VTrans2040

VIRGINIA FREIGHT ELEMENT

Prepared for the Office of Intermodal Planning and Investment

October 2017

Office of INTERMODAL Planning and Investment

VTrans 2040

SAFE • STRATEGIC • SEAMLESS

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MVDB Motor Vehicle Dealer Board COMMONWEALTH OF VIRGINIA

MARS Mid-Atlantic Regional Spaceport

VIRGINIA DEPARTMENT OF AVIATION

THE PORT OF VIRGINIA

VDOT Virginia Department of Transportation

DRPT Virginia Department of Rail and Public Transportation

FOREWORD

The Virginia Freight Element (VFE) is a component of VTrans2040, Virginia's multimodal long-range transportation plan, and serves as the state's freight plan. This Foreword summarizes the items required in a state freight plan as noted in FHWA guidance and how each is addressed in the Virginia Freight Element, or elsewhere:

Identify significant freight system trends, needs, and issues within the State.
The Virginia Freight Element describes trends in the following locations:

- Freight demand trends are located on Pages 4-1 through 4-19. Current and forecast levels of commodity types, tonnages and value by mode are discussed.
- Economic trends related to freight are described on Page 9-1 to the top of Page 9-7. Trends in the Major Industry Sector Shares (this relates to freight demand) of the Virginia Economy, appear on Page 9-5.
- Trends in terms of how Virginia and the broader region are supporting freight transportation in recent initiatives appear on Pages 6-2 to 6-4.
- The appendix report*, Economic Context of Freight Transportation in Virginia*, includes a thorough description of trends in freight demand and the role of freight transportation in the Virginia economy.
- The appendix report*, Economic Corridors Analysis*, details modal flows for 10 sections of Virginia's Corridors of Statewide Significance and shows how local (non-through) freight movements affect the local economies of the state.
- Trends concerning freight condition and performance by mode are detailed on Pages 7-1 through 7-15.
- National freight trends, including technology trends, with a potential impact on Virginia are shown on Pages 6-9 to 6-16.
- Freight trends as they relate to VTrans2040 scenario planning are described on Pages 6-17 to 6-20.

Needs and issues are described in the following sections:

- An assessment of strengths appears on Pages 6-1 to 6-2.
- A summary of freight challenges and needs is presented on Pages 6-4 to 6-8.
- Needs from truck drivers' perspectives are presented on Pages 8-2 to 8-5.
- Chapter 11, contains a comprehensive list of policy, program and project recommendations. Each recommendation contains a brief paragraph labeled "*Discussion"* which summarizes the need or issue that the recommendation addresses. For example, the "*Discussion"* that accompanies recommendation PO5, reads, "*First/last mile connectors are widely acknowledged to be a weak link in the freight transportation system. The connectors can be enhanced through a combination of access controls, operational improvements and targeted capacity enhancements, and a careful analysis and vetting process. By providing statewide, consistent guidance about design and right of way protection for first/last mile connections, Virginia can protect and improve accessibility to freight generators*."

Describe freight policies, strategies, and performance measures that will guide the State's freight-related investment decisions.

Freight policies are described in the following sections:

- State and Federal planning needs are described on Pages 1-3 to 1-4.
- Strategic goals and objectives are listed on Pages 2-1 to 2-2.
- A description of national freight policy and freight goals appears on Pages 2-2 to 2-3.
- Selected and relevant Virginia performance measures that are part of regular performance reporting appear on Pages 2-3 to 2-7.
- A discussion of performance-based decision making driven by federal policy and regulations appears on Pages 2-8 to 2-9.
- A discussion of governing FAST Act freight provisions appears on Pages 5-1 to 5-5.
- A discussion of the State's current decision-making processes and institutions appears on Pages 5-5 to 5-10.
- A discussion of proposed strategies to improve freight transportation in Virginia appears on Pages 11-1 to 11-4 as recommendations PO1 to PO12.

Describe how the plan will enable the State to meet the national multimodal freight policy goals (49 U.S.C. § 70101[b]) and the national freight program goals (23 U.S.C. § 167).

At the end of *Chapter 11, Freight Improvement Strategies*, starting on Page 11-14, a tabular cross-walk of the investment strategies and the national freight goals is provided. This table illustrates that there are multiple strategies to address each of the national freight goals.

List, as applicable, multimodal critical rural freight facilities and corridors designated under the National Multimodal Freight Network (49 U.S.C. § 70103), and the critical rural and urban freight corridors designated under the National Highway Freight Program (23 U.S.C. § 167).

- Appendix A includes Information regarding Critical Rural and Urban Freight Corridors and the status of the designation process.

Describe innovative technologies and operational strategies, including freight intelligent transportation systems, that improve the safety and efficiency of freight movement

- This appears on Pages 6-11 to 6-15.

Describe improvements to mitigate the deterioration of roadways serving heavy vehicles.

- Pages 5-7 to 5-8, after *Virginia Six-Year Improvement Program (SYIP),* describe Virginia's asset management process.
- Pages 7-1 and 7-2 describe the system wide condition and performance of Virginia's pavement and bridges.
- Pages 6-4 and 6-5 (*Overall Condition and Design of Roadway Infrastructure and Truck Size and Weight Limits*) outlines the challenges to maintenance on rural roads.

Provide an inventory of facilities within the State with freight mobility issues, and describe potential strategies to address such issues for State-owned or operated facilities.

- An analysis of truck freight delay using heavy vehicle volumes and NPMRDS speed data appears on Pages 7-5 to 7-6. This is a special purpose analysis conducted for the VFE.

- An assessment of truck parking needs appears on Pages 7-8 to 7-9.
- A description of rail bottlenecks is provided on Page 7-12.
- Port-related access and mobility issues are described on Pages 7-13 to 7-14.
- Airport cargo-related access and mobility issue are described on Pages 7-14 to 7-16.
- Strategies and recommendations to address mobility issues are described in the following *Chapter 11* locations:
  - Pages 11-7 to 11-8, Technology Strategies.
  - Pages 11-8 to 11-12, Infrastructure-related Strategies.
  - In addition, Figure 11-1 identifies the locations of 139 Virginia Multimodal Transportation Plan recommendations that will benefit freight mobility. The full list of recommendations appears in Appendix B.

Consider any significant congestion or delay caused by freight movements and potential strategies to mitigate that congestion or delay.

- Pages 6-7 to 6-8 describes port issues that create congestion and delay for all vehicles.
- Pages 7-13 to 7-14 describes port expansion projects that will help address the issue.
- Pages 7-14 to 7-15 describe cargo airport access issues and potential solutions.
- Rail at-grade crossings and solutions are discussed on Pages 3-7, 7-14, 7-10 to 7-11 (safety discussion), in an improvement recommendation in PO9 on Page 11-3, and P10 on Page 11-7.

Include a freight investment plan listing priority projects and funding mechanisms.

- Pages 10-1 to 10-3 contain Information regarding the Freight Investment Plan with details pertaining to fiscal constraint in Appendix D.

Consult with the State Freight Advisory Committee, as applicable.

- Consultation with the freight advisory groups and stakeholders is documented on Pages 8-1 to 8-5.

The Virginia Office of Intermodal Planning and Investment in cooperation with the Virginia Department of Transportation, Virginia Department of Rail and Public Transit, Virginia Department of Motor Vehicles, Virginia Motor Vehicle Dealer Board, Port of Virginia, Virginia Department of Aviation, and Virginia Commercial Space Flight Authority present the Virginia Freight Element in compliance with the Federal *Fixing America's Surface Transportation Act of 2015* (FAST Act).

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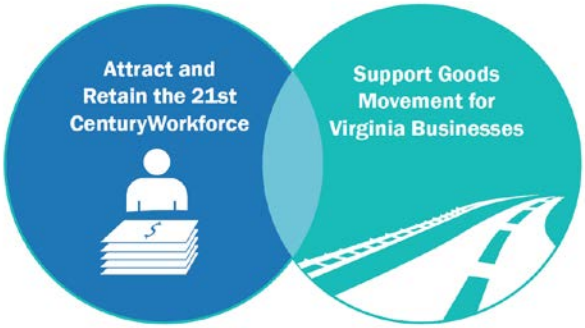
OVERVIEW

Maintaining and improving the efficiency of the multimodal freight system is vital to the economy and the quality of life of all Virginians. The Virginia Freight Element (Freight Element) of the VTrans2040 Multimodal Transportation Plan (VMTP) is designed to enhance goods movement on Virginia's multimodal transportation network by guiding freight policy, programming, and investment decisions.



The Freight Element accomplishes this in:

- Introducing the major freight trends and challenges in the Commonwealth;
- Summarizing the Commonwealth's freight transportation planning efforts;
- Illustrating how Virginia meets the Federal guidelines for statewide freight plans outlined in the most recent surface transportation law: Fixing America's Surface Transportation Act (FAST Act);
- Summarizing recent outreach efforts to engage public agencies and freight stakeholders in the development of the plan;
- Introducing freight policy, programming, and project recommendations; and
- Organizing and supplementing VTrans2040 to identify freight transportation needs throughout the Commonwealth.

Importance of Freight in Virginia

The movement of freight – raw materials, intermediate products, and finished goods – currently supports over $192 Billion of Virginia's Gross State Product annually or 26 percent of the entire statewide economy. In addition, freight-related industries sustain about 70 percent of jobs in Virginia.

Virginia hosts one of the nation's leading seaports (Port of Virginia), two national freight railroads, numerous local and regional railroads, some of the nation's most heavily used truck corridors, and four significant air cargo airports, one of which (Washington Dulles International Airport), is a major international air cargo facility.

By 2040, the forecast is for significant growth in freight movement to, from, within, and through Virginia. Some of the Commonwealth's freight infrastructure is well-positioned to absorb this growth. But much of its infrastructure will be challenged.

More efficient freight movement means lower transportation costs for industries and businesses that depend on freight transportation, helping them (and Virginia's economy) to grow and prosper, which makes Virginia a more attractive place to do business. In turn, lower costs of transporting goods to market also benefits Virginia's consumers in the form of lower prices.

The Freight Element builds on previous statewide planning efforts including the 2010 Virginia Statewide Multimodal Freight Study, 2014 Virginia Multimodal Freight Plan, and VTrans2035. The Freight Element

incorporates the input from these previous planning efforts and input received during the development of VTrans2040, the Commonwealth's current long-range transportation plan.

Compliance with Federal Law: FAST Act

The Freight Element is designed to meet the requirements of the FAST Act of 2015. Prior to the FAST Act, the Commonwealth had fulfilled the recommendations of the previous federal transportation law, Moving Ahead for Progress in the 21st Century, or MAP-21 through its proactive freight planning programs.

Virginia's Freight Challenges

The Freight Element presents the challenges facing goods movement in the Commonwealth now and in the future. Among the challenges faced by the freight system are:

- Virginia must find ways to preserve and improve the performance of its highways and railways, through the appropriate combination of additional capacity and utilization of existing capacity to accommodate passenger and freight movement.
- The trucking industry faces challenges associated with driver shortages, difficulty in meeting driver hour of service requirements, and adequate truck parking.
- Making sure that Virginia's freight rail system is modern and has sufficient capacity to meet demand is critical to maintaining a balanced transportation system.
- Maintaining and improving rail connections facilitates the movement of international shipping containers between the marine terminals and inland destinations and are critical to port accessibility.
- Continued investment in rail facilities, including short-line connections and terminals, can expand options for shippers and help shift freight to other modes.
- The Commonwealth must continue to exercise all available programs and leverage public-private partnership opportunities to meet the backlog of needs and growing freight demand.

Virginia's Freight Improvement Strategies

The needs and challenges identified in this Freight Element led to strategies for policies, programs, technologies, and projects that work for Virginia businesses and residents. The strategies reflect dozens of conversations with stakeholders, an in-depth analysis of data, and an understanding of best practices for improving freight efficiency. The 12 policy, 10 program, two technology, and 17 infrastructure-related recommendations encompass actions to bolster coordination, increase funding, and focus priorities.

Virginia's Fiscally Constrained Freight Investment Plan

The Freight Element lists the eligible and freight-beneficial projects that are supported by National Highway Freight Program Funds (NHFP). The Constrained Investment Plan also describes all sources of funding for each NHFP project as well as its location.

1. INTRODUCTION

Freight movement is so integral to the way of life in America that most individuals don't even notice it; however, most still tend to place very high expectations on it. For example, it has become commonplace to order products with the expectation that they will be delivered within a single day of the order. Speedy delivery happens so efficiently and seamlessly because of American know-how and the advanced logistics of our business sector. It also requires a well-functioning and well-integrated system of roads, rail, ports, and airports. The Commonwealth of Virginia operates and maintains much of that system and partners with the private sector to maintain and operate some of it as well. This system has to be fast, but it also needs to be safe for everyone.

Consideration needs to be given to how the goods we use can move more safely and efficiently, both now and in the future. Although the future is unpredictable, the right policies, technologies, and investments can help the Commonwealth be prepared.

The Virginia Freight Element (Freight Element) is part of that preparation. The Freight Element provides a review of the Commonwealth's multi-faceted and interconnected freight system and sets a direction for policies, technologies, and investments that will help us meet the future and thrive in it.

VTrans2040 Vision: Virginia's multimodal transportation system will be ***Good for Business***, ***Good for Communities***, and ***Good to Go***. Virginians will benefit from a sustainable, reliable transportation system that advances Virginia businesses, attracts a 21st century workforce, and promotes healthy communities where Virginians of all ages and abilities can thrive.

Purpose

Virginia has a diverse, dynamic, and growing economy that is 12th largest among all states in the nation. Virginia's businesses depend on reliable, accessible transportation systems to produce and deliver goods in a very competitive global environment. To meet these economic demands, Virginia has responded with billions of dollars' worth of investments in roads, bridges, port facilities, and rail improvements. Even so, more needs to be done. Looking forward, what are the right investments to increase efficiency, reduce costs, and improve connectivity, reliability, and access to markets?

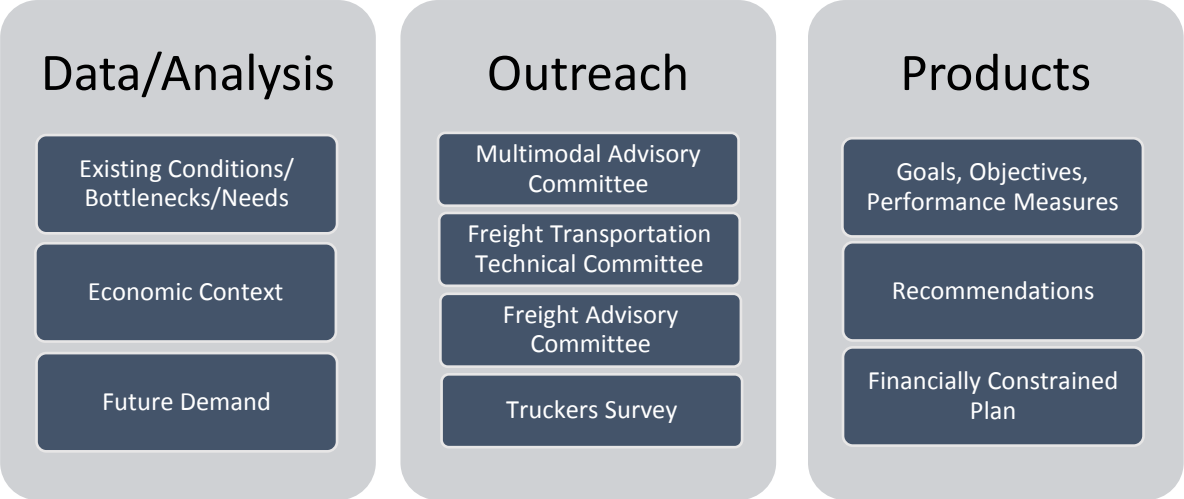
The Virginia Freight Element takes a long-term view of these questions with actions, investments, and policies to improve freight transportation in Virginia. It is a product of a multi-year, long-range planning process called VTrans2040. VTrans2040 brings together and strengthens the connections between thematic, long-range, goal-driven planning and short-term capital programming decisions that are based on financial capacity and a well-established prioritization process. This Freight Element focuses on the unique system that moves commodities to, from, and within Virginia.

Freight Element Development Process

The Virginia Freight Element is the product of extensive discussions with public and private sector partners, as well as in-depth analyses of the Commonwealth's freight transportation system condition and performance (**Figure 1-1**). The Freight Element consists of technical analyses, policy reviews, outreach, and consideration of regulatory requirements, such as the following:

- **Legal and Regulatory Requirements**
  The *Forward* and *Section 1 – Introduction* demonstrates how the Freight Element is aligned with the requirements in the recent Federal *Fixing America's Surface Transportation Act (FAST Act)*, as well as VTrans2040, Virginia's long-range multimodal transportation plan.
- **Strategic Direction**
  Section 2 – Strategic Goals and Objectives provides the critical first step in the planning process of establishing goals and objectives that articulate the state's long-range direction for freight movement.
- **Existing System Review and Needs Analysis**
  Section 3 – Virginia Freight Transportation Assets, *Section 6 – Strengths, Challenges, Needs, and Trends*, and *Section 7 – Condition and Performance of Virginia's Freight System* present a comprehensive inventory of Virginia's multimodal freight transportation infrastructure and identifies issues related to safety, bottlenecks, freight demand, and freight mobility, thereby providing a starting point for consideration of modal needs.
- **Future Freight Demand Analysis**
  Section 4 – Virginia Freight Demand includes an overview of freight flow forecasts for goods moving to, from, and within Virginia by domestic mode and commodity type.
- **Economic Analysis**
  Section 9 – Economic Context of Freight presents an analysis of the economic context of Virginia's industries.
- **Recommendations**
  Section 11 – Freight Improvement Strategies culminates in a set of policies and projects to improve freight transportation in Virginia, based on analyses and engagement with stakeholders.

Figure 1-1: Freight Element Development Process



State and Federal Planning Needs

The Commonwealth makes investment decisions from a base of national and local policies that set broad direction for decision-making and funding programs with specific eligibility requirements. These policies, laws, and the institutions that develop them all influence how the Freight Element's recommendations and implementation strategies are chosen and described.

FAST Act Requirements

The current federal transportation law, FAST Act, provides dedicated funding throughout the nation for surface transportation projects for fiscal years 2016 to 2020 and outlines the requirements for the National Highway Freight Program (NHFP). The annual national appropriation for the NHFP is expected to be $1.2 billion. Eligible projects include construction, operational improvements, freight planning, and performance measures. In order to obligate funds under the NHFP, states are required to have a State Freight Plan, which must at a minimum:

1. Identify significant freight system trends, needs, and issues within the State;
2. Describe freight policies, strategies, and performance measures that will guide the State's freight-related investment decisions;
3. List, as applicable, multimodal critical rural freight facilities and corridors designated under the National Multimodal Freight Network (49 U.S.C. § 70103), and the critical rural and urban freight corridors designated under the National Highway Freight Program (23 U.S.C. § 167);
4. Describe how the plan will better enable the State to meet the national multimodal freight policy goals (49 U.S.C. § 70101[b]) and the national freight program goals (23 U.S.C. § 167);
5. Describe innovative technologies and operational strategies, including freight intelligent transportation systems, that improve the safety and efficiency of freight movement;
6. Describe improvements to hinder or mitigate the deterioration of roadways serving heavy vehicles;
7. Provide an inventory of facilities within the State with freight mobility issues, and describe potential strategies to address such issues for State-owned or operated facilities;

8. Consider any significant congestion or delay caused by freight movements and potential strategies to mitigate that congestion or delay;
9. Include a freight investment plan listing priority projects and funding mechanisms; and
10. Consult with the State Freight Advisory Committee, as applicable.

2. Strategic Goals and Objectives

Coordinated strategic goals and objectives provide the framework for implementing Virginia's Freight Element in a consistent and complementary way. The goals have been coordinated with other relevant statewide plans to promote positive outcomes in interactions with the state's transportation and non-transportation systems and to ensure consistency with federal and state planning and investment initiatives.

VTrans Goals and Objectives

Virginia's multimodal goals and objectives identified in VTrans2040 assimilate the freight-relevant components of the highway, rail, port, and aviation plans, as well as studies and initiatives involving Virginia's freight transportation system. The following VTrans2040 Goals and Objectives were updated and adopted in 2015.

Goal A – Economic Competitiveness and Prosperity

Invest in a transportation system that supports a robust, diverse, and competitive economy.

Objectives:

- A.1. Reduce the amount of travel that takes place in severe congestion.
- A.2. Reduce the number and severity of freight bottlenecks.
- A.3. Improve reliability on key corridors for all modes.

Goal B – Accessible and Connected Places

Increase the opportunities for people and businesses to efficiently access jobs, services, activity centers, and distribution hubs.

Objectives:

- B.1. Reduce average peak-period travel times in metropolitan areas
- B.2. Reduce average daily trip lengths in metropolitan areas.
- B.3. Increase the accessibility to jobs via transit, walking and driving in metropolitan areas.

Goal C – Safety for All Users

Provide a safe and secure transportation system for passengers and goods on all travel modes.

Objectives:

- C.1. Reduce the number and rate of motorized fatalities and severe injuries.
- C.2. Reduce the number of non-motorized fatalities and severe injuries.

Goal D – Proactive System Management

Maintain the transportation system in good condition and leverage technology to optimize existing and new infrastructure.

Objectives:

- D.1. Improve the condition of all bridges based on deck area.
- D.2. Increase the lane miles of pavement in good or fair condition.
- D.3. Increase the percent of transit vehicles and facilities in good or fair condition.

Goal E – Healthy Communities and Sustainable Transportation Communities

Support a variety of community types promoting local economies and healthy lifestyles that provide travel options, while preserving agricultural, natural, historic, and cultural resources.

Objectives:

- E.1. Reduce per-capita vehicle miles traveled.
- E.2. Reduce transportation-related NOX, VOC, PM, and CO emissions.
- E.3. Increase the number of trips traveled by active transportation (bicycling and walking).

These goals and objectives are multimodal in nature and address the freight requirements outlined in the National Freight Policy below.

National Freight Policy

The Federal Surface Transportation Act MAP-21 and its successor, the FAST Act, focus on establishing a national performance-based program for transportation. MAP-21 established a freight transportation network and national surface transportation goal areas. It also created requirements for the U.S. Department of Transportation (USDOT) to develop national transportation performance measures and to promulgate rules to implement them. MAP-21 established a national freight movement and an economic vitality goal focused on improving the national freight network, strengthening the ability of rural communities to access national and international trade markets, and supporting regional economic development. To achieve this, the law required the USDOT to develop a National Freight Policy, which included the following goals:

National Freight Goals

- Goal 1: To invest in infrastructure improvements and to implement operational improvements that strengthen the contribution of the national freight network to the economic competitiveness of the United States; reduce congestion; and increase productivity, particularly for domestic industries and businesses that create high-value jobs.
- Goal 2: To improve the safety, security, and resilience of freight transportation.
- Goal 3: To improve the state of good repair of the national freight network.
- Goal 4: To use advanced technology to improve the safety and efficiency of the national freight network.
- Goal 5: To incorporate concepts of performance, innovation, competition, and accountability into the operation and maintenance of the national freight network.
- Goal 6: To improve the economic efficiency of the national freight network.
- Goal 7: To reduce the environmental impacts of freight movement within the national freight network.

The FAST Act continues these policies, as well as establishes new policies and programs. The FAST Act established new freight-specific funding programs, new requirements for states to update their freight plans every 5 years, and a Port Performance Program. These provisions will raise the visibility of and focus on freight transportation needs. **Table 2-1** and **Figure 2-1** illustrate the alignment of the National Freight Goals and VTrans2040 Goals.

