	Anne Arundel	This project consists of the design and construction of improvements to the Midfield Cargo Complex facilities, apron, and aircraft parking positions to support new cargo operations. Improvements include security, building modifications, apron rehabilitation, additional aircraft parking positions, and tenant relocation costs.	\$33.5
2	Airfield Lighting Vault Relocation at BWI Marshall Airport	Anne Arundel	This project will relocate the existing Airfield Lighting Vault, demolish the existing facility and convert the site to aircraft apron pavement. In addition, the demolition will allow for taxiway and apron improvements between Taxiways T and P. The building will be replaced with a dedicated facility that incorporates all new airfield lighting control and infrastructure, purpose design layout incorporating circuit resiliency by segregating portions of the airfield into different sections reducing the possibility of a single point of failure and a state of the art nitrogen inert fire protection system.	\$11.8

Exhibit 7C. 10: MDOT MTA Funded Freight Rail Projects (TBD)

#	Project Name	Jurisdiction	Description	Estimated Cost (millions)
1	Freight Rail Capital Improvements	Statewide	Grade crossings, structures, and track safety improvements (short line)	~ \$5.0 annually