Table 2-1: Alignment of VTrans2040 Goals and National Freight Goals

VTrans2040 Goals	National Freight Goals
Goal A: Economic Competitiveness & Prosperity	Goal 1: Reliability, Congestion, Cost
Goal C: Safety for All Users	Goal 2: Safety, Security, Resiliency
Goal D: Proactive System Management	Goal 3: State of Good Repair
Goal C: Safety for All Users Goal D: Proactive System Management	Goal 4: Advanced Technology
Goal B: Accessible & Connected Places Goal D: Proactive System Management	Goal 5: Multi-state Corridor Planning
Goal A: Economic Competitiveness & Prosperity	Goal 6: Efficiency
Goal E: Healthy & Sustainable Communities	Goal 7: Environmental Impacts

Figure 2-1: Alignment of VTrans2040 Goals and National Freight Goals

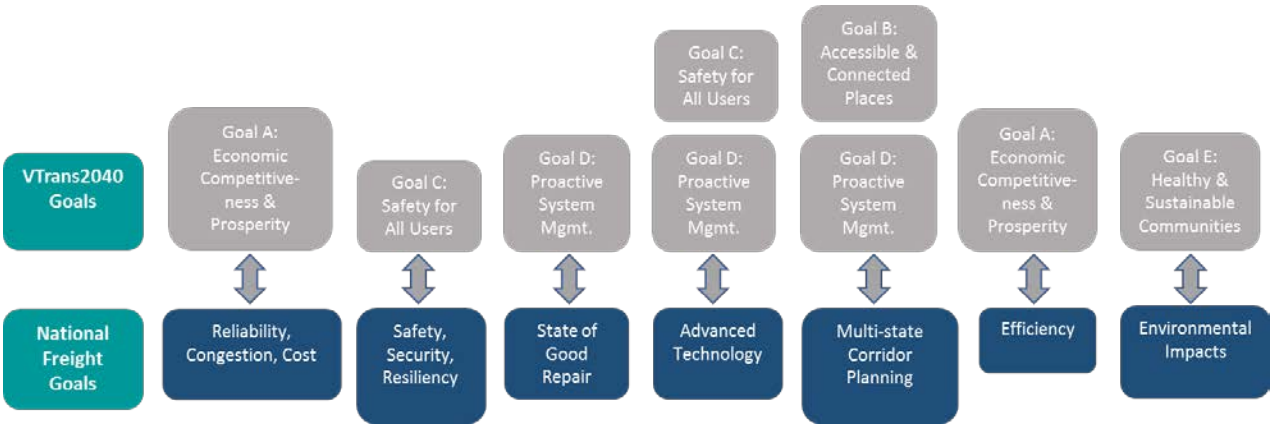


Table 11-1 in *Chapter 11: Freight Improvement Strategies* provides a cross-walk of the strategies in the VFE and how they address the National Freight Goals, illustrating that all the goals are addressed through multiple policy, program, technology and/or infrastructure strategies.

Objectives and Performance Measures

The Annual Performance Report to the CTB provides information about the performance of the Virginia's surface transportation system in order to track attainment of the goals, objectives, and guiding principles developed for VTrans2040. The programs, policies, and investment strategies of the Virginia Department of Transportation (VDOT), Department of Rail and Public Transportation (DRPT), and the Office of Intermodal Planning and Investment (OIPI) are fully described in the report to show how multimodal performance will be improved.

The Performance Report examines transportation-related issues and opportunities associated with potential changes in catalytic factors, including freight movement. The report identifies important emerging insights that influence VTrans2040, including the need to improve the efficiency of multimodal freight options to respond to the expected growth of freight dependent industries. These trend insights shaped the vision, goals, objectives, and guiding principles for VTrans2040. Through these goals and objectives, VTrans2040 establishes measurable targets for the future performance of the transportation system.

Under VTrans2040 Goal A: Economic Competitiveness and Prosperity, the Performance Report identifies one measure that directly supports freight and two that indirectly support freight.

Objectives and Performance Measures Directly Supporting Freight

Objective A.2:

Reduce the number and severity of freight bottlenecks

Measure:

Number of highway bottlenecks with daily freight ton hours of delay per mile > 250,000

This measure identifies truck freight bottlenecks through an assessment of average hours of delay per mile. The intent is to track the locations where truck traffic is significantly delayed in the Commonwealth. For this measure, a lower value is better.

In 2012, 10 of the 37 bottlenecks were in Northern Virginia, with the I-495 segment between VA 267 and the American Legion Bridge being the most severe bottleneck in the Commonwealth.

From 2012 to 2015, peak hour delay and peak hour travel time reliability showed changes across these 37 bottlenecks based on INRIX speed data (**Table 2-2**). In terms of peak hour delay, three locations experienced less delay, 17 locations experienced the same amount of delay, and 17 locations experienced an increase in delay. The three locations experiencing less delay include I-95 in Fairfax and Prince William Counties, where the I-95 Express Lanes opened in December 2014. In terms of reliability, in five locations travel time reliability improved, 14 locations stayed the same, and in 18 locations, reliability decreased.

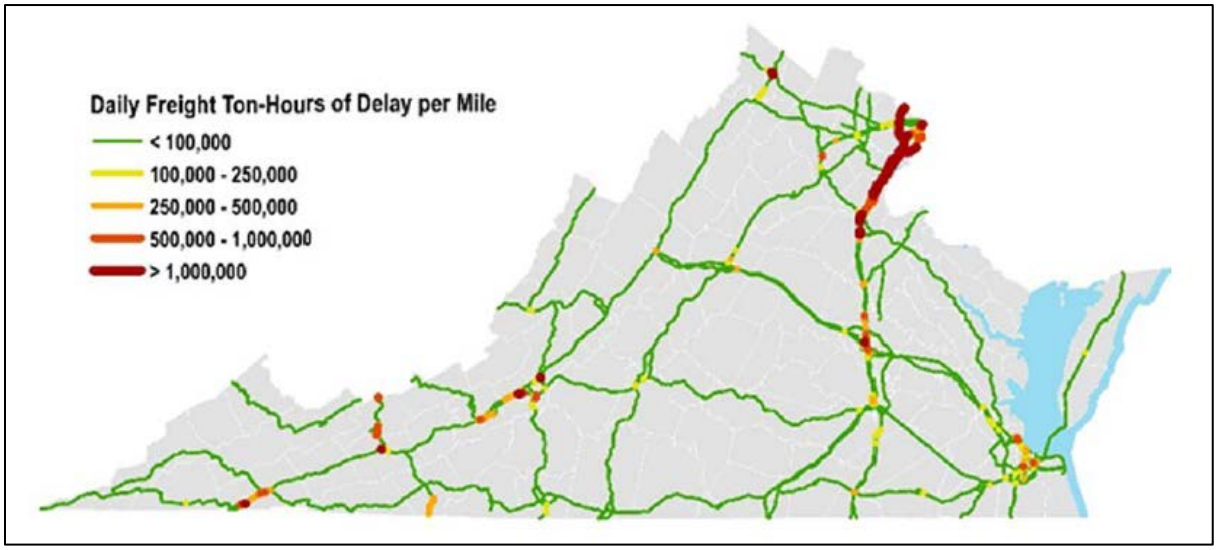
Table 2-2: Truck Freight Bottlenecks in Virginia – 2012 Statistics

Virginia Truck Freight Bottlenecks	2012 Statistics
Number of CoSS Bottlenecks: *Segments>250k Ton-Hours Per Mile*	37
Daily CoSS Freight Ton Hours of Delay: *In Bottlenecks>250k Ton-Hours Per Mile*	503,267,369
Average Daily Freight Ton Hours of Delay: *Per Bottleneck*	1,723,518
Total Daily CoSS Freight: *Ton-Hours of Delay*	605,433,431

Source: Annual Performance Report, 2017

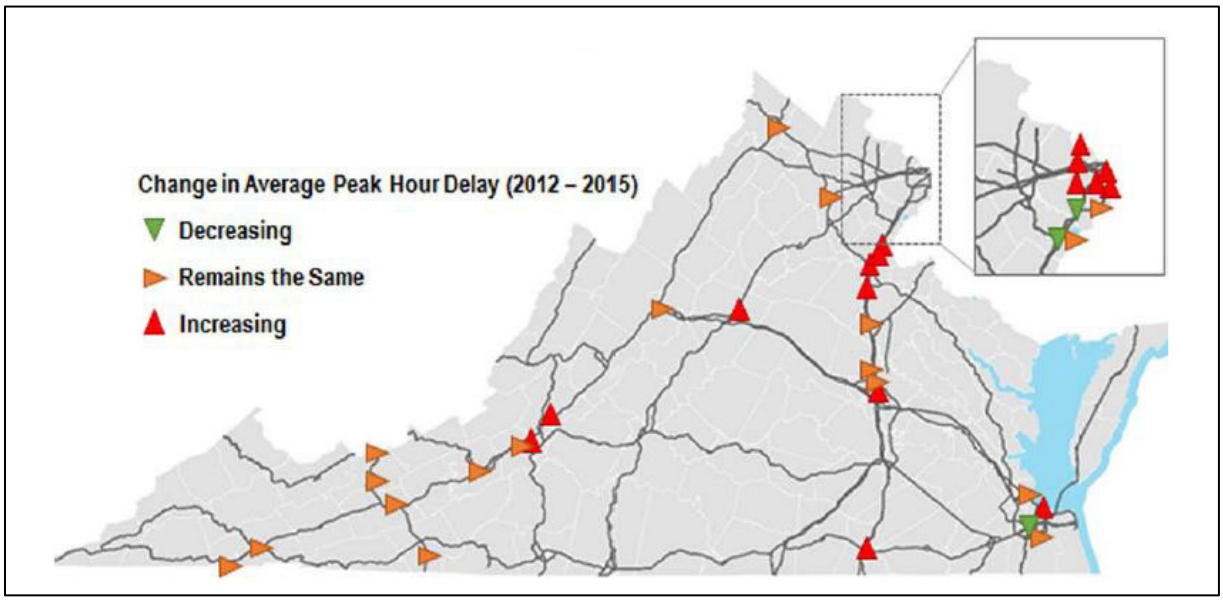
Figure 2-2 presents the Daily Freight Ton Hours of Delay across the Corridors of Statewide Significance in 2012 based on the IHS Transearch data and INRIX speed data. This represents baseline conditions. **Figure 2-3** presents the change in direction in average peak hour delay from 2012 to 2015 with each of the 37 bottlenecks as an indicator of where daily ton hours of delay are increasing or decreasing, independent of changes in tonnage.

Figure 2-2: Daily Freight Ton-Hours of Delay per Mile on Corridors of Statewide Significance in 2012



Source: Annual Performance Report, 2017.

Figure 2-3: Change in Average Peak Hour Delay between 2012 and 2015



Source: Annual Performance Report, 2017.

Metrics Indirectly Supporting Freight

Objective A.1:

Reduce the amount of travel that takes place in severe congestion

Measure:

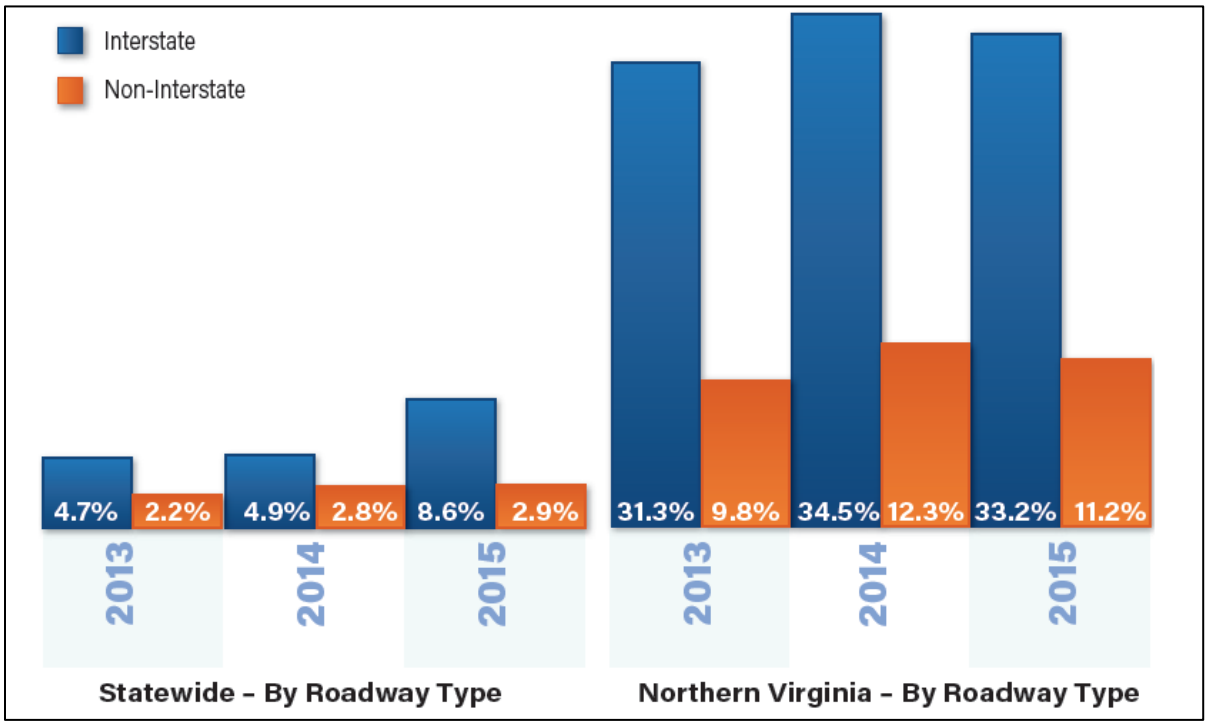
Percent peak hour VMT occurring in severely congested corridors

This is important as severe congestion increases the cost of mobility for everyone, including freight carriers, and reduces the efficiency and effectiveness of the transportation network. Subsequent losses of productivity due to severe congestion result in economic losses that impact the region's residents and businesses.

This measure identifies the amount of vehicle miles traveled (VMT) in severely congested conditions. Severe congestion is defined as when average speeds during the peak hour of travel are less than half of the 85th percentile speed (typically representative of the speed limit). For this measure, a lower value is better.

Figure 2-4 shows the estimated share of peak hour VMT occurring in severely congested conditions by year. Roadway segments (links) have been identified as severely congested when the ratio of 85th percentile speed to peak period speeds is 2.0.

Figure 2-4: Percent Peak-Hour Severely Congested VMT



Source: Annual Performance Report, 2017.

The statewide data show steady, year over year increases in percent of peak-hour, severely congested VMT. The most notable statewide increase, from 4.9 percent in 2014 to 8.6 percent in 2015, is on the interstate system. In comparison, in Northern Virginia, the percent of severely congested peak hour

VMT decreased by 1.2 percent in 2015 compared to 2014 on the interstate system. This is attributed, in part, to the opening of the I-95 Express Lanes in December 2014.

Objective A.3:

Improve reliability on key corridors for all modes

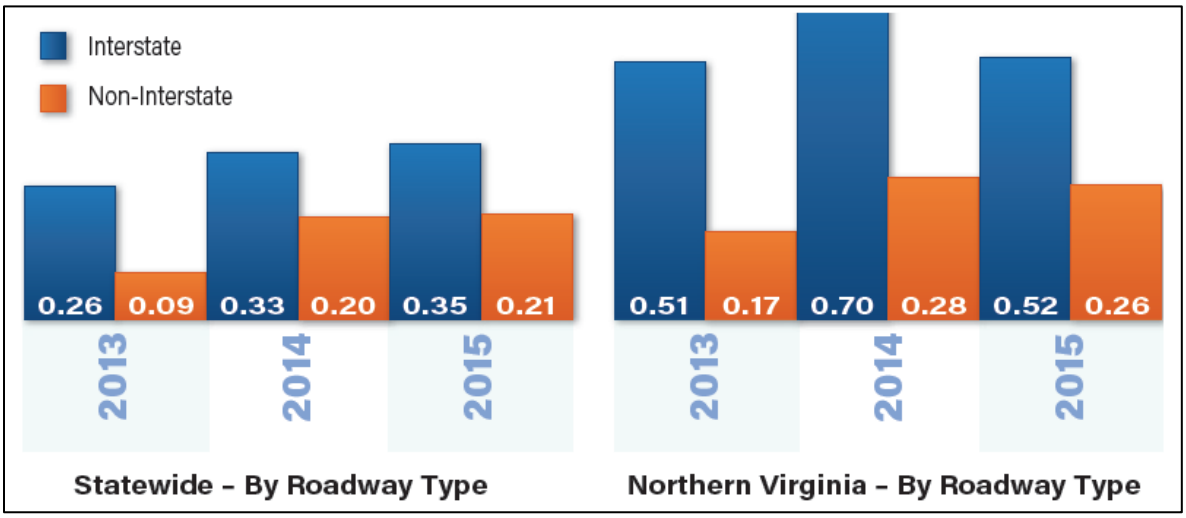
Measure:

Roadway buffer time index

Virginia tracks travel time reliability in order to understand the variability in traffic conditions experienced by passenger and commercial vehicles. Travel time reliability is important to all transportation system users across all modes. Freight carriers require predictable travel times in order to remain competitive; reliable travel times are correlated to improved safety and improved quality of life. Travel time reliability measures are used to better manage and operate transportation systems.

Roadway reliability is calculated using the Buffer Time Index (BTI), defined as the extra time (or time cushion) that travelers must add to their average travel time when planning trips to ensure on-time arrival. For example, a BTI of 0.20 means drivers would add 20 percent to their planned travel time. For this measure, a lower value is better. **Figure 2-5** shows the average BTI, by year, for interstates and non-interstates. The data suggest that interstate roadways have greater variability than non-interstate roadways. In 2015, statewide average BTIs were 0.35 on interstate roadways and 0.20 on non-interstate roadways. In comparison, in Northern Virginia, the average BTI in 2015 was notably higher than the statewide average, with 0.52 for interstate roadways and 0.26 for non-interstate roadways.

Figure 2-5: Buffer Time Index (BTI)



Source: Annual Performance Report, 2017.

The increase in Northern Virginia interstate BTI in 2014 and the decrease in 2015 is partially associated with construction of the I-95 Express Lanes and subsequent opening of the Express Lanes in December 2014.

Performance-Based Decision Making

Federal law established under MAP-21 and the FAST Act requires a transition to a performance-driven and outcome-based program. The purpose of performance-based decision making is to increase the transparency and accountability of states for their investment of federal tax dollars into transportation infrastructure. A performance-driven program provides a data-driven framework for improved project planning and investment decision-making processes that account for system reliability, economic vitality, and environmental sustainability.[1]

The FHWA has established national goals that states and local agencies can collectively work towards to address safety, infrastructure condition, congestion reduction, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays.[2]

In order to help states achieve these national goals, FHWA published final rules establishing performance measures for state departments of transportation (State DOT) and Metropolitan Planning Organizations (MPO) to use, as required, by the MAP-21 and the FAST Act. This is the first time all state DOTs and MPOs are required to track and report performance data using a national framework of consistent performance measures.

The measures must be used by State DOTs and MPOs to assess the performance of the Interstate and non-Interstate National Highway System (NHS) for the purpose of carrying out the National Highway Performance Program (NHPP); to assess freight movement on the Interstate System; and to assess traffic congestion and on-road mobile source emissions for the purpose of carrying out the Congestion Mitigation and Air Quality Improvement (CMAQ) Program.

State DOTs must establish two-year and four-year performance targets, as applicable, within one year of the effective date of final rule. Beginning January 1, 2018, State DOTs will be required to report to FHWA the condition, performance, and progress of transportation projects in performance reports. State DOTs are encouraged to coordinate with MPOs to establish consistent targets, to the maximum extent practicable. The FHWA will biennially assess each State DOT's progress toward achieving performance goals and use the data to more reliably assess the impacts of Federal funding investments.

Transportation agencies are encouraged to establish additional performance measures that are relevant to the goals in their transportation plan and that help them measure progress towards those goals. To better adapt performance-based planning to Virginia's freight goals and objectives and its unique freight transportation challenges, VDOT has developed the following performance measures and targets to consider for integration within its planning processes.

Relative to freight travel, the FHWA established one performance measure for state DOTs to adopt and implement in order to assess freight movement on the interstate system. This measure, Truck Travel Time Reliability (TTTR), represents the average reliability of reliable or uncongested truck travel for all reporting segments on the interstate system. The FHWA also determined data requirements and methods of calculation that are institutionalized in federal regulations issued in 2017. To assist states in implementing this performance measure, the FHWA provides state DOTs and MPOs free access to the

[1] https://www.federalregister.gov/articles/2014/06/02/2014-12155/statewide-and-nonmetropolitan-transportation-planning-metropolitan-transportation-planning#h-21.

[2] http://www.fhwa.dot.gov/tpm/about/goals.cfm

National Performance Management Research Data Set (NPMRDS) - a travel time data set that includes freight-only travel times. **Table 2-3** summarizes these draft performance measures as organized under various statewide freight transportation goals and objectives.

Table 2-3: Alignment of VTrans2040 and National Performance Management Measures

VTrans 2040 Freight Goal	Relevant National Performance Measure
▪ **Safety for All Users**	Number and rate of traffic fatalities
	Number and rate of serious injuries
	Number of non-motorized fatalities and non-motorized serious injuries
▪ **Proactive System Management**	Percentage of National Highway System bridges classified in good condition
	Percentage of National Highway System bridges classified in poor condition
	Percentage of interstate pavements in good condition
	Percentage of interstate pavements in poor condition
	Percentage of non-interstate National Highway System pavements in good condition
	Percentage of non-interstate pavements in poor condition
▪ **Healthy Communities and Sustainable Transportation Communities**	Air quality criteria emission levels in areas that have not met standards: Volatile Organic Compounds, Nitrous Oxides, Carbon Monoxide, and particulate matter (PM_{10}/$PM_{2.5}$)[3]
▪ **Economic Competitiveness and Prosperity** ▪ **Healthy Communities and Sustainable Transportation Communities**	Annual hours of peak hour excessive delay per person[4]
▪ **Economic Competitiveness and Prosperity** ▪ **Proactive System Management**	Truck Travel Time Reliability on the Interstate System

[3] Greenhouse gas emissions measure had not been determined at the time of this writing

[4] For areas over 1 million population by 2018 and 200,000 population, in 2022 and beyond

3. Virginia Freight Transportation Assets

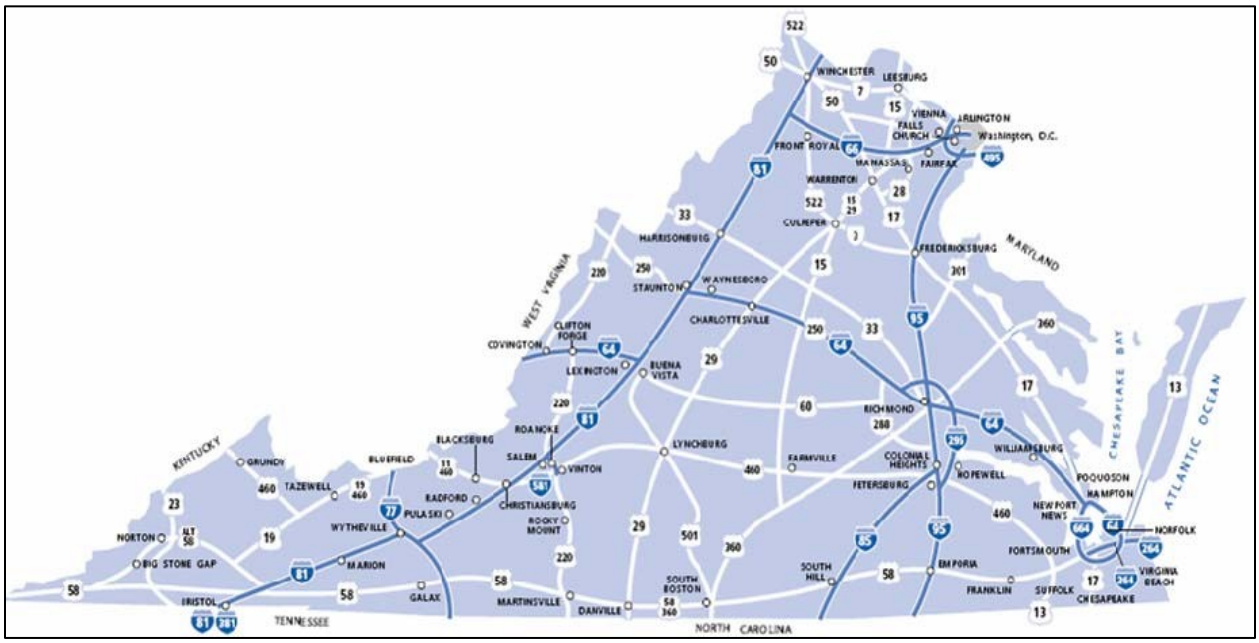
Virginia's freight network is inclusive of highway, rail, ports and waterways, airports, and pipelines across the Commonwealth. The following infrastructure assets are critical to the economic well-being of the state.

Highway Assets

Virginia's street network includes nearly 68,500 miles of interstate, primary, secondary, urban, toll, and frontage roadways. VDOT is the owner-operator of approximately 85 percent of this network. The component that carries the most freight is the interstate system.[5]

Interstates 95 and 81 are major north-south corridors. I-95 runs from Florida to Maine and within Virginia, extends from the North Carolina border to Washington, D.C. and Maryland. I-81 runs from Tennessee to the Canadian border. Within Virginia, I-81 stretches from the Tennessee border to the West Virginia border, serving the western portion of the state from Bristol to Winchester. I-64 provides an east-west connection across the state from West Virginia to the Hampton Roads region, terminating in Chesapeake. **Figure 3-1** displays the state's major interstates and highways.

Figure 3-1: Virginia's Interstate and Primary Highway Network



Source: Virginia Statewide Multimodal Freight Study, Phase I, 2009.

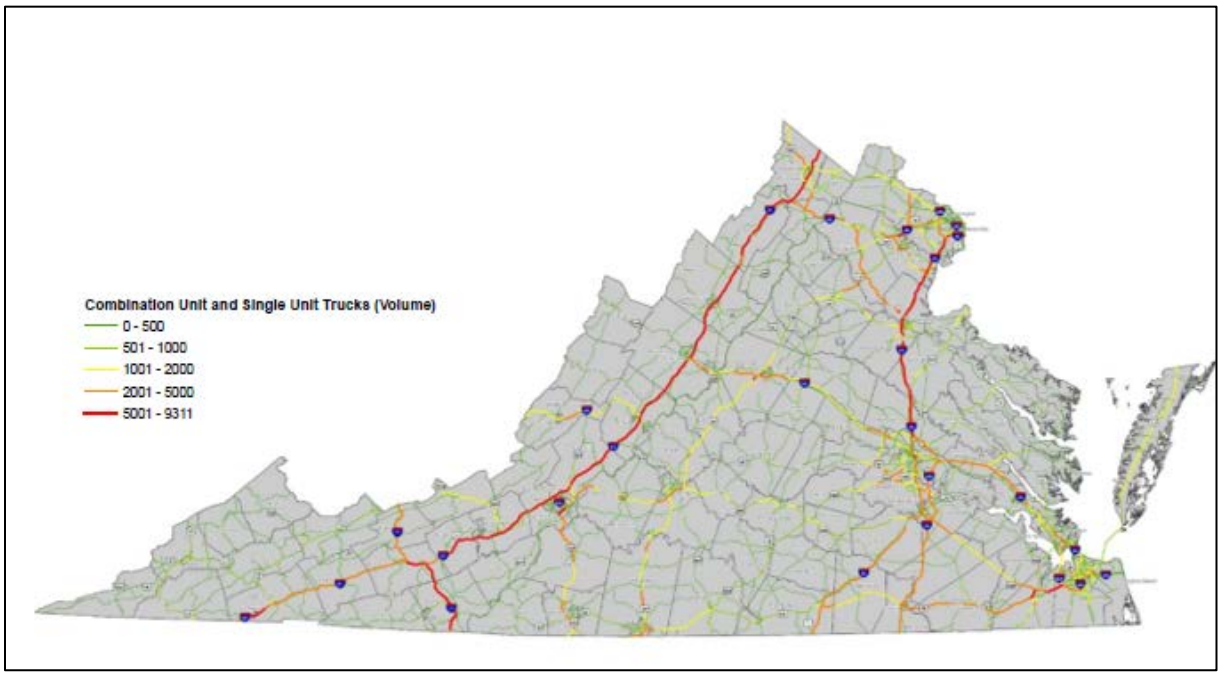
Truck Counts

Figures 3-2 and 3-3 show the average annual daily traffic counts of all truck types (combination unit and single unit) and the corresponding average truck percentages. I-81, I-77, and I-95 are the most heavily

[5] Virginia Department of Transportation, "Virginia's Highway System" www.virginiadot.org/about/vdot_hgwy_sys.asp. Accessed October, 2016.

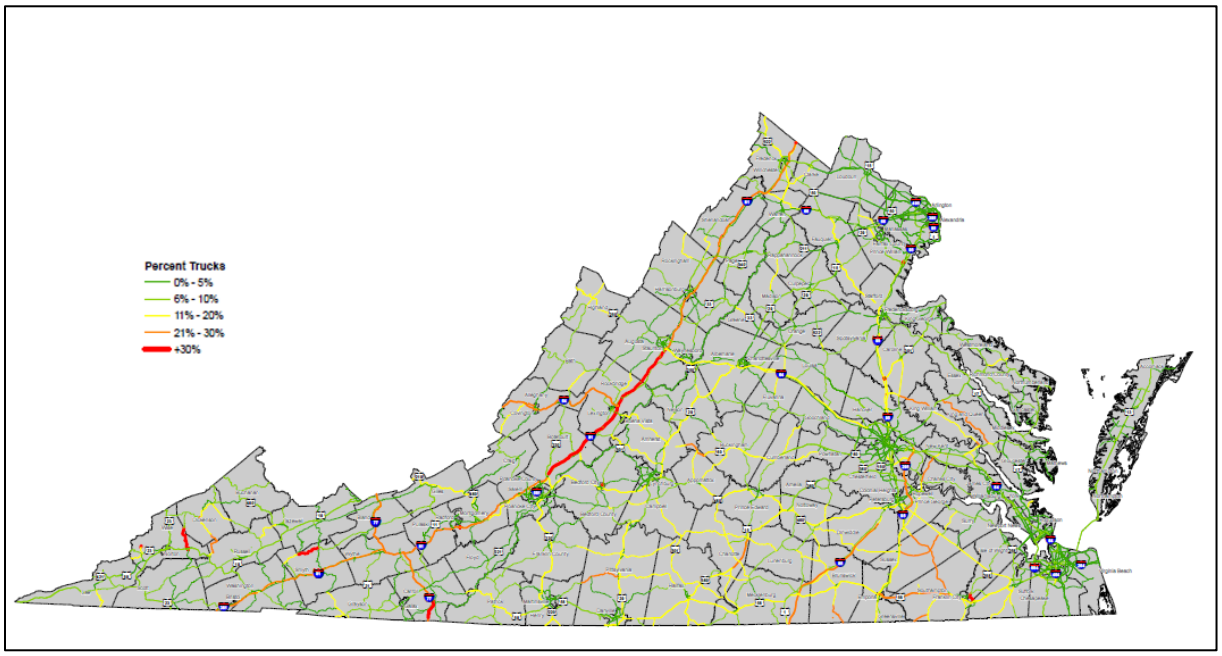
traveled roadways, whereas I-81, I-77, and I-64 from West Virginia to the I-81 interchange have the greatest proportion of truck traffic.

Figure 3-2: Average Annual Daily Truck Traffic Counts within Virginia



Source: Prepared by CDM Smith based on VDOT, 2015 AADT 2015 data.

Figure 3-3: Truck Percentage on Virginia Roadways



Source: Prepared by CDM Smith based on VDOT, 2015 data.

Railroad Assets

The Virginia freight railroad network consists of nearly 3,400 rail miles with the two Class I railroads — the Norfolk Southern (2,020 miles) and CSX (850 miles) operating the majority of those miles. There are no Class II railroads and nine Class III short line railroads in Virginia. The major rail lines run north-south and east-west. The rail network provides service and access to key nodes across the Commonwealth including Norfolk, Richmond, Lynchburg, Roanoke, and Alexandria. **Table 3-1** shows the number of miles by railroad in Virginia.

Table 3-1: Rail Mileage in Virginia (2012)

Railroad	Total Miles Owned	Percent of Total Virginia Rail Network Owned	Miles Leased/Operated Under Contract or Trackage Rights[1]	Total Miles Operated
Class I Railroads				
CSX Transportation *See Note (a) below*	958	31.54%	263	1,051
Norfolk Southern Railway (NS)	1,883	62.00%	107	1,990
Subtotal (Class I)	**2,841**	**93.54%**	**370**	**3,041**
Class III Railroads (Short Line RR)				
Bay Coast Railroad (BCR)	58	1.91%	10	68
Buckingham Branch Railroad (BB)	17	0.56%	267	284
Chesapeake & Albemarle Railroad (CA)	0	0.00%	18	18
Chesapeake Western Railway (CHW)	43	1.42%	0	43
Commonwealth Railway	17	0.56%	0	17
Norfolk & Portsmouth Belt Line Railroad (NPB)	11	0.36%	15	26
North Carolina & Virginia Railroad (NCVA)	3	0.10%	0	3
Shenandoah Valley Railroad (SV)	20	0.66%	0	20
Winchester & Western Railroad (WW)	27	0.89%	0	27
Subtotal (Class III)	**196**	**6.46%**	**310**	**506**
Virginia Rail Network Total	**3,037**	**100.00%**	**680**	**3,547**
[1] Trackage rights allow one railroad to operate over the infrastructure of another railroad.				

Source: Virginia Statewide Rail Plan, 2017

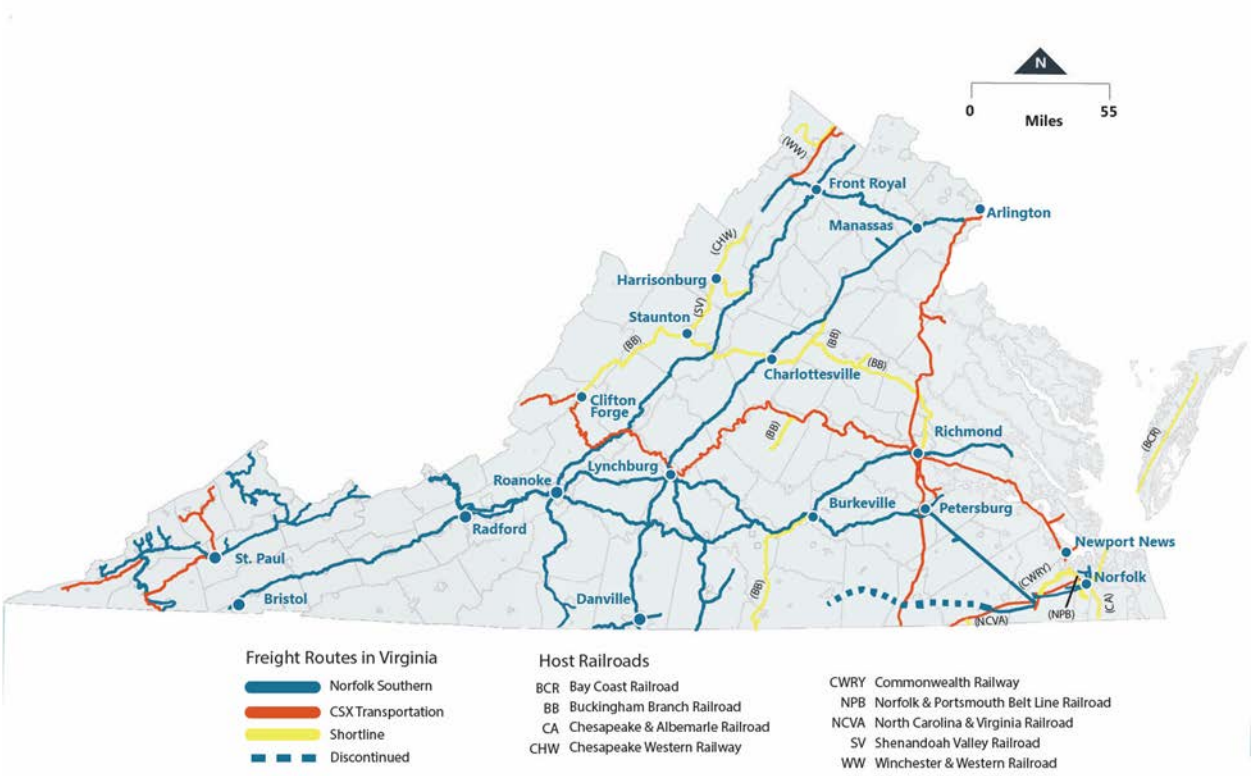
Virginia's rail network is entirely privately owned, as are the terminals, locomotives, and railcars. Virginia's rail freight traffic can be generally classified among four types of train service based on the commodity being carried and the type of operation[6]:

1. Auto Train Service – For assembled automobiles, vans, and trucks moving in multilevel cars;
2. Bulk Train Service – For grain, coal, and similar bulk commodities moving in unit trains;
3. Intermodal Train Service – For commodities moving in containers or truck trailers on flat cars or specialized intermodal cars; and
4. General-Merchandise Train Service – Everything else, including commodities moved in box cars and tank cars.

The length of trains, as measured by the number of cars, varies by the type of train. Typically, auto trains consist of between 55 to 60 cars, bulk trains about 85 cars, general merchandise around 80 cars, and intermodal trains about 110 cars per train[7]. The major freight rail corridors are shown in **Figure 3-4**.

[6] Association of American Railroads, *National Rail Freight Infrastructure Capacity and Investment Study*, 2007.
[7] Ibid.

Figure 3-4: Virginia's Freight Rail Network



Source: Virginia Department of Rail and Public Transportation, 2017.

CSX Transportation

CSX Corporation and its rail, intermodal, and rail-to-truck transload services provide traditional rail service for the transport of intermodal containers and trailers. CSX owns 958 miles and operates over a total of 1,051 miles of rail in Virginia through negotiated trackage rights. CSX's north-south intermodal mainline in Virginia is known as the National Gateway Corridor, generally paralleling I-95. This route provides service from Alexandria to Richmond and then farther south via Petersburg and Emporia. At Weldon, south of the Virginia/North Carolina border, this mainline has an eastward extension to the Port of Virginia facilities in Hampton Roads.

The National Gateway Corridor is the primary intermodal train corridor connecting the Port of Virginia to national markets and is currently being improved to handle double-stack intermodal

trains[8]. The CSX line with the heaviest use is the coal corridor along the Buckingham Branch Railroad, which carries east-west unit trains of coal from the Appalachian coalfields through Richmond, eastward to the Virginia Peninsula to the CSX-served Coal Marine Terminals in Newport News. After delivering its cargo, the empty coal trains return westward, back to the mines.

Norfolk Southern

Norfolk Southern Corporation (NS), through its Norfolk Southern Railway subsidiary, owns 1,883 miles and operates on a total of 1,990 miles of track in Virginia, through negotiated trackage rights. NS serves all major eastern ports and connects with rail partners in the West and Canada. NS operates two intermodal corridor routes in Virginia. NS's north-south intermodal mainlines in Virginia are known as the Crescent Corridor. One segment runs through Virginia from Hagerstown, Maryland, southward through Front Royal, Manassas, and Danville to the Carolinas (the Piedmont line). The Crescent Corridor second mainline segment parallels I-81 from Hagerstown, Maryland, through Front Royal, Roanoke, and Bristol (the Shenandoah line) and serves the Commonwealth's Virginia Inland Port near Front Royal.

NS's east-west intermodal mainline in Virginia, known as the Heartland Corridor, runs from the Port of Virginia, through Roanoke, to the West Virginia border in Southwest Virginia and then to Midwest markets in Ohio, Illinois, and other states. The Heartland Corridor is the primary NS international intermodal train corridor connecting the Port of Virginia to national markets. The line with the heaviest use is the Coal Corridor that carries east-west unit trains of coal from the Appalachian coalfields to the NS Coal Marine Terminal at Lamberts Point in Norfolk. The Coal Corridor is a dual-line section consisting of the former Virginian Line and the Norfolk and Western Line from the coalfields to Abilene, where both lines merge to continue eastward to Norfolk.

Short Line Railroads

Short lines have become a critical component of the rail industry and produce benefits to shippers and local communities trying to support economic development. Short lines often serve as the first or last link in business-to-business delivery by providing the intensive switching operations that are not profitable for the Class I railroads. The nine short line railroads which collectively operate 506 route-miles in the Commonwealth are briefly described below.

Bay Coast Railroad

Bay Coast Railroad (BCR) operates the former Eastern Shore Railroad line. BCR operates from Norfolk, Virginia to Pocomoke City, Maryland. The rail line is unique in its ability to handle special over-height and over-width rail shipments that could not be accommodated on the NS and CSX main line corridors because of tunnel and bridge restrictions. BCR consists of 68 miles of track and an unused 26-mile car float (ferry) operation from Cape Charles to Virginia Beach. BCR interchanges with NS and Norfolk & Portsmouth Belt Line Railroad in Norfolk and NS in Pocomoke City, Maryland. BCR is headquartered in Cape Charles. The major commodities hauled include chemicals, gas, grain, paper, aggregates, cement, and hi-wide shipments.

Buckingham Branch Railroad

Buckingham Branch Railroad (BB) is a family-owned short line railroad operating 284 miles of historic track in Central Virginia. The Bryant family owns and operates a 17.3-mile-long line between Dillwyn and

[8] Virginia Statewide Rail Plan, 2013.

Bremo known as the Buckingham Division. BB also leases and operates a 200-mile-long line of railroad from Richmond to Clifton Forge, owned by CSX. The company's headquarters is in Dillwyn, in a former Chesapeake and Ohio Railroad station, a historic landmark in the community. In addition, BB leases and operates an approximately 56-mile line from NS between Burkeville and Clarksville. This former section of Southern Railway's Richmond Division is known as the Virginia Southern Division.

The BB receives freight cars from CSX at Strathmore on the Buckingham Division and at Doswell and Clifton Forge. It also receives railcars from NS at Charlottesville, Orange, and Waynesboro on the Richmond Alleghany Division. The Shenandoah Valley Railroad also interchanges (or exchanges) freight cars with the BB at Staunton.

The portion of the line between Clarksville and Oxford, North Carolina is owned by NS. It has not been in use for more than a decade and has not been maintained. The Virginia Southern Division is located in Keysville and interchanges with NS at Burkeville.

Chesapeake & Albemarle Railroad

Chesapeake & Albemarle Railroad (CA) is a short line railroad and is part of the North Carolina and Virginia Railroad (NCVA), which is owned by Genesee & Wyoming, Inc. CA started operations on April 2, 1990, and operates on 82 miles of track from Chesapeake to Edenton, North Carolina. CA operates 18 miles of rail in Virginia along this route. It is headquartered in Ahoskie, North Carolina, and interchanges with both NS (at Chesapeake) and CSX (at Portsmouth). CA was spun off from NS operations in the 1980s as part of its Thoroughbred Short Line Program.

Chesapeake Western Railway

Chesapeake Western Railway (CHW) is an intrastate railroad operating subsidiary of NS, including 43 miles of track, located in west-central Virginia. The CHW has a north-south line which extends between Broadway and Pleasant Valley and an east-west line which extends between Elkton and Harrisonburg. The two lines intersect in Harrisonburg. The CHW recently abandoned a portion of the line from Broadway to Mt. Jackson.

Commonwealth Railway

Commonwealth Railway (CWRY) is a short line railroad operating 17 miles of track of the former Norfolk, Franklin and Danville Railway line from Suffolk to Portsmouth. Its local office is in the Wilroy area of Suffolk. CWRY is owned by Genesee & Wyoming, Inc. CWRY was spun off from NS in the 1980s as part of its Thoroughbred Short Line Program. In May 2008, CWRY purchased the remaining interest in the line from NS with funding assistance from the DRPT's Rail Enhancement Program. From 2007 to 2009, the Port of Virginia (POV) and CWRY worked to complete the Commonwealth Railway Mainline Safety Relocation Project. This project removed 4.5 miles of railway with 14 at-grade crossings traveling through the densely-developed areas of Chesapeake and Portsmouth to the Virginia International Gateway (VIG) terminal at the POV in Portsmouth. The heavily used rail corridor was relocated to the median of Route 164, which had been constructed in the 1980s anticipating the need for a freight rail corridor in the future.

CWRY is the primary rail carrier to the VIG terminal in Portsmouth and provides double-stack rail service to VIG and the future Craney Island Marine Terminal under construction by the POV. The mainline relocation improvements allow CWRY to continue to serve with a high-density freight rail with improved safety and less community traffic interference.

CWRY provides competitive dual Class I railroad access to the marine terminals and industries in Portsmouth, with rail connections to both NS and CSX near Suffolk. CWRY also operates a new rail marshalling yard near Suffolk to assemble intermodal train segments from the VIG terminal into full unit trains for transit to various inland locations.

Norfolk & Portsmouth Belt Line Railroad

Norfolk & Portsmouth Belt Line Railroad (NPBL) is a short line railroad that has operated in Norfolk, Portsmouth, and Chesapeake since 1898. It is a terminal switching company that owns 26 miles of track (plus 27 miles of trackage rights) and links commerce around the deep water port from Sewells Point to Portsmouth Marine Terminal, including the Southern Branch of the Elizabeth River. The NPBL is jointly owned by NS, with 57 percent of the railroad and which leases the locomotives for use by the company, and CSX, with 43 percent. NPBL provides dual access including interchanges with CA, CSX, BCR (formerly the Eastern Shore Railroad), and NS. Some of the Belt Line's customers are A & R Logistics, Portsmouth Marine Terminal, ARREFF Terminals, Elizabeth River Terminals, and Perdue Agribusiness.

North Carolina & Virginia Railroad

North Carolina & Virginia Railroad (NCVA) is a 54-mile short line switching railroad owned by Genesee & Wyoming, Inc., that started in 1987 on the former Seaboard Coast Line Railroad from Boykins to Tunis, North Carolina. NCVA operates 3 miles of rail in Virginia from Boykins to the North Carolina state line. It is headquartered in Ahoskie, North Carolina, and interchanges with CSX in Boykins.

Shenandoah Valley Railroad

Shenandoah Valley Railroad (SV) is a privately owned short line railroad which extends from Staunton in Augusta County through Rockingham County to Pleasant Valley, a total of 20 miles. The line was originally built by the Baltimore & Ohio Railroad and later purchased in 1942 by the Chesapeake Western Railway. The new short line was formed in 1993 by several major shippers who adopted the old historic name. SV is operated under contract by the Durbin & Greenbrier Valley Railroad (DGVR). DGVR also operates four excursion trains on scenic routes in nearby West Virginia. The railroad interchanges with BB in Staunton, and with NS in Pleasant Valley.

Winchester & Western Railroad Co.

Winchester & Western Railroad Co. (WW) is Virginia's oldest operating short line, beginning operations in 1917. The 54-mile FRA Class III railroad, with 27 miles of rail in Virginia, operates between Gore and Winchester and from Winchester, up though the Eastern Panhandle of West Virginia, to Hagerstown, Maryland. WW is exclusively a freight line with connections to CSX and NS.

Strategic Rail Corridor Network

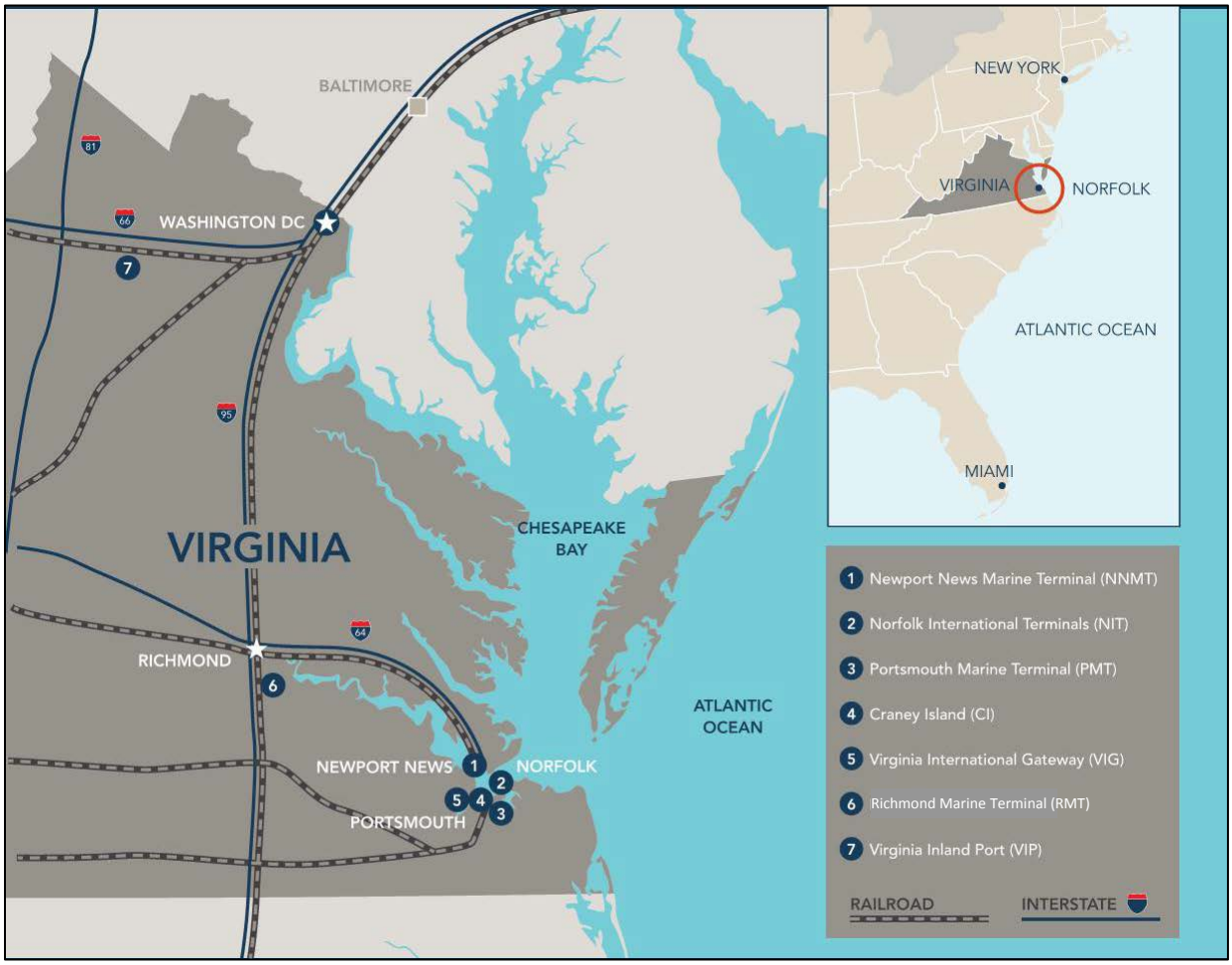
The Strategic Rail Corridor Network (STRACNET) is a program under the Department of Defense's Railroad and Highways for National Defense program to ensure the nation's rail and highway infrastructure can respond to defense emergencies. STRACNET consists of 38,800 miles of rail lines that are important for national defense and provide service to 193 defense installations. The program integrates defense rail needs into railroad civil sector planning. As a practical matter for rail network planning, a STRACNET-designated rail line requires that it maintain clearances of at least 16.92 feet vertically and 12 feet horizontally. Because STRACNET width requirements exceed the width of most passenger coaches, raised passenger station platforms on STRACNET rail lines must be constructed in such a way that they do not conflict with STRACNET requirements. Wide-load trains must be able to

route around obstructions (such as on another track), raised station platforms must be constructed so that the edges can be flipped up in case of national emergency, or trains should be able to shift away from station platforms (such as through gauntlet tracks).

Port and Waterway Assets

The Port of Virginia consists of an inland intermodal ramp (the Virginia Inland Port), an upriver barge terminal (Richmond Marine Terminal), and four deep-water marine terminals: Norfolk International Terminals, Newport News Marine Terminal (NNMT), Virginia International Gateway (VIG), and Portsmouth Marine Terminal (PMT). In addition, a seventh facility, Craney Island (CI) is currently under construction. Their locations are shown in **Figure 3-5**.

Figure 3-5: The Port of Virginia Facilities



Source: Port of Virginia 2015 Annual Report.

The Virginia Port Authority (VPA) owns and operates through its private subsidiary: Virginia International Terminals LLC (VIT), the Virginia Inland Port (VIP), NIT, NNMT, and PMT. VIG is privately owned by Alinda Capital Partners and Universities Superannuation Scheme Limited, and is leased to the VPA. The Richmond Marine Terminal (RMT), previously known as the Port of Richmond, is owned by the City of Richmond and leased to the VPA.

The VIP, one of several intermodal facilities in Virginia, is a rail-truck container transfer facility located in Front Royal, Virginia, approximately 60 miles west of Washington, D.C. VIP is situated on 161 acres and has a capacity of 78,000 TEUs (20-Foot Equivalent Units, a standard measure for container cargo capacity).[9] VIP includes 17,820 feet of rail track, which provides access through Norfolk Southern to NIT and VIG, and is accessible via I-66 and I-81.

RMT is a container, break-bulk, and bulk terminal located on nearly 121 acres along the James River in Richmond, Virginia. RMT includes a 1,570-foot long wharf and 7,775 linear feet of rail track on site. It has a capacity of up to 60,000 TEUs. RMT is connected to the overall freight network through CSX and Norfolk Southern rail (the latter via a local switch) and I-95. Break bulk cargo or general cargo is not loaded in containers but rather as individual pieces or on pallets.

NIT, situated on 567 acres, is the VPA's largest container terminal, located along the Elizabeth and Lafayette Rivers in Norfolk, Virginia. NIT is divided into three major sections: the South Terminal (272 acres), North Terminal (245 acres), and the Central Rail Yard (50 acres). It includes six 50-foot berths, 14 Super Post-Panamax ship-to-shore cranes, 6,600 linear feet of wharf, and 18,000 linear feet of working track. NIT has a capacity of 1,426,800 TEUs. It has direct Norfolk Southern rail access, and CSX rail access via the Norfolk & Portsmouth Belt Line (NPBL). NIT is located adjacent to I-64 and I-564.

NNMT is the VPA's main break-bulk and roll-on/roll-off facility. It is located on 165 acres along the James River in Newport News, Virginia. The facility contains nearly 3,000 linear feet of wharf and 33,900 linear feet of rail. Access to the overall freight network is given through CSX on-dock rail service, with the ability to transfer to Norfolk Southern in Richmond. The facility is located off of I-664. Roll-on/roll-off capability allows freight (such as cars and trucks) to be driven between the ship and the terminal, rather than lifted on and off.

VIG is a semi-automated container terminal situated on 231 acres along the Elizabeth River in Portsmouth, Virginia. VIG contains three 50-foot berths, eight Super Post-Panamax ship-to-shore cranes, and an on-dock rail yard with 13,200 linear feet of working track. It has a capacity of 1,131,000 TEUs. Access is given through Commonwealth Railway, with on-dock connections to Norfolk Southern and CSX, I-64, and I-664. It is the largest privately-owned marine terminal in the U.S. Post-Panamax ships can be more than twice as large as the typical cargo ship in operation in 2000, and require larger berths, more powerful cranes, and deeper channels than older vessels.

PMT occupies 287 acres of land along the Elizabeth River in Portsmouth, Virginia. It is a container/mixed-use terminal. PMT includes two 43-feet deep berths, 3,540 feet of wharf, and six Post-Panamax ship-to-shore cranes. Access to the intermodal freight network is given through CSX and Norfolk Southern rail (the latter through the NPBL interchange), and I-264 and I-664.

Craney Island (CI) is designed to be a semi-automated container terminal to be built on reclaimed land created as part of the Craney Island Eastward Expansion project, which constructs additional dredged material storage cells at the U.S. Army Corps of Engineers' Craney Island Dredged Material Management

[9] Port of Virginia facility capacities obtained through Port of Virginia Facilities Specs, accessed: www.portofvirginia.com/facilities

Area (CIDMMA). CI is to have dual rail access to both Norfolk Southern and CSX and road access to I-164 (**Figure 3-6**). The initial phase of the terminal is anticipated to open sometime between 2030 and 2040.

Figure 3-6: Planned Craney Island Road and Rail Connections

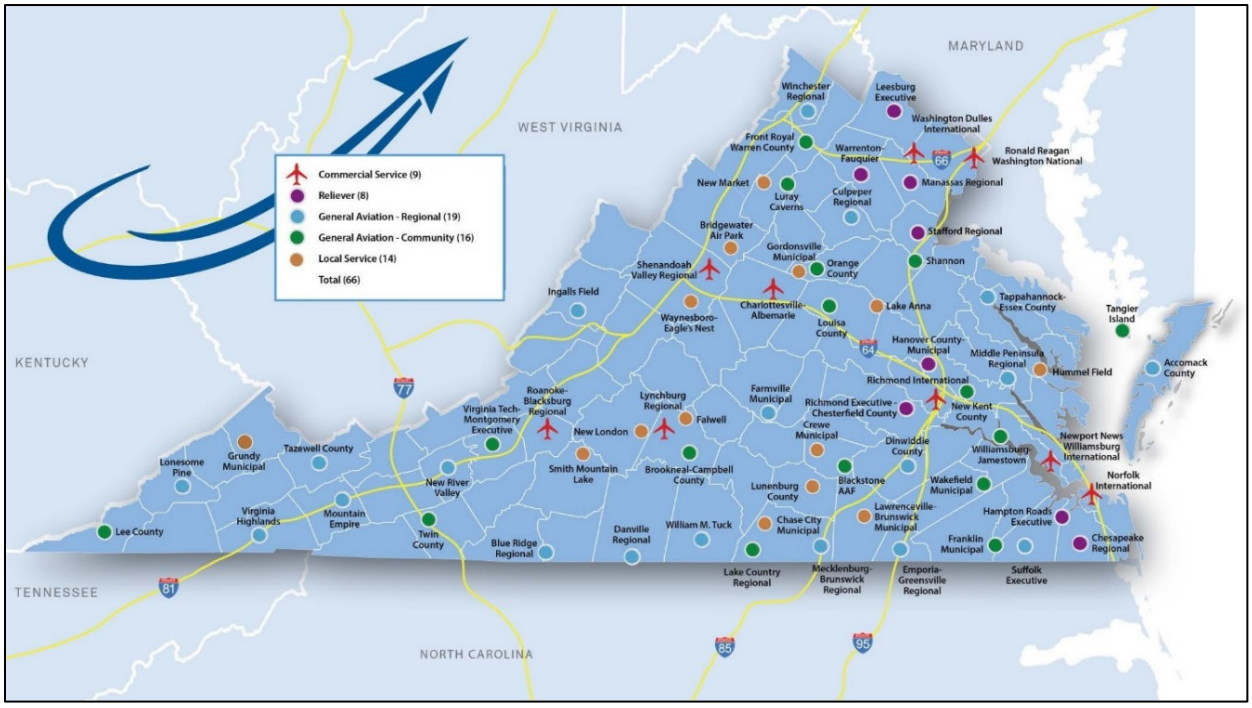
Source: Master Rail Plan for the Port of Virginia, April 16, 2015.

Aviation Assets

There are 66 airports within the Commonwealth of Virginia. As shown in **Figure 3-7**, nine of these airports are commercial service airports.

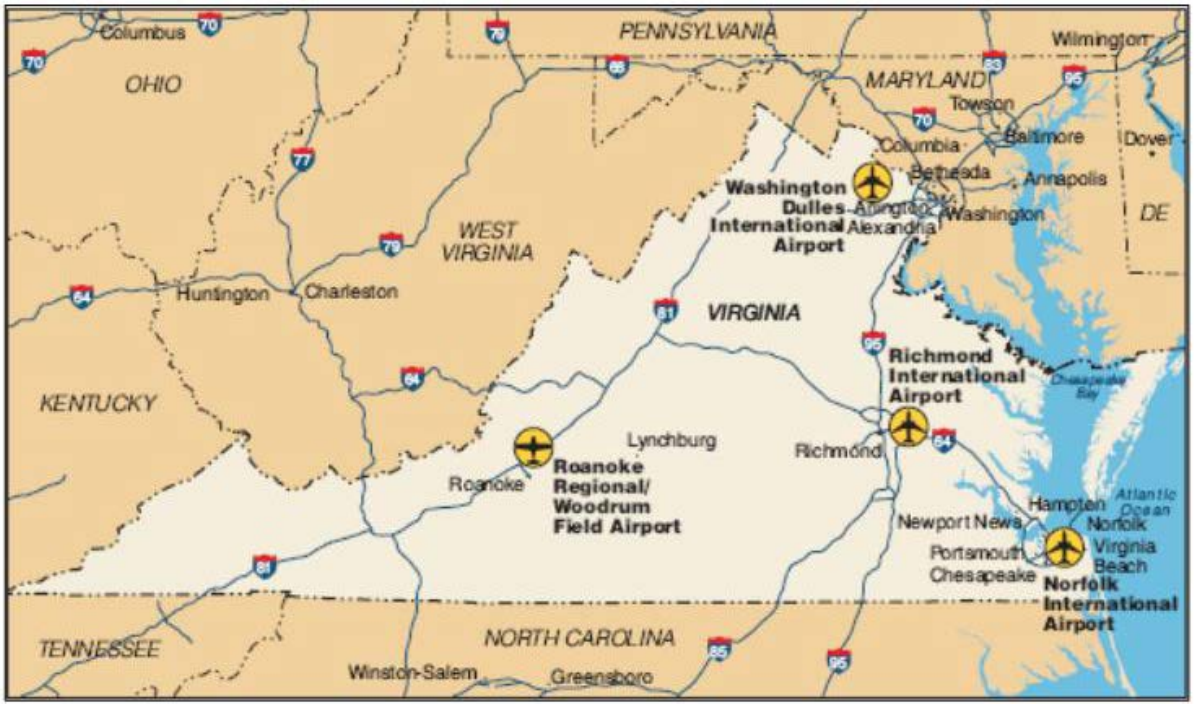
Of these airports, Virginia is served by four main cargo airports: Washington Dulles International Airport, Richmond International Airport, Norfolk International Airport, and Roanoke-Blacksburg Regional/Woodrum Field Airport (ROA), as shown in **Figure 3-8**.

Figure 3-7: Virginia's Existing Air Transportation Network



Source: Virginia Air Transportation System Plan Update, April 6, 2016.

Figure 3-8: Virginia's Significant Cargo Airports



Source: Virginia Multimodal Freight Plan, September 30, 2014.

Pipeline Assets

Approximately 44,700 miles of pipelines move natural gas, crude oil, and petroleum products throughout Virginia. The pipeline mileage carrying each commodity type is shown in **Table 3-2**. The USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA) regulates pipeline transport while the Office of Pipeline Safety (OPS) within PHMSA inspects and enforces interstate and intrastate (highly volatile only) pipeline safety regulations and certifies state representatives, through the Virginia State Corporation Commission, for intrastate gas pipeline inspection.

Table 3-2: Virginia Pipeline Mileage by Commodity

Commodity	Pipeline Miles
Natural Gas	43,589
Distribution	40,380
Gathering	25
Transmission	3,185
Refined Products	1,135
Total	**44,724**

Source: USDOT, Pipeline Data Mart, https://hip.phmsa.dot.gov/, *Accessed August 2016. Notes: Refined Products are petroleum products obtained by distilling and processing crude oil that are liquid at ambient conditions. Examples include gasoline, diesel, jet fuel, kerosene, and fuel oil.*

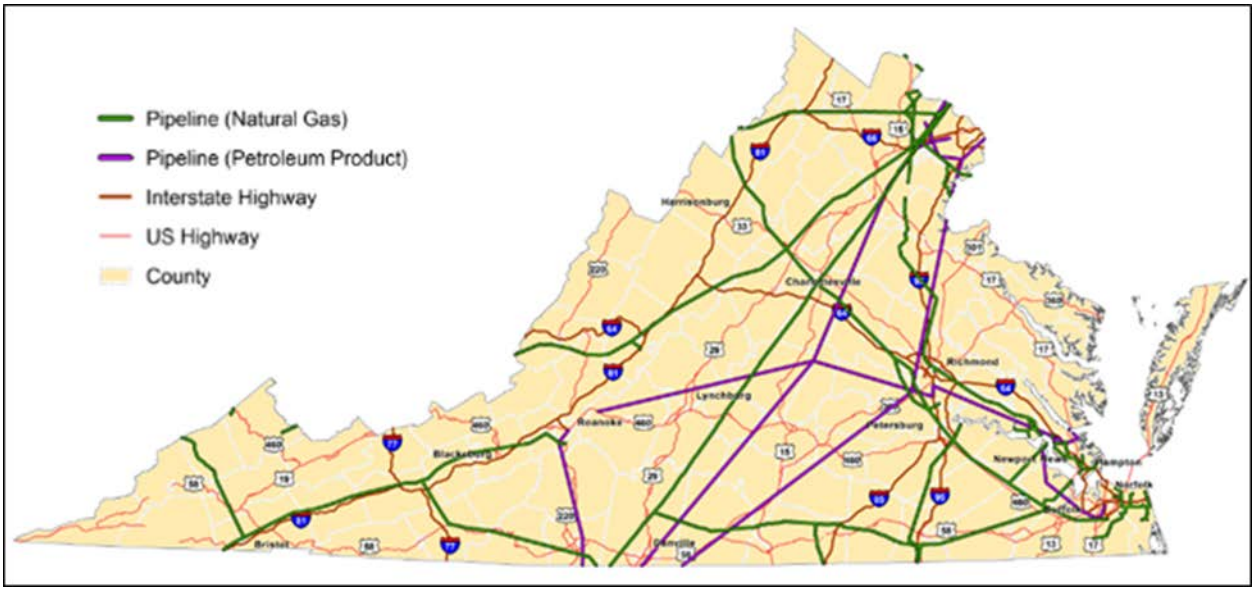
There are several major petroleum products and natural gas pipelines traversing the state, as shown in **Figure 3-9**. Two major petroleum product pipelines, the Colonial Pipeline and the Plantation Pipeline (Kinder Morgan), deliver refined petroleum products to locations in Virginia. The Colonial Pipeline reaches from Texas to New Jersey with several delivery locations in Virginia. The Plantation Pipeline runs from Louisiana and Mississippi to its terminus in northern Virginia near Washington, DC.[10] Virginia also receives petroleum products from overseas at its ports in Newport News and Norfolk.[11] The major gas pipeline owners include:

- Appalachian Natural Gas
- Columbia Gas Transmission Corporation
- Dominion Cove Point LNG LP
- Dominion Transmission Incorporated
- East Tennessee Natural Gas LLC
- Transcontinental Gas Pipeline
- Washington Gas and Light Company

[10] U.S. Energy Information Administration, Virginia State Energy Profile, www.eia.gov/state/print.cfm?sid=VA, Accessed: August, 2016.

[11] Ibid.

Figure 3-9: Major Pipelines in Virginia



Source: prepared by CDM Smith, based on U.S. Energy Information Administration data.

Virginia's natural gas fields are located in the southwestern corner of the state. In recent years, more than 70 percent of the state's natural gas production has come from coalbed methane wells drilled into coal-rich formations rather than from conventional natural gas reservoirs.[12] Two of Virginia's coalbed methane fields are among the nation's top 100 natural gas fields as ranked by proved reserves.[13]

Most of Virginia's natural gas supply is delivered by natural gas pipelines. Natural gas supplies come to Virginia from both the Gulf Coast and the Appalachian regions.[14] As a result of increased natural gas production in Pennsylvania, most of the natural gas enters the state from the north through Maryland. Almost half the natural gas passes through Virginia to parts of Maryland, North Carolina, and Tennessee.[15]

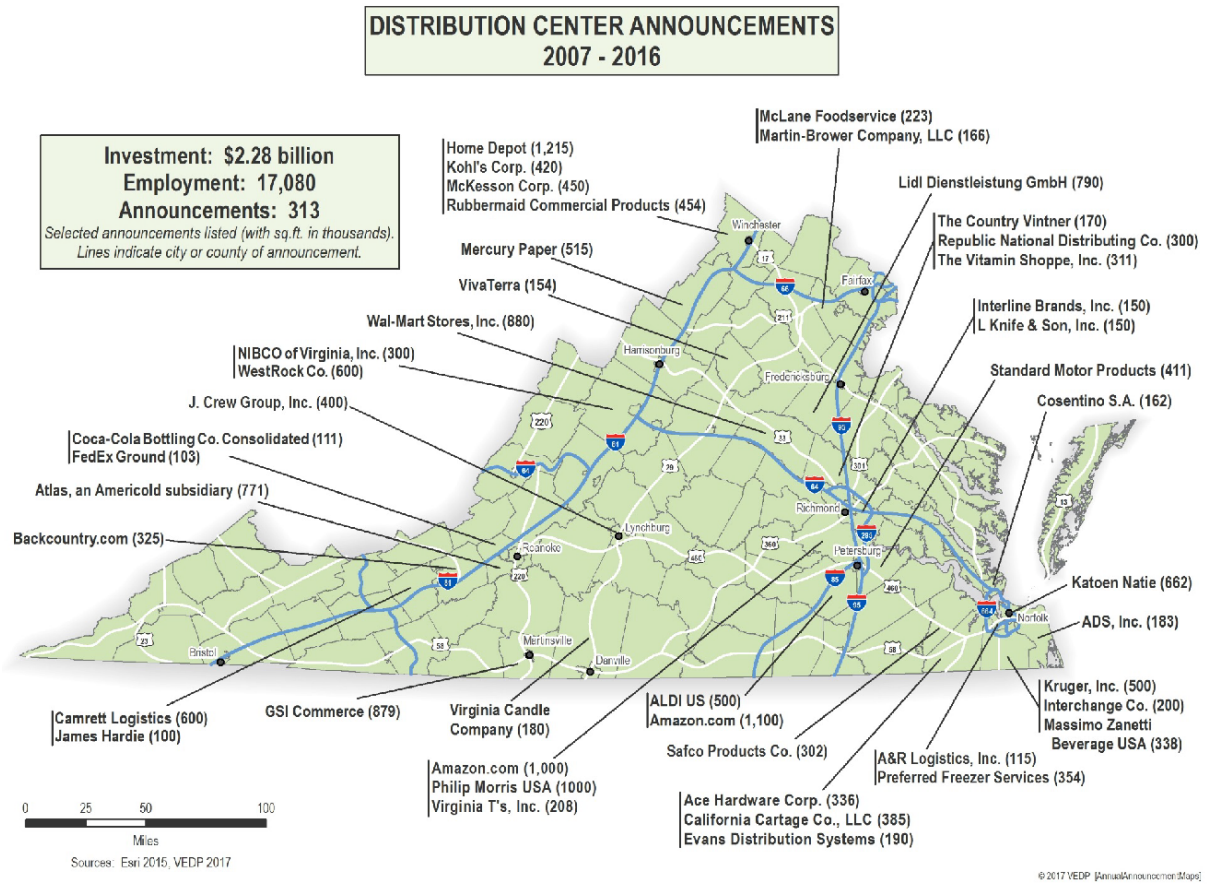
Warehouse/Distribution Facilities

Warehouse and distribution facilities focus on the storage and flow of goods – ensuring that commodities are inventoried and transported to local vendors. As of 2007, the Commonwealth had over 1,300 warehouses with nearly 100 million square feet of space.[16] Between 2007 and 2016, 313 distribution center announcements were listed, representing investment of $2.28 billion and employment of 17,080 (**Figure 3-10**).[17] The announcements, gathered by the Virginia Economic

[12] U.S. Energy Information Administration, Virginia State Energy Profile, www.eia.gov/state/print.cfm?sid=VA. Accessed August 2016.
[13] Ibid.
[14] Ibid.
[15] Ibid.
[16] Hampton Roads Planning District Commission, *Intermodal Management System Regional Freight Study,* April 2007.
[17] Distribution Center Announcements (Jobs), Virginia Economic Development Partnership, Virginia Logistics Profile 2016.

Development Partnership from state, regional and local partners, as well as published sources, represent the economic activity happening within the Commonwealth.

Figure 3-10: Distribution Center Announcements, 2007 – 2016

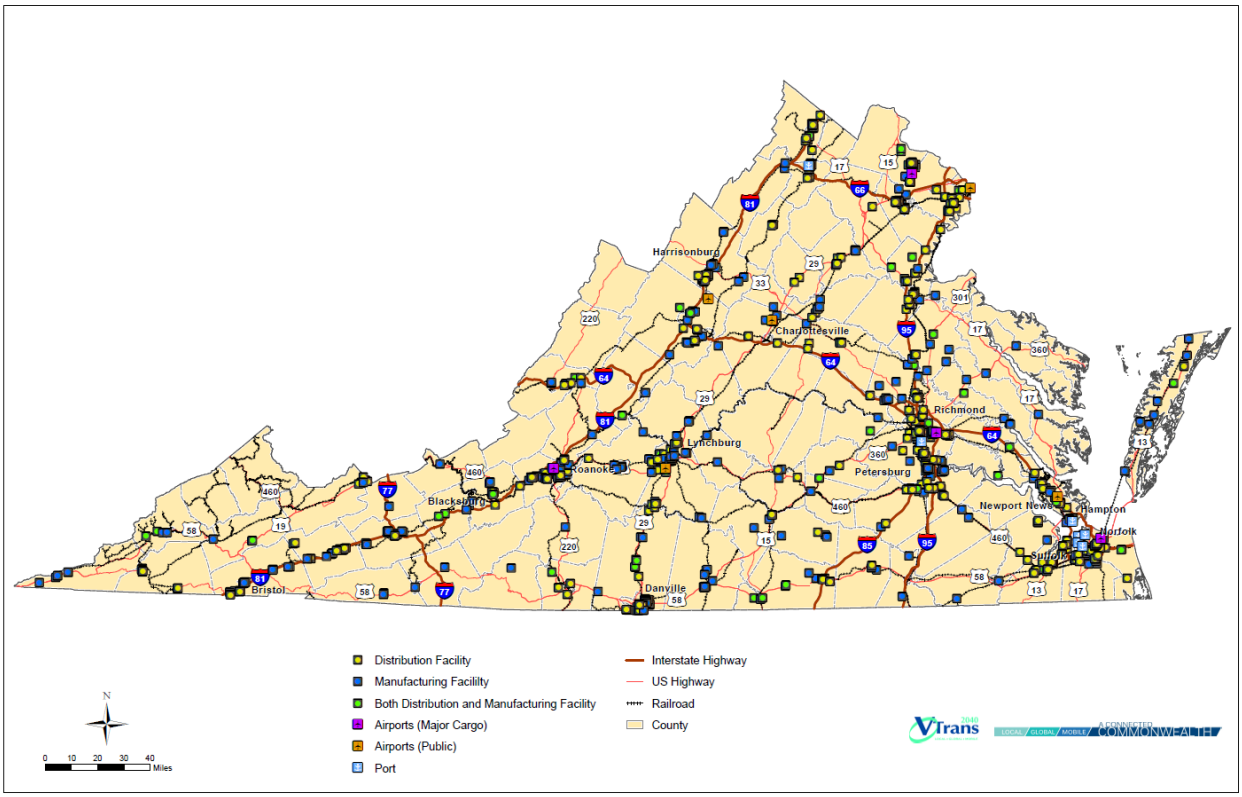


Source: Distribution Center Announcements (Jobs), Virginia Economic Development Partnership, Virginia Logistics Profile 2016.

Figure 3-10 demonstrates the square footage of a select group of soon-to-be or soon-to-expanded warehouse and distribution centers, as announced to the public between 2007 and 2016. In order to determine which facilities are currently located within the state, VDOT conducted a review of existing sources and aerial photographs. VDOT's preliminary data, which comprehensively documents warehouse and distribution center locations, revealed 1,064 warehouse and distribution center facilities within Virginia.[18] As **Figure 3-11** demonstrates, many warehouse/distribution facilities as well as manufacturing locations are concentrated around ports and airports, as well as along the I-81 and I-95 corridors.

[18] As of September 2016.

Figure 3-11: Warehouse/Distribution Centers and Manufacturing Locations in Virginia



Source: Prepared by CDM Smith based on Virginia Department of Transportation data, September 2016.

Intermodal Connectors

"Intermodal connectors" are roadways that tie together the intermodal freight facilities to the national transportation system. Connectors link major freight activity nodes to arterial highway systems and improve the ability of networks to serve ports, rail yards, airports, and other freight-intensive nodes efficiently. When designed, maintained, and operated with freight in mind, connector routes facilitate the best use of individual modes and improve the overall efficiency of regional highway networks. Designated National Highway System (NHS) connectors are often referred to as the first and last miles of roadway used by truckers to travel between the major highways of the NHS and the nation's ports, rail terminals, and air cargo hubs.

Rail Transload Facilities

Transloading is the movement of freight from one mode of transportation (e.g., ocean container or air cargo) to another (e.g., truck or rail). This process is common because one mode of shipping often cannot be used for the entire logistical operation. Transloading can occur at any place depending on the requirements of the shipment. Transload facilities are designed to minimize the handling of cargo and may require warehouses, truck or rail yards, or material handling facilities. Some of the benefits of transloading include:

- Faster return of ocean containers to productive use by the steamship line
- Reduced repositioning expenses
- Reduced cost for inland moves of ocean containers

- Multimodal choice which leads to a faster delivery to market

Norfolk Southern has Thoroughbred Bulk Transfer (TBT) terminals that provide rail/truck transfer facilities. Terminals are licensed and operated by independent contractors who are experts in bulk transfer and distribution. TRANSFLO facilities are the CSX transload facilities.

Lamberts Point Coal Terminal is a Norfolk Southern-served and operated transload terminal located on the Elizabeth River in Norfolk. Lamberts Point has an annual capacity of 48 million tons. The heart of the terminal is Pier 6, which has two shiploaders that permit the facility to load two vessels simultaneously. The pier is 1,850 feet long and allows loading to a 50-foot draft.

Arreff Terminals Inc. is an agricultural product transload facility in Portsmouth. The terminal serves grains and animal feed with service from Norfolk Southern. There is 15-car capacity and no storage available.

Several lumber-specific transload facilities were noted on the NS web page[19] including:

- **Alexandria TBT** in Alexandria provides five acres of outside and no indoor storage capacity
- **Chesapeake TBT** in Chesapeake provides seven acres of outside storage and no inside storage
- **H.L. Lawson & Sons** in Roanoke has ten acres of outside storage and 600,000 square feet of inside storage
- **J and E Reload** in Culpepper has three acres of outside storage and 24,000 square feet of inside storage
- **Petersburg TBT** in Petersburg provides three acres of outside storage and no inside storage

The Richmond TRANSFLO facility has a 55 rail car spot capacity with service provided by CSX. The TRANSFLO facility handles acids, chemicals, foods, plastics, petroleum products, fracking sand, and minerals.

Other Intermodal Facilities

Virginia currently has three truck/rail container terminals. Two are located in the Hampton Roads area and handle a combination of domestic and international cargo. The other is the Virginia Inland Port (VIP) in Front Royal, which serves as an extension of the maritime terminals of the Port of Virginia in the Hampton Roads area. Virginia is also the site of several major initiatives aimed not only at improving the efficiency of rail intermodal movements that originate or terminate in Virginia, but also that pass through Virginia. The Heartland Corridor project improved the efficiency of container movements between the Port of Virginia and the Midwest by allowing double stack intermodal containers to travel a more direct route. Additional clearance on the NS Alta Vista Line will further increase the capacity between Norfolk and the Midwest. The CSX National Gateway initiative will improve the efficiency of container movements between the Mid-Atlantic and the Northeast/Midwest by clearing obstructions that currently limit double stack train operations in the I-95 corridor, as well as improving train operations to and from the Port of Virginia. The NS Crescent Corridor initiative is enhancing the

[19] Norfolk Southern, "Norfolk Southern: Connecting Rail to Road", www.nscorp.com/content/dam/nscorp/ship/paper-clay-and-forest/forest-products/ns_served_transloads_brochure.pdf Accessed: October 2016.

efficiency of train movements between the Northeast and Southeast, removing trucks from Virginia's highways, particularly I-81.

Intermodal connections in Virginia are also facilitated by numerous non-containerized truck/rail transload facilities.

Norfolk International Terminal (Norfolk)

Located in the Hampton Roads Harbor on 567 acres along the Elizabeth and Lafayette Rivers, NIT has direct access to Norfolk Southern's Heartland Corridor, allowing second-day double-stack service to Midwest markets. Thousands of daily truck movements are processed through 17 interchange lanes and two on-terminal transfer zones. Future plans call for an expansion of up to 26 interchange lanes. NIT is located adjacent to I-64 and I-564 and Hampton Boulevard in Norfolk, with additional access to US 17 and US 58.

Portlock (Chesapeake)

Portlock is a Norfolk Southern terminal that handles Container on Flat Car (COFC).

Virginia Inland Port (Front Royal)

The VIP is an intermodal container transfer facility in Front Royal, Virginia (Warren County) owned by the Virginia Port Authority. VIP occupies 161 acres of land and is approximately 60 miles west of Washington, D.C. The terminal brings the Port of Virginia 220 miles closer to inland markets and enhances service to the Washington, D.C. / Baltimore Metro Region by providing rail service to the terminals in Hampton Roads. VIP also consolidates and containerizes local cargo for export. The terminal is serviced by 17,820 feet of rail track that runs adjacent to Norfolk Southern's Crescent Corridor. Intermodal rail cars arrive at VIP and gain access via Norfolk Southern rail to Harrisburg, PA and the New York/New Jersey region. The facility is a U.S. Customs-designated port of entry, and the full range of customs functions is available to customers. Containerized rail service is provided five days a week to VIP from both NIT and the VIG in Portsmouth.

Portsmouth Marine Terminal (Portsmouth)

PMT occupies 287 acres of land and is located on the west bank of the Elizabeth River. The terminal is able to handle containers, break-bulk, and roll-on/roll-off cargo. The facility is served by CSX directly and Norfolk Southern via the Norfolk Portsmouth Beltline Railway.

Currently, 45 acres in the northeast corner of the facility are occupied by a joint venture arrangement headed by Skanska Arrangement Infrastructure Development for construction of a second Midtown Tunnel, scheduled to be complete in 2017. The 44-acre Empty Container Yard is in service and the warehouse adjacent to the operations building is currently being leased. With NIT and VIG nearing full capacity, the Virginia Port Authority is currently assessing the best use of the facility to promote commerce and economic development for Virginia.

The Intermodal Association of North America (IANA)'s North American Intermodal Facilities Directory identifies pertinent information for terminals, ramps, container yards, and depots in the United States and Canada, including specific geographic locations. The directory comprises information maintained by IANA, as part of its administration of the Driver Vehicle Inspection Reporting (DVIR) service. IANA maintains a list of these intermodal facilities along with managing the assignment of unique codes for each location to ensure routing of the Driver Vehicle Inspection Reports to the proper facility, and

maintenance and repair vendor, as required by the Federal Motor Carrier Safety Administration. In addition to the rail transload facilities and IANA's directory listings, www.bulktransporter.com maintains a bulk transload directory. The directory of Virginia facilities includes the following facilities in **Table 3-3**.

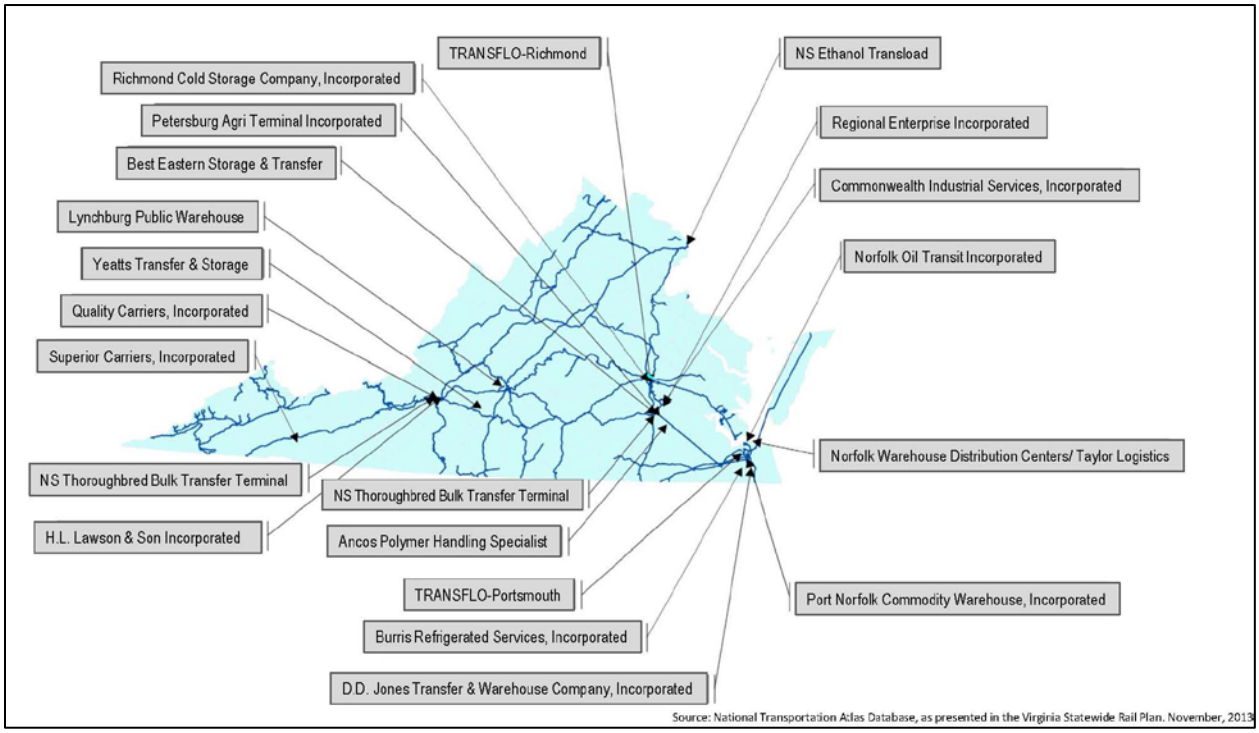
Table 3-3: Virginia Bulk Intermodal Facilities

Name	City	Rail Connection	Products
Norfolk Southern BTB	Alexandria	Norfolk Southern	Acids, Chemicals, Food, Plastics, and Petroleum Products
RSI Leasing, Inc.	Alexandria	Norfolk Southern	Ethanol
A&R Transport Inc.	Chesapeake	CSX, Norfolk Southern	Chemicals, Foods, and Plastics
Norfolk Southern BTB	Chesapeake	Norfolk Southern	Acids, Chemicals, Food, and Plastics
TRANSFLO	Fredericksburg	CSX	Chemicals, Food, and Petroleum Products
Commonwealth Industrial Services	Hopewell	Norfolk Southern, CSX	Chemicals and Plastics
Superior Carriers	Marion	Norfolk Southern	Acids, Chemicals, Food, Plastics, and Petroleum Products
Norfolk Southern BTB	Petersburg	Norfolk Southern	Acids, Chemicals, Plastics, and Petroleum Products
RSI Leasing Inc.	Petersburg	Norfolk Southern BTB	Acids, Chemicals, Plastics, Petroleum Products, and Ethanol
Arreff Terminals Inc.	Portsmouth	CSX, Norfolk Southern	Feed Grade Agricultural Products
TRANSFLO	Richmond	CSX	Acids, Chemicals, Food, Plastics Petroleum Products, and Fracking Sand
Norfolk Southern BTB	Roanoke	Norfolk Southern	Acids, Chemicals, Food, Plastics, and Petroleum Products
Mid-Atlantic Transloading Inc.	Virginia Beach	Bay Coast Railroad served by CXS and Norfolk Southern	Chemicals, Plastics, and Fracking Sand
HH Omps Inc.	Winchester	CSX	Food, Plastics, and Fracking Sand

Source: Bulk Transporter. "Virginia: Bulk Transload Facilities Directory," bulktransporter.com/transload-directory/virginia. Accessed: October 2016.

Non-containerized truck/rail transfer facilities identified in the State Rail Plan are shown in **Figure 3-12**. There are some facilities that are identified on multiple lists. For example, transload facilities often handle bulk, non-containerized products that may result in a facility noted above as well as on the figure that follows.

Figure 3-12: 2012 Non-Containerized Truck/Rail Transfer Facilities in Virginia



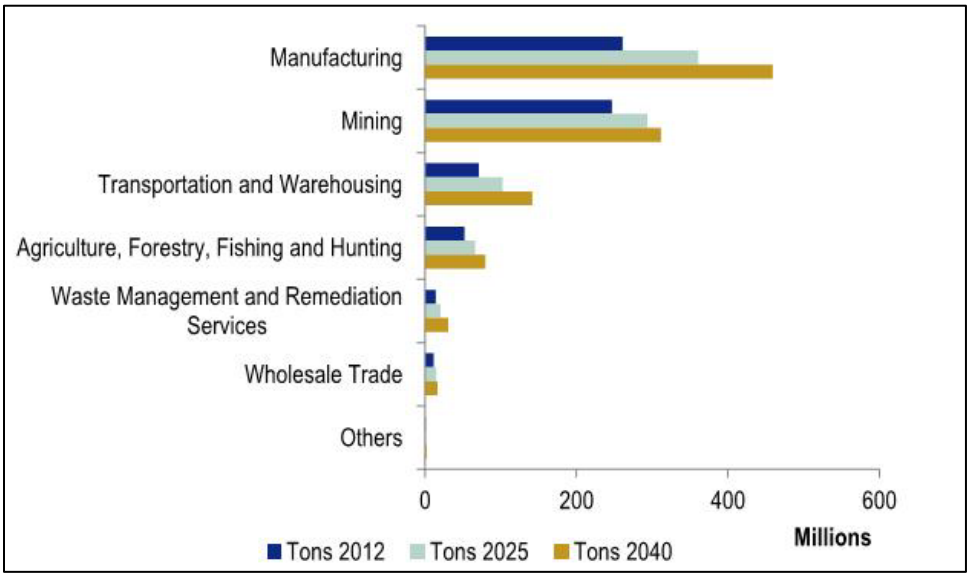
Source: Virginia Statewide Rail Plan, 2013

Although this is not a complete list of intermodal facilities, and some facilities are in multiple directories, it does highlight many of the most active facilities.

4. Virginia Freight Demand

In 2012, Virginia's freight network handled 658 million tons of cargo, valued at $801 billion. By 2040, freight movement in Virginia is expected to increase to more than 1 billion tons, valued at $1.7 trillion.[20] The manufacturing industry creates more freight demand than any other industry. In 2012, the manufacturing sector moved the most freight in terms of both weight and value, as shown in **Figures 4-1** and **4-2**. Manufacturing accounted for nearly 40 percent of all freight tonnage in the state, and nearly 74 percent of the monetary value of all cargo. The mining industry accounted for 38 percent of the total weight and just under 2 percent of the total value, whereas the transportation and warehousing sector accounted for 11 percent of the total weight and 18 percent of total value. These three sectors, along with agriculture, forestry, fishing, and hunting, are expected to account for the majority of freight demand through 2040.

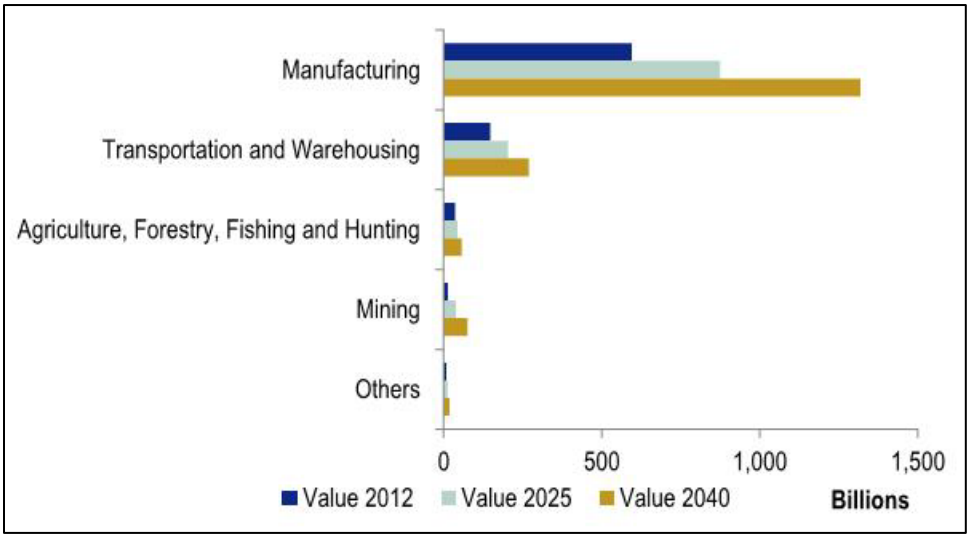
Figure 4-1: Freight Tonnage by Industry, 2012 - 2040



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

[20] VTrans2040 Freight Trends Analysis Technical Report, June 2015

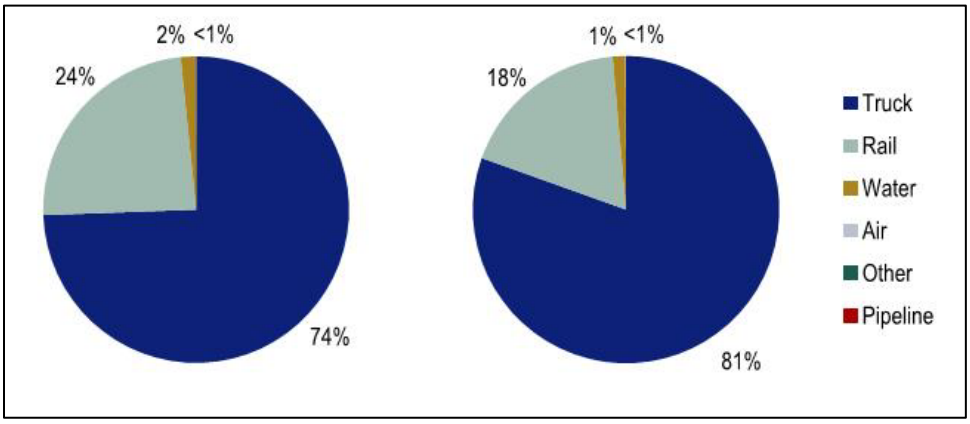
Figure 4-2: Freight Value ($) by Industry, 2012 – 2040



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

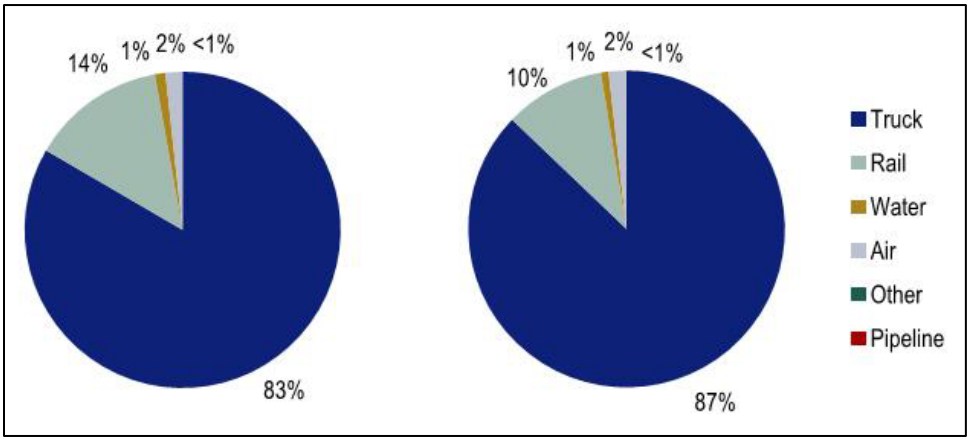
In terms of both weight and value, trucks account for most freight movement within the state and are expected to continue to do so (**Figures 4-3 and 4-4**). Rail carried nearly 24 percent of the total tonnage and 14 percent of the total value in 2012. However, its proportion of total freight within Virginia is expected to decrease as a percent of total freight movements by 2040 (to 18 percent and 10 percent of weight and value, respectively).

Figure 4-3: Mode Spilt by Weight, 2012 (left) and 2040 (right)



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

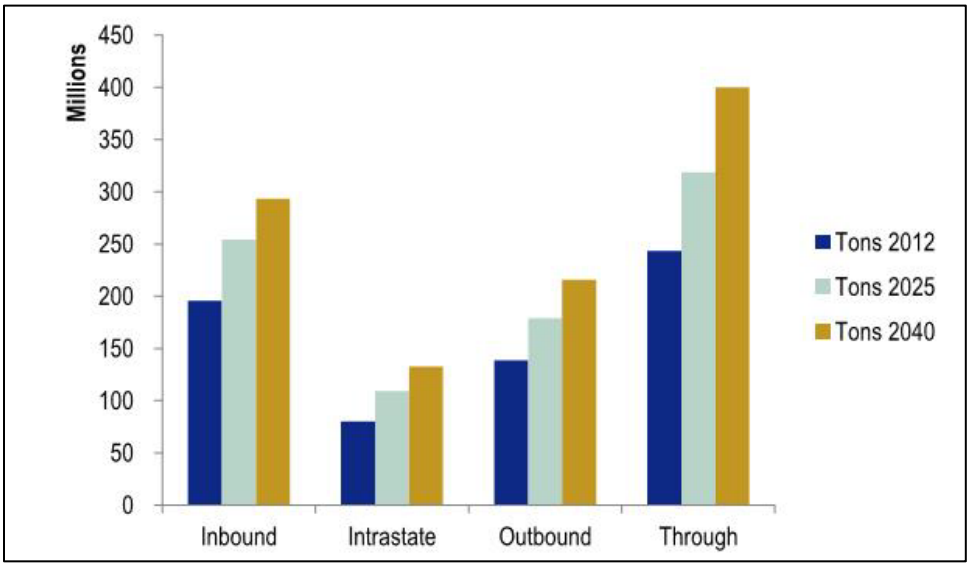
Figure 4-4: Mode Spilt by Value ($), 2012 (left) and 2040 (right)



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

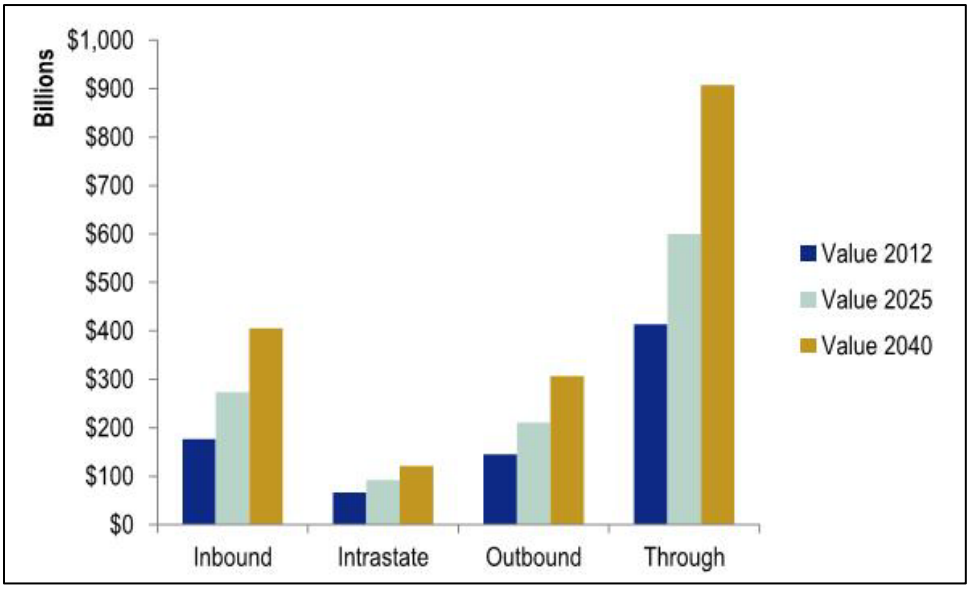
As shown in **Figures 4-5 and 4-6**, more freight travels through Virginia than is destined to, or originates from it (37 percent by weight and 52 percent by value). Inbound freight represented 30 percent of total weight and 22 percent of total value, while outbound freight represented 21 percent of total weight and 18 percent of total value. Freight traveling intrastate accounted for 12 percent of total tonnage and 8 percent of total value.

Figure 4-5: Direction of Total Freight by Tonnage, 2012 – 2040



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

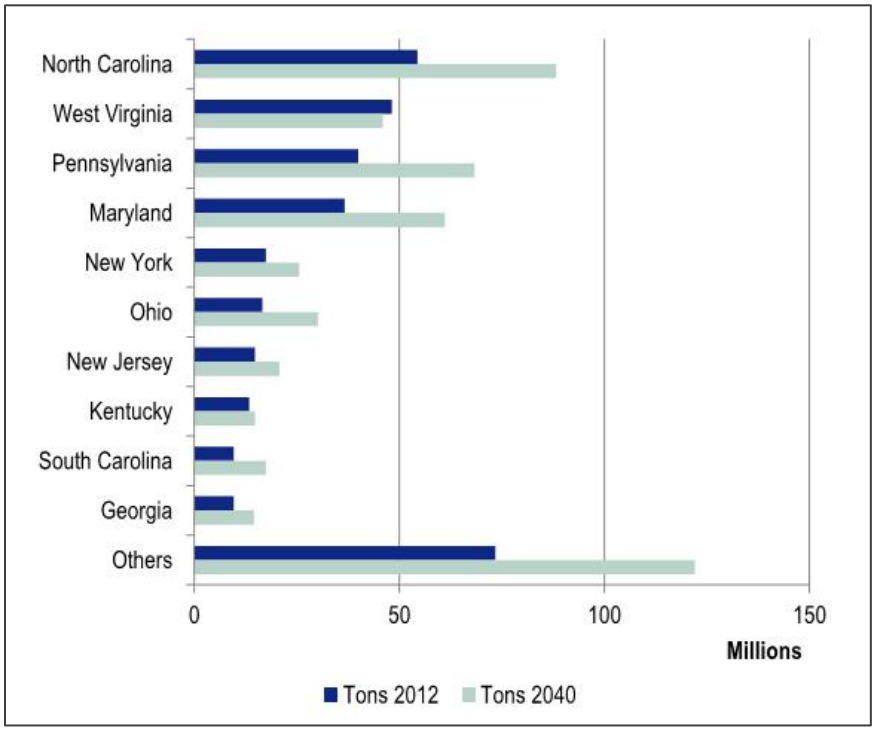
Figure 4-6: Direction of Total Freight by Value ($), 2012 – 2040



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

Domestically, the top trading partners by weight were North Carolina, West Virginia, and Pennsylvania (**Figure 4-7**). By 2040, the top three partners are projected to be North Carolina, Pennsylvania, and Maryland (West Virginia drops to fourth).

Figure 4-7: Top Ten Domestic Trading Partners by Weight, 2012 - 2040

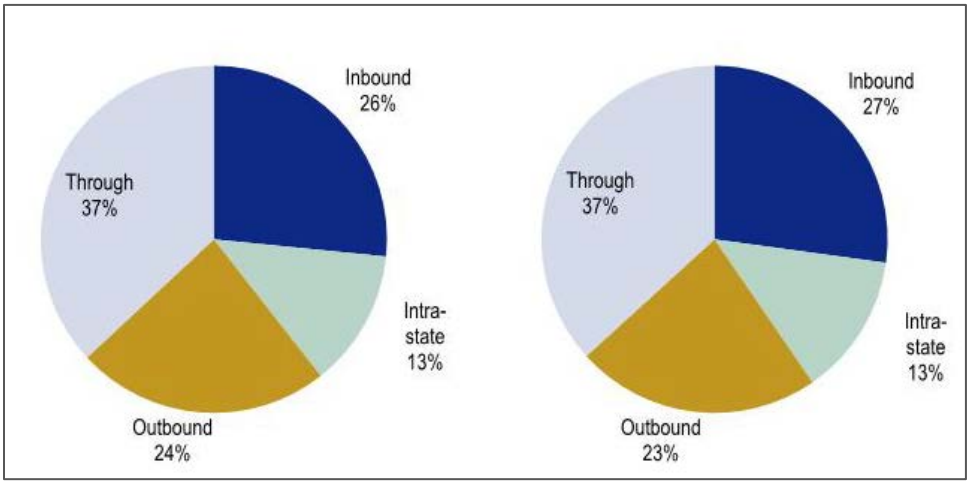


Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

Truck Freight Demand

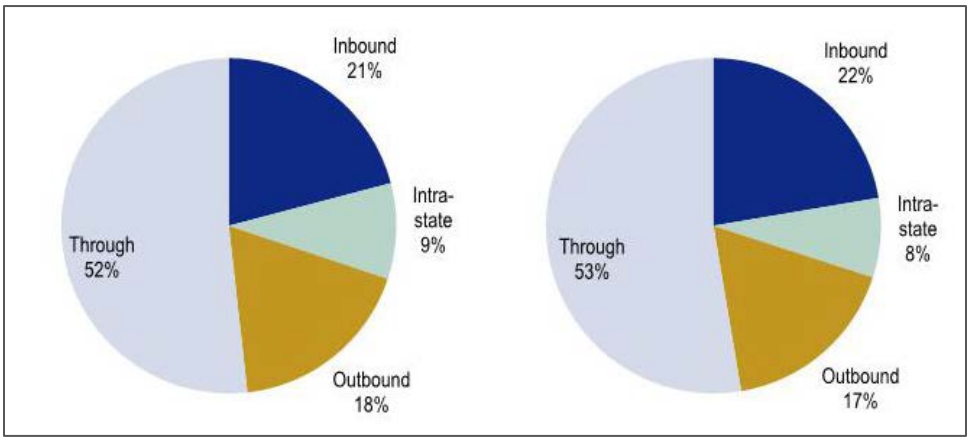
In 2012, the most recent year of available commodity flow data, trucks moved nearly 490 million tons of freight over Virginia's roadway network, equating to $668 billion. By 2040, those numbers are expected to increase to 838 million tons (1.9 percent per year) and $1.5 trillion (2.9 percent per year).[21] The majority of highway-bound freight will be carried as through-traffic (37 percent by weight and 52 percent by value), as shown in **Figures 4-8 and 4-9**. Through, outbound, inbound and intrastate truck freight shares are expected to remain steady through 2040.

Figure 4-8: Direction of Truck Freight by Weight, 2012 (left) and 2040 (right)



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data)

Figure 4-9: Direction of Truck Freight by Value ($), 2012 (left) and 2040 (right)

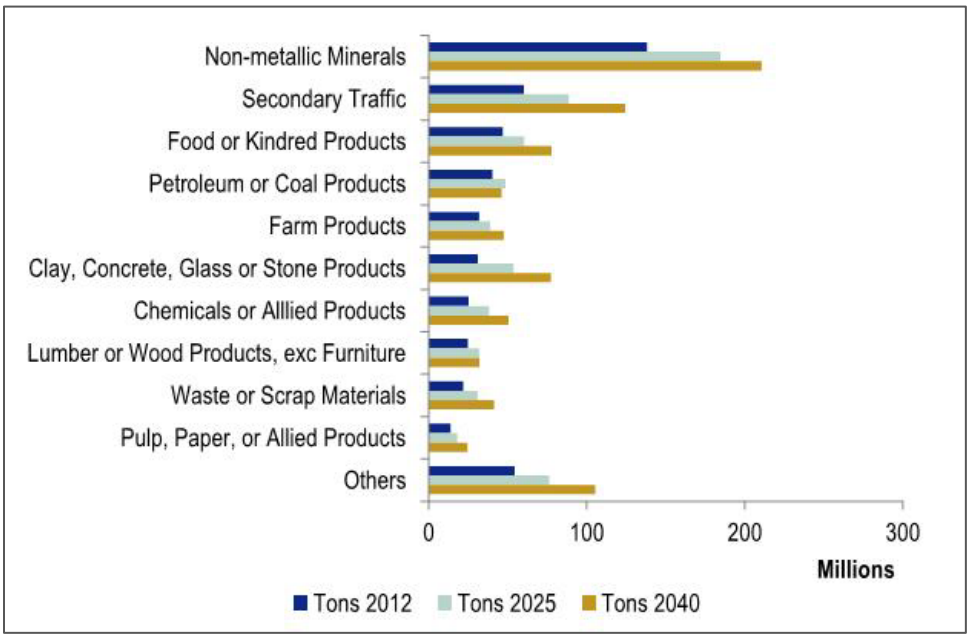


Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data)

[21] *VTrans2040 Freight Trends Analysis Technical Report, June 2015*

By weight, the top commodity moved by truck along Virginia's roadways was non-metallic minerals such as limestone clay and gypsum (accounting for 28 percent), followed by secondary traffic (traffic associated with warehouse and distribution centers – 12 percent), and food and kindred products (10 percent). These three commodities, as well as concrete, glass or stone products, and other (miscellaneous) commodities will dominate freight by trucking in terms of weight by 2040 (**Figure 4-10**).

Figure 4-10: Top Ten Truck Commodities by Weight, 2012 – 2040

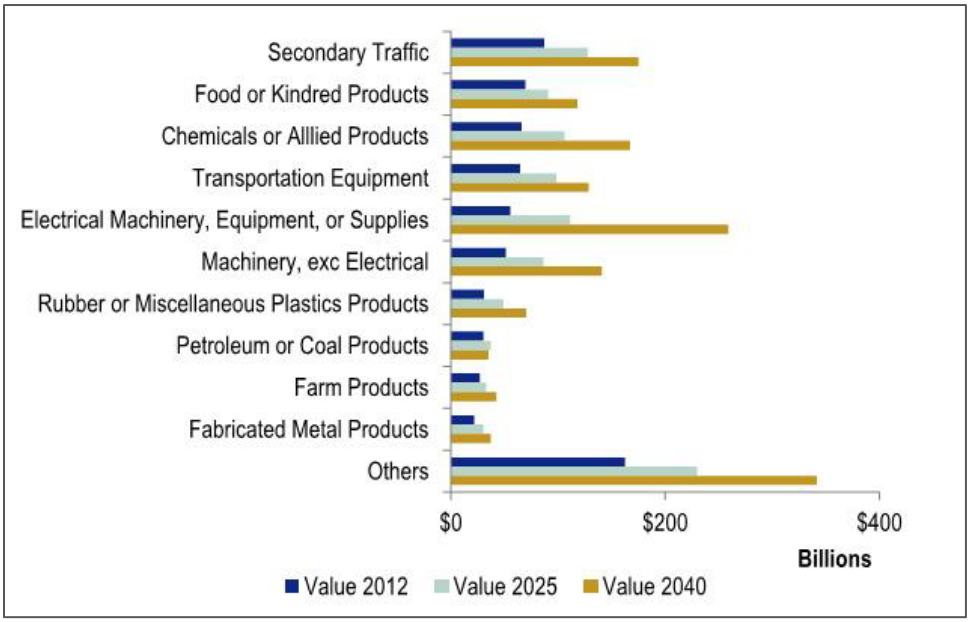


Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data)

By value, secondary traffic was the top commodity in 2012 (**Figure 4-11**), representing 13 percent of total truck value. Several commodities: food or kindred products, chemicals or allied products, and transportation equipment, each accounted for 10 percent of total truck value. Electrical machinery, equipment or supplies is forecast to be the top commodity by 2040, representing 17 percent of total value.

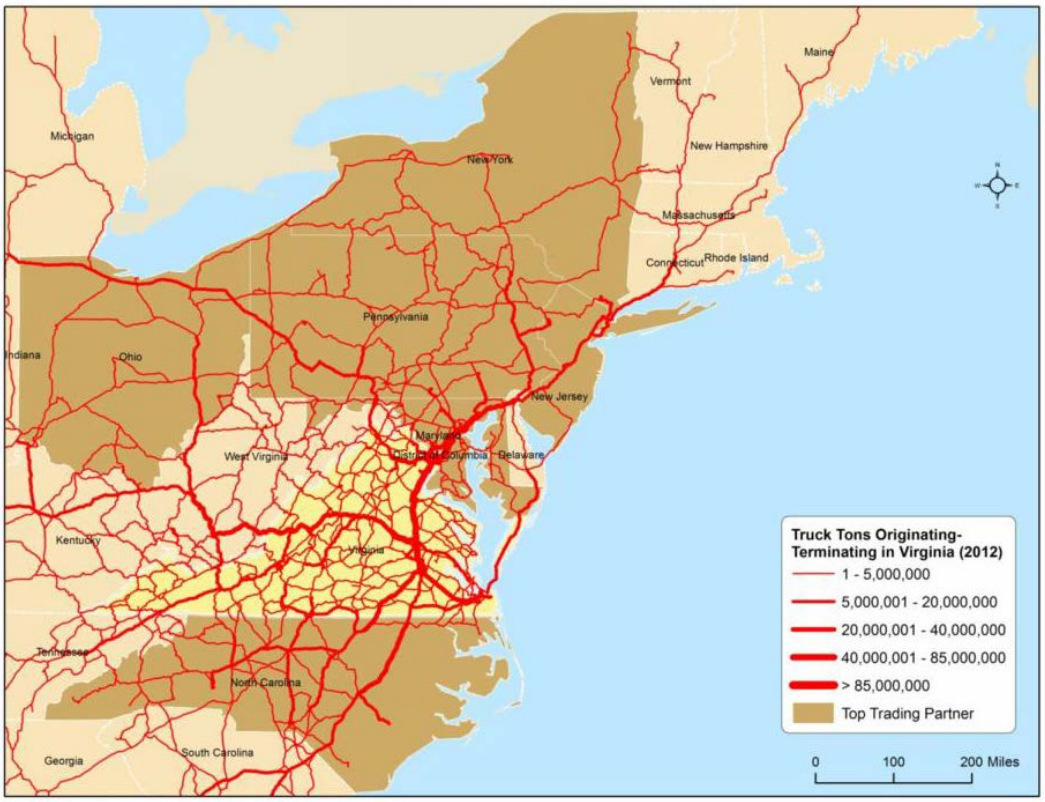
The majority of freight moving by truck travels along routes shown in **Figure 4-12** to or from the state's top trading partners: North Carolina, Pennsylvania, Maryland, New York, New Jersey and Ohio (ranging from 51 million tons traded with North Carolina to 12 million tons traded with Ohio). I-95, I-84, I-77 and I-64 are the major interstate freight routes, whereas U.S. Routes 13, 58, 220, 360 and 460 are significant highway freight routes.

Figure 4-11: Top Ten Truck Commodities by Value ($), 2012 – 2040



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data)

Figure 4-12: Truck Freight Flows by Tons Originating-Terminating in Virginia and Top Trading Partners, 2012



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data assigned to the 2007 Freight Analysis Framework 3.5 highway network data)

Rail Freight Demand

Virginia's rail network hauled over 157 million tons of freight in 2012. The rail system moves a large volume of goods between the Midwest and the Mid-Atlantic, and the Commonwealth has partnered with railroad operators to increase the capacity and efficiency of the system for those movements in the past 10 years. The volume of freight moving over the rail system excluding through movements is shown in **Figure 4-13**. **Figure 4-14** displays the total rail tons moved, including through movements. The major rail freight movements are east-west movements to/from the Norfolk area. This figure also shows Virginia's top rail trade partners.

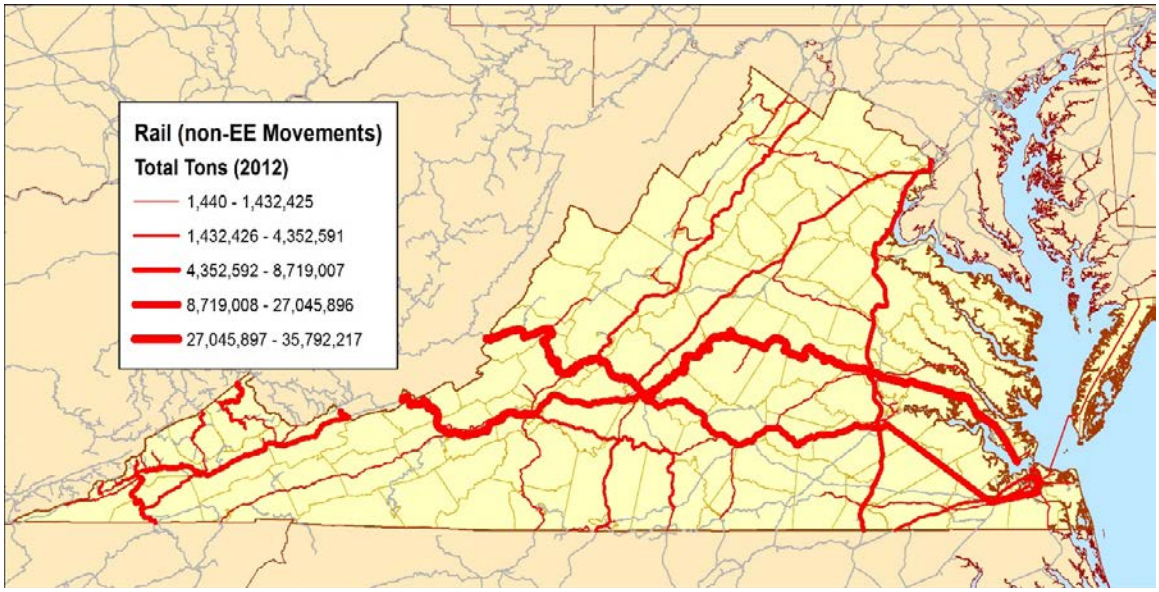
Thirty-nine percent of this traffic was destined for Virginia, 12 percent was outbound, 9 percent was transported within the state, and 40 percent passed through. By 2040, total rail freight tonnage is expected to grow to nearly 189 million tons, a growth of 20 percent, or 0.5 percent annually. The percent of the inbound, outbound, intrastate, and through rail flows by weight in 2012 and the expected shares in 2040 are shown in **Figure 4-15**.

Rail moved over $110 billion worth of goods in Virginia in 2012. Through movements accounted for 61 percent of the rail freight by value moved in the state. Next were inbound movements accounting for 24 percent, then outbound flows (13 percent). The smallest share of rail freight value was intrastate (2 percent). By 2040, the total value of shipments moved by rail is expected to increase 62 percent to $179 billion, or 1.2 percent annually. The percent of the inbound, outbound, intrastate, and through rail flows by value in 2012 and the expected shares in 2040 are shown in **Figure 4-16**.

In 2012, the top rail commodity by weight was coal, which accounted for 60 percent of the state's total rail tonnage. Chemicals and allied products followed by miscellaneous mixed shipments (in intermodal containers or trailers) were next, accounting for 7 percent and 6 percent, respectively. By value, the top rail commodity in 2012 was miscellaneous mixed shipments (i.e., intermodal), which accounted for 46 percent of the total rail value. The second rail commodity was chemicals and allied products (15 percent), and the third rail commodity was transportation equipment (6 percent).

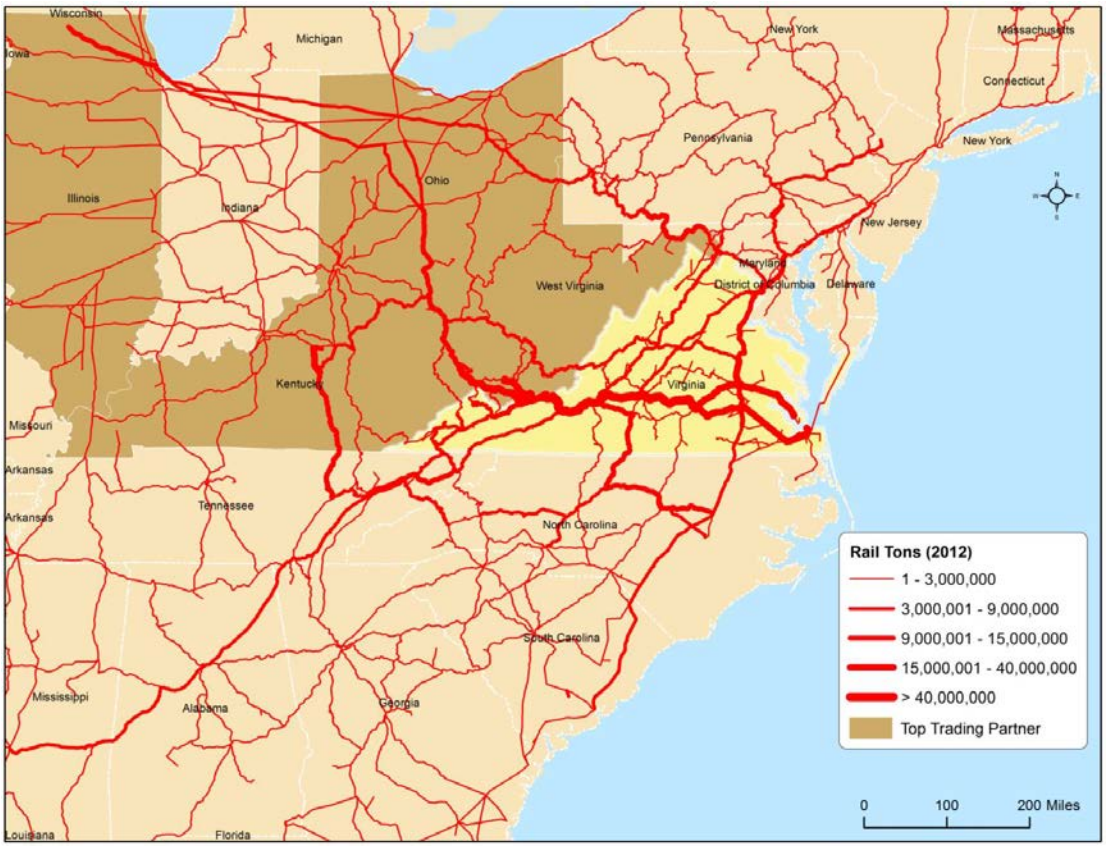
By 2040, coal is expected to remain the top rail commodity by weight accounting for 42 percent of the State's total rail tonnage and reflecting a projected decline of 16 percent. Chemicals and allied products (10 percent) and miscellaneous mixed shipments are expected to remain in the top three commodities shipped by rail (7 percent). When measured by value, miscellaneous mixed shipments (displayed as Freight All Kind in **Figure 4-18**) will continue to be the top commodity in 2040, accounting for 41 percent. **Figures 4-17** and **4-18** chart the weight and value of the top 10 commodities moved by rail in Virginia in 2012 and 2040.

Figure 4-13: 2012 Rail Tonnage on Virginia's Rail System (No Pass-through Movements)



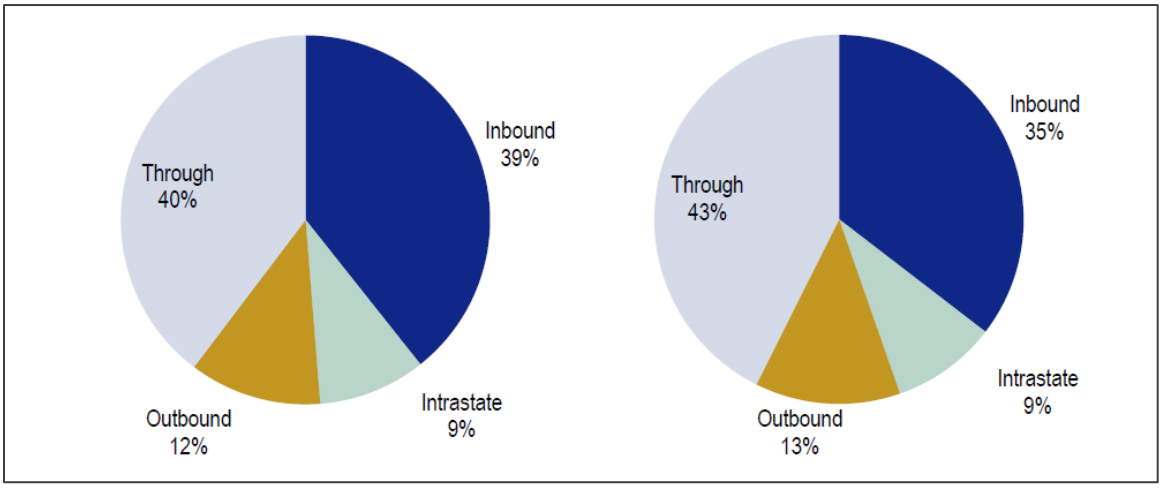
Source: 2012 IHS Transearch data and CDM Smith.

Figure 4-14: Virginia Rail Freight Flows by Tonnage, 2012



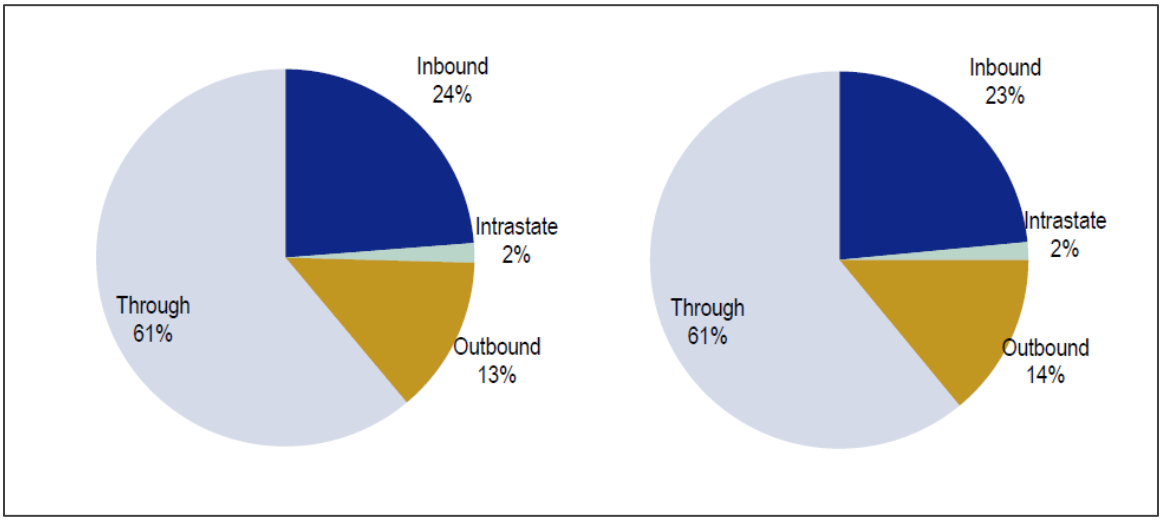
Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data assigned to the 2007 Freight Analysis Framework 3.5 highway network data).

Figure 4-15: Direction of Rail Freight by Weight, 2012 (left) and 2040 (right)



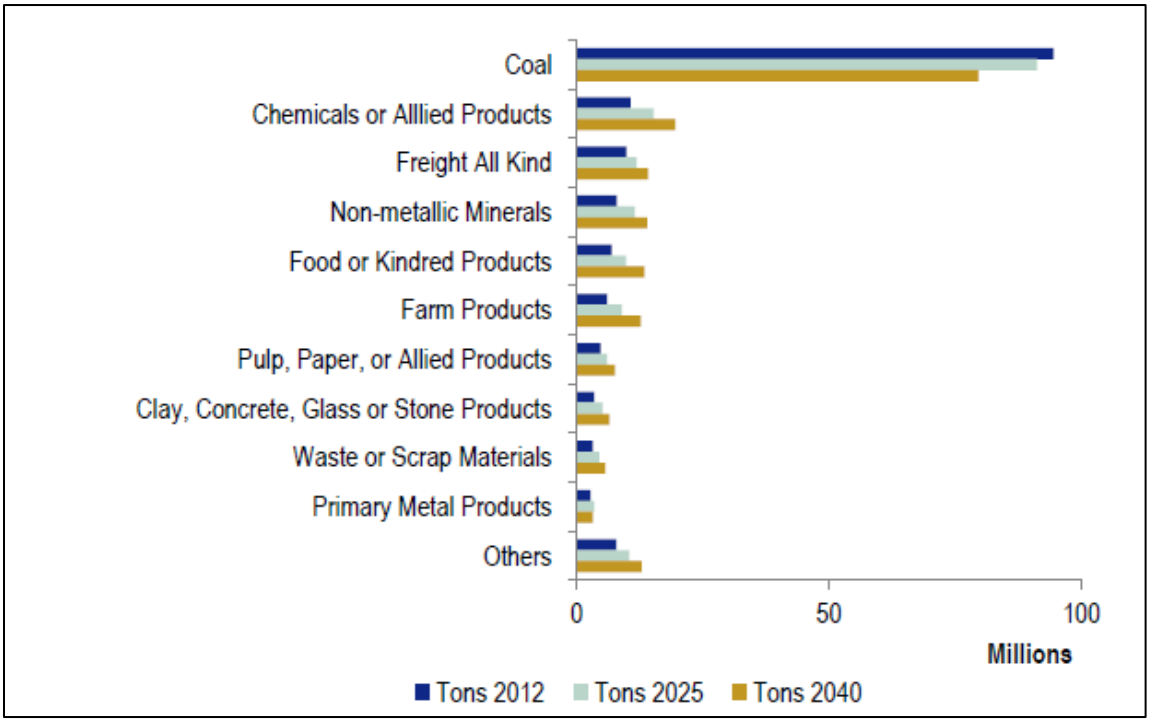
Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

Figure 4-16: Direction of Rail Freight by Value, 2012 (left) and 2040 (right)



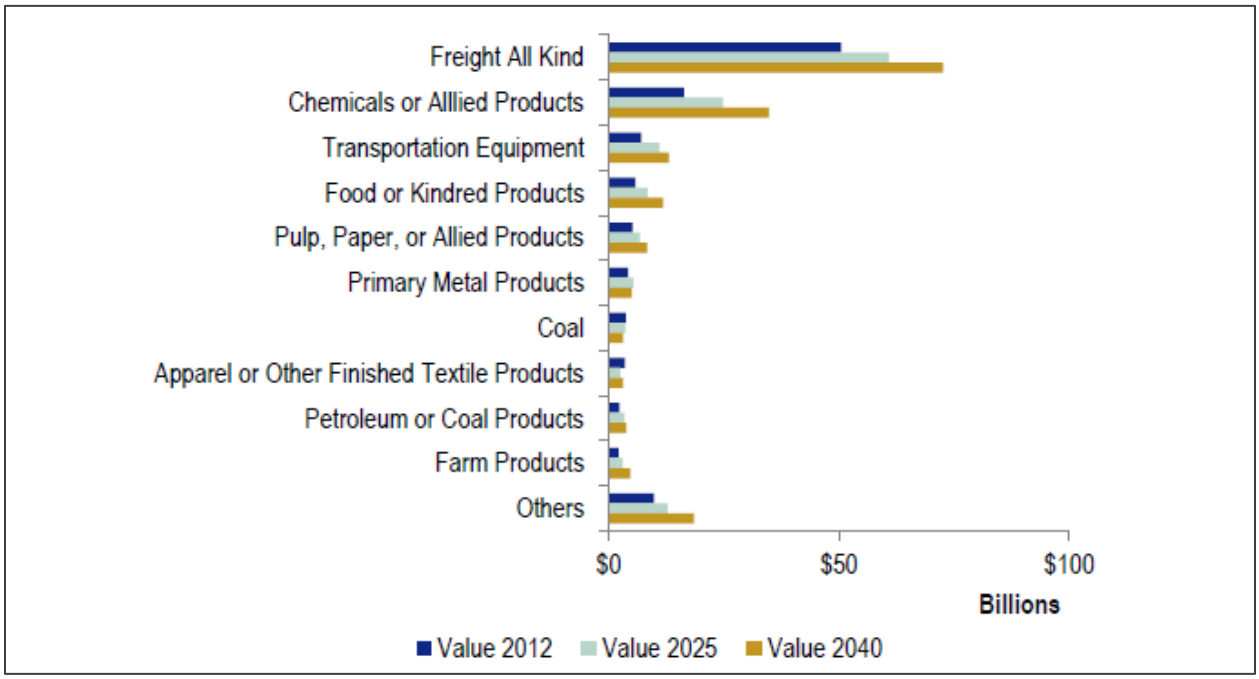
Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

Figure 4-17: Top 10 Commodities by Tons, 2012



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

Figure 4-18: Top 10 Commodities by Value, 2012



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

Port and Waterway Demand

In 2012, Virginia moved over 10 million tons of inbound, outbound, and intrastate freight by water. By 2040, water freight is projected grow 36 percent to 14 million tons. When measured by value in 2012, $9 billion were moved by water in the state. Over the next three decades, these shipments are expected to grow by 56 percent to $14 billion.

In 2016, the Port of Virginia moved a record 2,655,706 TEUs of cargo, valued at $69.9 billion, which ranked them 7th in the U.S. and 3rd on the East Coast. The Port of Virginia accounted for just over 1 percent of U.S. total imports and exports (1.1 percent and 1.2 percent, respectively), but nearly 14 percent of East Coast totals[22] (**Table 4-1**).

Table 4-1: Top 10 U.S. East Coast Container Ports, 2016

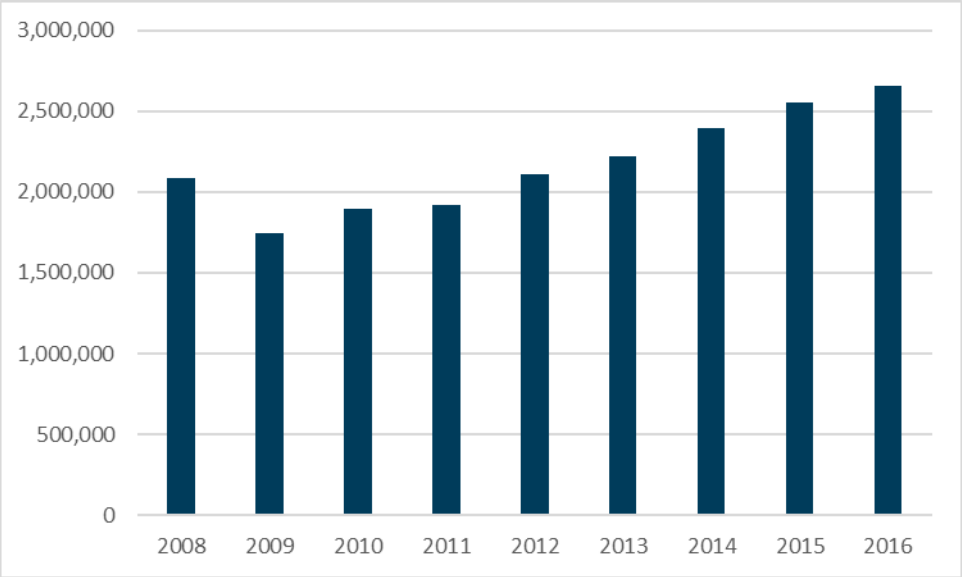
U.S. East Coast Port	TEUs	East Coast Market Share
New York/New Jersey	6,251,953	33%
Savannah	3,644,521	19%
The Port of Virginia	2,655,706	14%
Charleston	1,996,282	10%
Port Everglades	1,058,687	6%
Miami*	1,030,758	5%
Jacksonville	981,347	5%
Baltimore	869,485	5%
Philadelphia	459,701	2%
Wilmington (NC)	260,493	1%

Source: Port of Virginia 2015 Trade Overview.

In 2016, nearly 2.7 million TEUs were handled by the Port of Virginia, an increase of 4.0 percent over 2015. This continued a period of sustained growth – in 2015 the volume of cargo processed at the port increased 6.5 percent over the previous year. As shown in **Figure 4-19**, the Port of Virginia saw a nearly 16 percent decrease from 2008 to 2009 in cargo, but has experienced an increase every year since, and by 2012 surpassed the 2008 numbers.

[22] U.S. Census, U.S. International Trade Data, State Data, http://www.census.gov/foreign-trade/statistics/state/data/index.html. Accessed: June 2017.

Figure 4-19: Freight Handled by the Port of Virginia, 2008 – 2016, Measured in TEUs



Source: Port of Virginia Statistics.

The top commodities in terms of weight coming into and out of the Port of Virginia are presented in **Table 4-2**. Nuclear reactors, boilers and machinery is the top import, while mineral, fuel, oil and etc. is the top export. Among the top commodity categories, only plastics and iron and steel are included as both a top import and export.

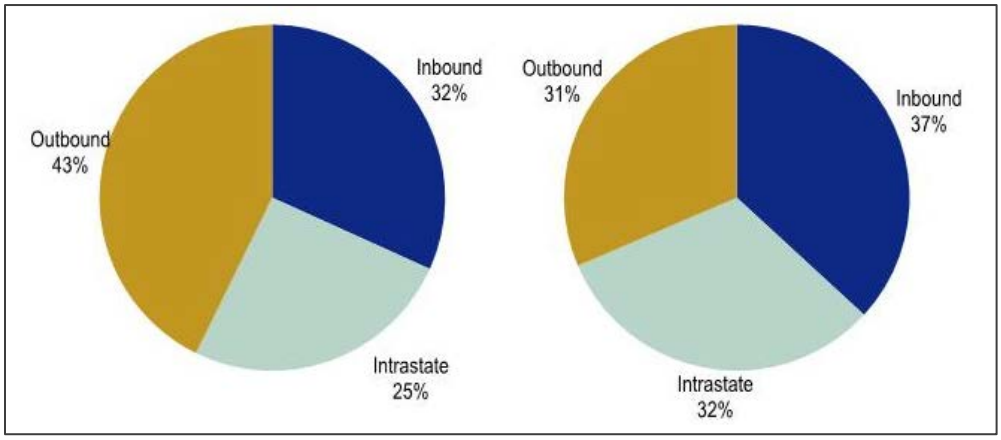
Table 4-2: 2015 Top 10 Commodities in Tons

Rank	Import	Export
1	Nuclear Reactors, Boilers, Machinery	Mineral, Fuel, Oil, Etc.
2	Salt, Sulfur, Earth, Stone	Miscellaneous Grain, Seed, Fruit
3	Furniture and Bedding	Wood
4	Beverages, Spirits and Vinegar	Wood pulp, Etc.
5	Vehicles, not Railway	Food Waste, Animal Feed
6	Plastics	Plastics
7	Stone, Plaster, Cement	Cereals
8	Mineral, Fuel, Oil, Etc.	Paper and Paperboard
9	Electrical Machinery	Fertilizers
10	Iron and Steel	Organic Chemicals

Source: Port of Virginia 2016 Trade Overview.

In 2012 (the last year IHS TRANSEARCH commodity flow data is available) in terms of weight, nearly 43 percent of all domestic waterborne freight was outbound, 32 percent was inbound, and 25 percent was intrastate (**Figure 4-20**). By 2040, inbound and intrastate domestic freight is expected to increase at the expense of outbound freight. In terms of monetary value, outbound and inbound freight are fairly equal, and are expected to increase by 2040, at the expense of intrastate commerce. Though intrastate cargo is expected to increase in weight by 2040, it is expected to decrease in value.

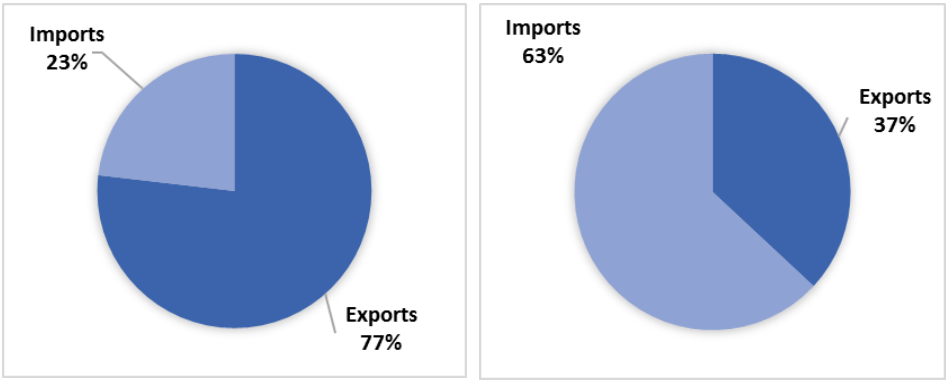
Figure 4-20: Direction of Domestic Waterborne Freight by Weight, 2012 (left) and 2040 (right)



Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

The Port of Virginia is the State's most significant conduit for international trade. The port imports high value commodities and exports lower value, higher weight cargo. By weight, the port exported much more cargo (38.7 million tons) than it imported (11.6 million tons) in 2016. However, in terms of value, POV imported much more ($44.1 billion) than it exported (25.8 billion). The pattern of importing higher value goods and exported lower value commodities such as agricultural goods is expected to continue into the future. **Figure 4-21** presents shares of imports and exports by value and tonnage in 2016.

Figure 4-21: Port of Virginia, Distribution of Imports and Exports by Value (left) and Tonnage (right), 2016)



Source: 2016 Port of Virginia Trade Overview.

Internationally, the Port of Virginia's top trading partners in terms of weight are China and Brazil (**Table 4-3**) and China in terms of monetary value (**Table 4-4**).

Table 4-3: 2015 Top 10 Trading Partners with the Port of Virginia by Weight

Rank	Import	Export
1	China	Brazil
2	Germany	China
3	Brazil	Netherlands
4	India	United Kingdom
5	Italy	India
6	Turkey	Italy
7	France	South Korea
8	Vietnam	Japan
9	Netherlands	Turkey
10	Vietnam	Ukraine

Source: Port of Virginia 2016 Trade Overview.

Table 4-4: 2015 Top 10 Trading Partners with the Port of Virginia by $ Value

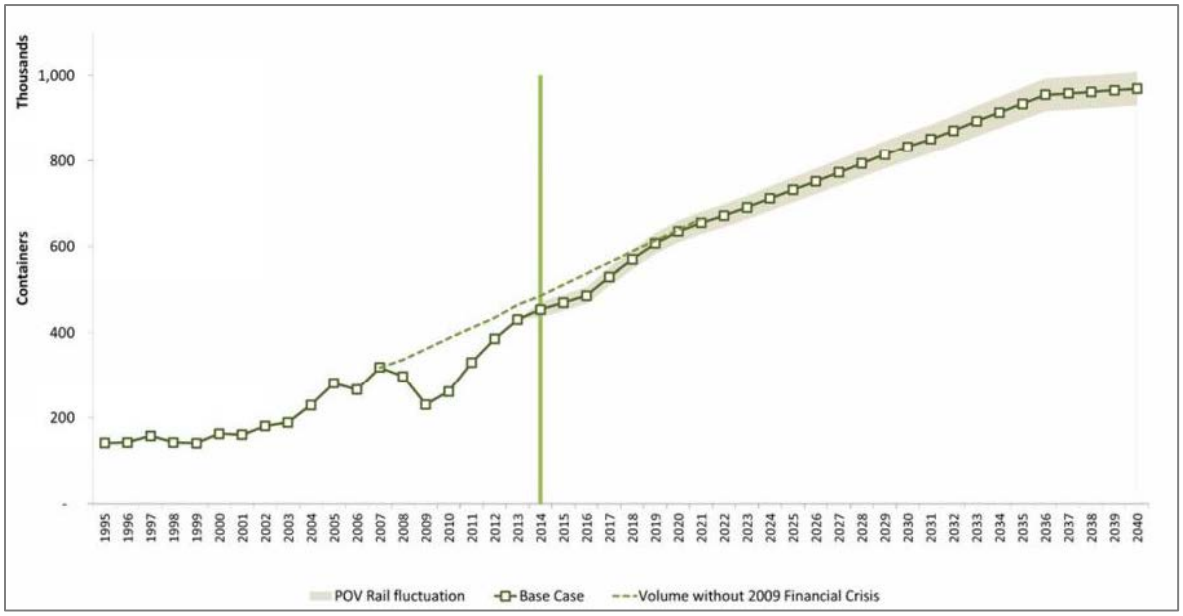
Rank	Import	Export
1	China	China
2	Germany	Belgium
3	India	Germany
4	Italy	United Kingdom
5	Japan	Netherlands
6	United Kingdom	Japan
7	Brazil	Brazil
8	France	Saudi Arabia
9	Vietnam	India
10	Malaysia	Austria

Source: Port of Virginia 2016 Trade Overview.

Nearly 63 percent of the Port's cargo is moved via truck, 33 percent are moved by rail, and 4 percent are moved by barge.[23] The Port of Virginia, as shown in **Figure 4-22** projects an annual 3 percent average growth rate of containerized rail volume through the ports through 2040.

[23] The Port of Virginia, Annual Report 2015

Figure 4-22: Historic and Projected Containerized Rail Volume through the Port of Virginia



Source: Master Rail Plan for the Port of Virginia, April 16, 2015.

Aviation Demand

In 2015, Dulles International Airport (IAD) handled nearly 482 million pounds of freight cargo, ranking the airport as 46th in the nation. As demonstrated in **Table 4-5**, three of the four main cargo airports saw slight increases in landed weight from 2014 to 2015[24]. However, Norfolk International Airport (ORF) was the only one among the four to witness an increase in air cargo from 2000 (**Table 4-6**). Though, IAD, Richmond International Airport (RIC) and Roanoke-Blacksburg Regional Airport (ROA) saw significant drops between 2000 and 2015, their overall U.S. ranking remained relatively consistent – demonstrating that the drop at these airports reflects an overall drop in air cargo throughout the U.S.

Table 4-5: Rank of Virginia Cargo Airports among All U.S. Airports and Percent Change from 2014

ID	Airport Name	2015 Landed Weight (lbs.)	2014 Landed Weight (lbs.)	% Change
IAD	Washington Dulles International	481,928,116	479,925,622	0.42%
RIC	Richmond International	414,615,016	408,252,520	1.56%
ORF	Norfolk International	199,228,038	197,539,516	0.85%
ROA	Roanoke-Blacksburg Regional/ Woodrum Field	128,517,300	128,954,840	-0.34%

Source: Federal Aviation Administration All-Cargo Data for U.S. Airports, Preliminary Calendar Year 2015 (published June 17, 2016)

[24] "Landed weight" refers to the weight of aircraft transporting only cargo.

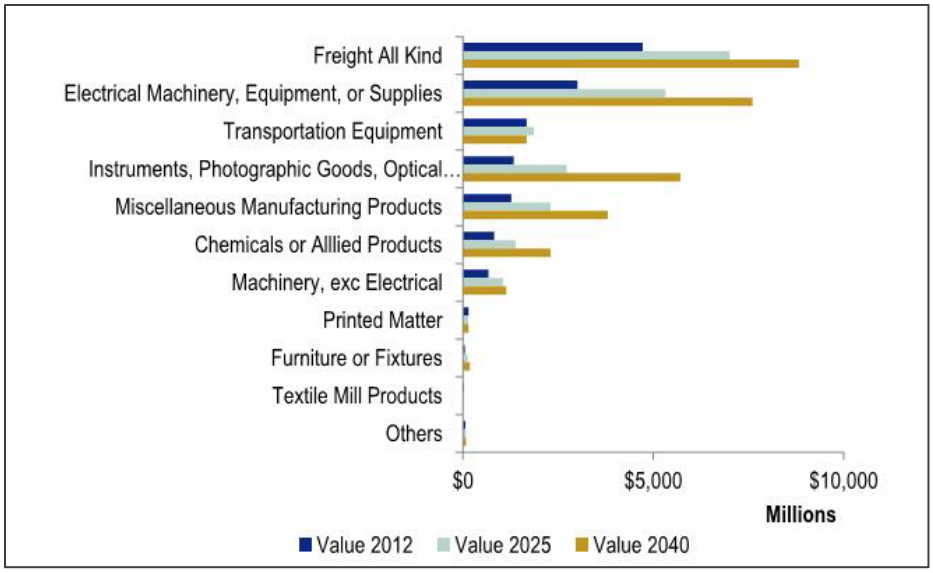
Table 4-6: Rank of Virginia Cargo Airports among All U.S. Airports 2015, 2010, 2005, and 2000, Percent Change

Airport ID	2015		2010		2005		2000		% Change 2000-2015
	Rank	Landed Weight (lbs.)	Rank	Landed Weight (lbs.)	Rank	Landed Weight (lbs.)	Rank	Landed Weight (lbs.)	
IAD	46	481,928,116	46	450,313,574	47	609,997,900	42	792,568,000	-39.19%
RIC	54	414,615,016	64	340,193,701	66	404,237,494	56	634,875,190	-34.69%
ORF	88	199,228,038	83	214,872,076	88	235,580,740	101	182,603,920	9.10%
ROA	106	128,517,300	108	126,082,685	100	200,074,040	105	166,999,400	-23.04%

Source: Federal Aviation Administration All-Cargo Data for U.S. Airports, Preliminary Calendar Year (CY) 2015 (published June 17, 2016); Qualifying Cargo Airports, Rank Order, and Percent Change from 2009, CY 2010 (published October 4, 2011); Qualifying Cargo Airports, Rank Order, and Percent Change from 2004, CY 2005 (published October 31, 2006); Qualifying Cargo Airports, Rank Order, CY 2000 (published October 5, 2001).

In 2012, the last year commodity flow data is available, $13.8 billion of domestic air cargo came through Virginia's airports. By 2040, the value is expected to more than double to $31.5 billion. Among air shipments, the top domestic commodities by value are miscellaneous mixed freight; electrical machinery, equipment or supplies; transportation equipment; instruments, photographic goods, optical goods, watches, or clocks; and miscellaneous manufacturing products (**Figure 4-23**). Together, these shipments accounted for nearly 87 percent of the value in 2012, and are expected to account for that much in 2040 as well.

Figure 4-23: Top Domestic Air Cargo Commodities by Value, 2012 – 2040

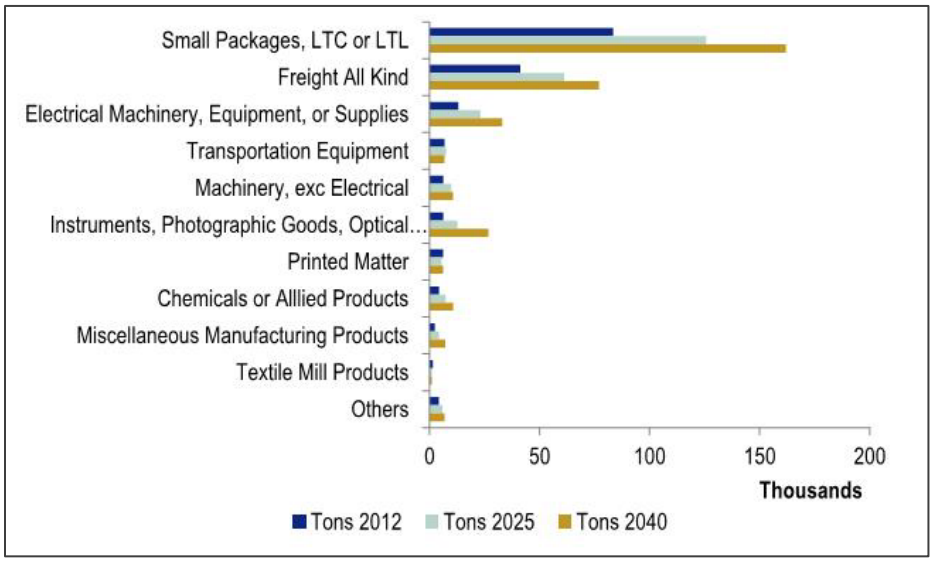


Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

In 2012, as shown in **Figure 4-24**, the top domestic commodities by weight were small packages; miscellaneous mixed freight; electrical machinery, equipment or supplies; and transportation

equipment. Together, these commodities accounted for approximately 82 percent of domestic air shipment weight. By 2040, several other commodities, particularly the instruments, photographic goods, optical goods, watches, or clocks sector, are expected to surpass transportation equipment in terms of weight.

Figure 4-24: Top Domestic Air Cargo Commodities by Weight, 2012 – 2040



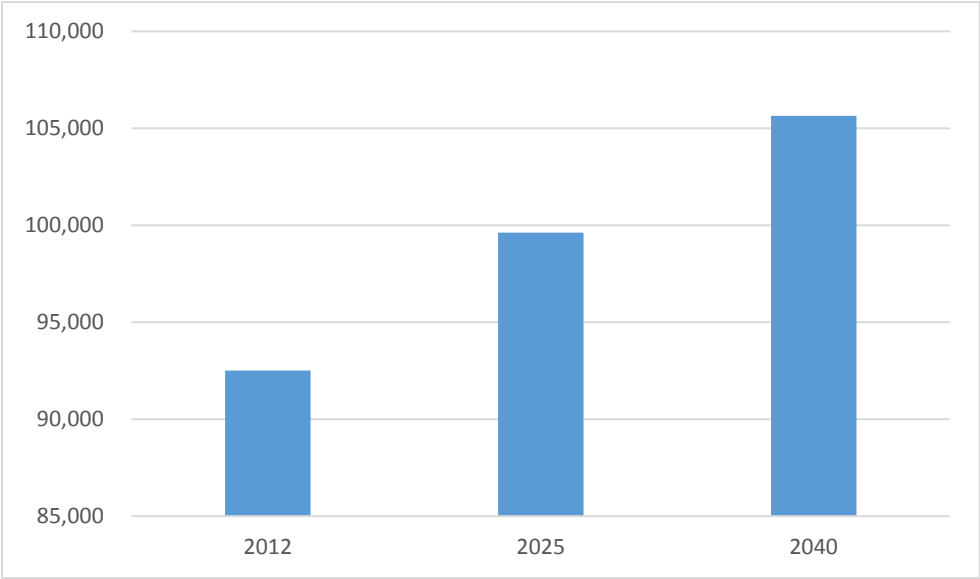
Source: VTrans2040 Freight Trends Analysis Technical Report, June 2015 (2012 IHS Transearch data).

Pipeline Demand

Virginia pipeline movements in 2012 totaled 90,000 tons valued at $48 million, see **Figure 4-25**. On average, the pipeline movements are valued at $533 per ton (**Figure 4-26**). Pipeline movements represent less than one percent of the Commonwealth's freight tons and value.

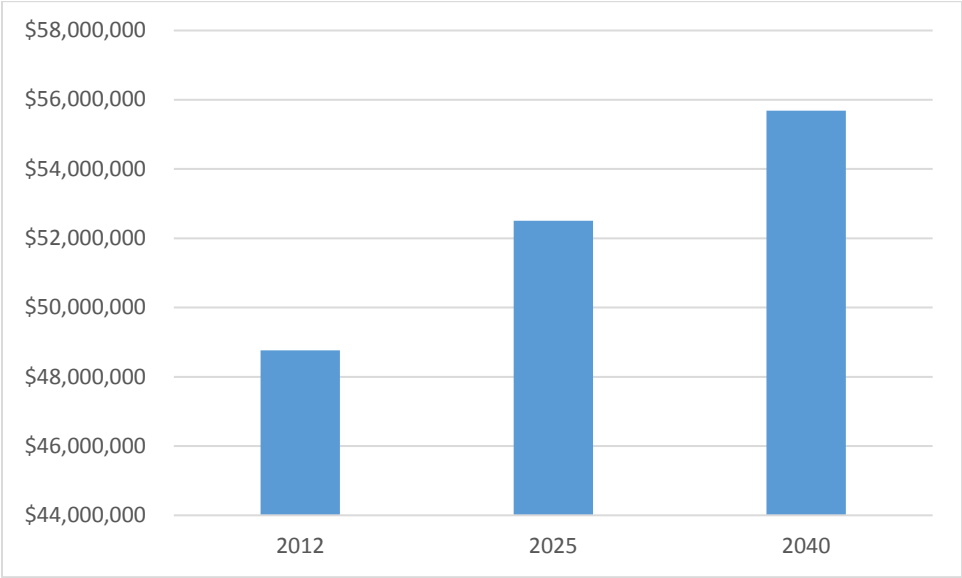
The 2012 Transearch data indicates a slow and steady growth in pipeline movements. Pipeline movements are expected to grow by eight percent between 2012 and 2025 and another six percent from 2025 to 2040.

Figure 4-25: Virginia Pipeline Freight by Tons, 2012



Source: prepared by CDM Smith, based on 2012 IHS Transearch® data.

Figure 4-26: Virginia Pipeline Freight by Value, 2012



Source: prepared by CDM Smith, based on 2012 IHS Transearch® data.

5. Freight Policies, Strategies, and Institutions

National and state freight policies guide the development and implementation of the Virginia Freight Element. They provide the framework for the actions to be taken in order to understand and improve the movement of goods and identify regulations that must be complied with. Some of these policies also identify funding sources that the Commonwealth may want to take advantage of for freight-related initiatives and projects. This chapter documents the national and state freight policies, as well as national, state, and regional freight strategies and freight institutions.

National Freight Policy

National freight policy is intended to improve the condition and performance of the national freight network and provide a foundation for the United States (U.S.) to compete in the global economy. The policy addresses outcomes related to economic competitiveness and efficiency; congestion; productivity; safety, security, and resilience of freight movement; infrastructure condition; use of advanced technology; performance; innovation; competition; accountability in the operation and maintenance of the network; and environmental impacts.

FAST Act Freight Policy and Provisions

The FAST Act, passed in 2015 and promulgated by the Federal Highway Administration (FHWA) focuses heavily on investments in freight, and creates a new National Highway Freight Program (NHFP) with support from the Highway Trust Fund (HTF). It also establishes the Nationally Significant Freight and Highway Projects, a new discretionary program with annual average funding of $900 million.

The NHFP directs federal resources and policies to improve the National Highway Freight Network (NHFN); ensuring the Network provides a foundation for the U.S. to compete in the global economy. This formula program is authorized at $6.2 billion over five years; each state's share of the NHFP will be based on the state's overall share of highway program apportionments. Flexibility of NHFP dollars within a state is related to its share of miles on the Primary Highway Freight System.

The FAST Act specifies goals associated with this national policy related to the condition, safety, security, efficiency, productivity, resiliency, and reliability of the Network, and also reduces the adverse environmental impacts of freight movement on the Network. These goals are to be pursued in a manner that is not burdensome to state and local governments (49 U.S.C. 70101). The main freight-related provisions of the FAST Act are described in the sections that follow.

National Highway Freight Network

The FAST Act includes an estimated $1.2 billion per year for use towards a new NHFP, with a focus on improving the efficiency of freight and movement of freight on the NHFN. Despite the emphasis on highways, a state may elect to use up to 10 percent of awarded NHFP funds towards public or private freight rail, ports and water facilities, and intermodal facilities each fiscal year. States are required to have a federally approved freight plan to obligate NHFP funds (beginning December 4, 2017).

The establishment of a NHFN by the FHWA was required by the FAST Act. This network is to include the Primary Highway Freight System (PHFS), State- and MPO-designated critical rural and urban freight corridors, and other portions of the Interstate Highway System that do not fall within the PHFS. Critical Rural Freight Corridors (CRFCs) and Critical Urban Freight Corridors (CUFCs) are corridors that provide critical freight connectivity to the NHFN. States are tasked with designating these important corridors, and by doing so, can strategically direct resources toward improved system performance and efficient movement of freight along the NHFN. The designation of CRFCs and CUFCs will increase the State's NHFN, allowing expanded use of NHFP formula funds and FASTLANE Grant Program funds for eligible projects that support national goals identified in 23 U.S.C. § 167(b) and 23 U.S.C. § 117(a)(2). The details of the requirements for the critical rural and urban freight corridors are provided in **Appendix A**.

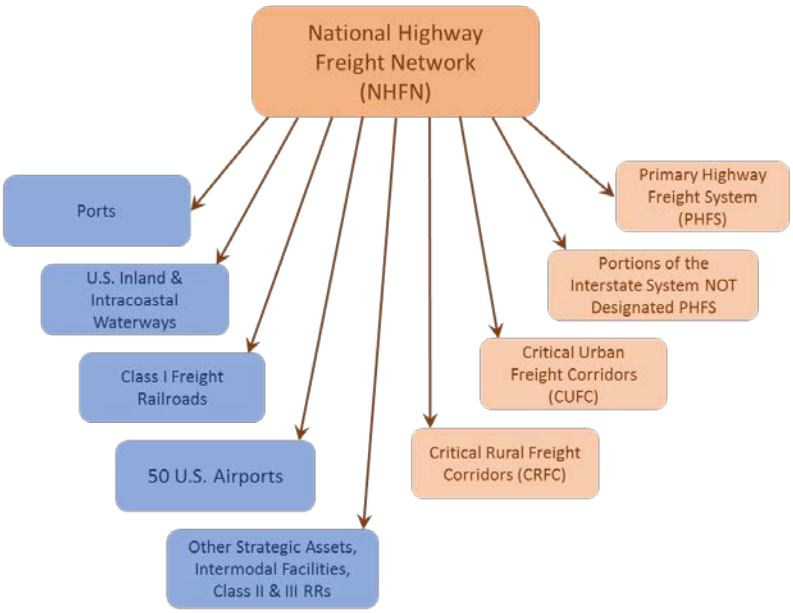
National Multimodal Freight Network

To complement its highway-oriented freight provisions, the FAST Act also includes many multimodal freight policy and planning provisions. Among this set of provisions is the National Highway Freight Network (NHFN) shown in **Figure 5-1**. The FAST Act directs the USDOT to establish an interim National Multimodal Freight Network (NMFN) to:

- Assist States in strategically directing resources toward improved system performance for the efficient movement of freight on the NMFN;
- Inform freight transportation planning;
- Assist in the prioritization of Federal investment; and
- Assess and support Federal investments to achieve the national multimodal freight policy goals described in section 70101(b) of title 49, U.S.C., and the national highway freight program goals described in section 167 of title 23, U.S.C.

The interim NMFN includes the NHFN, freight rail systems of Class I railroads, the Great Lakes, the St. Lawrence Seaway, inland and intracoastal waterways, ports and airports that meet specified criteria, and other strategic freight assets. Following a public comment period, the USDOT must designate a National Multimodal Freight Network, and must redesignate this network every five years thereafter, with input from a wide range of stakeholders.

Figure 5-1: National Highway Freight Network



National Freight Strategic Plan

In October 2015, the National Freight Advisory Committee (NFAC) appointed by the Secretary of Transportation, published the draft National Freight Strategic Plan (NFSP). The NFSP implements and advances the National Freight Policy and Goals established under MAP-21 and continues under the FAST Act. It highlights key trends and challenges, including congestion, institutional and financial, that need to be addressed to enable economic growth. The Plan describes a range of possible public and private sector actions to improve freight infrastructure and planning processes. The USDOT currently is in the process of revising the October 18, 2015 draft NFSP to conform to the additional requirements of the FAST Act enacted in December 2015.

Freight Data, Planning, and Reporting

The USDOT is charged with developing and improving data and tools to support an outcome-oriented, performance-based approach for evaluating transportation projects. This work, which is ongoing, includes considering improvements to the existing methods of freight flow data collection.

Freight Conditions and Performance Report

The FAST Act requires the USDOT to prepare a biennial report describing the condition and performance of the national freight network.

State Freight Advisory Committees and Freight Plans

The FAST Act requires the USDOT to encourage each state to establish a freight advisory committee composed of a representative cross-section of public and private sector freight stakeholders. It also requires the USDOT to encourage each state to develop a comprehensive plan for its immediate and long-range freight-related planning and investment.

Jason's Law

Jason's Law makes construction of safety rest areas, commercial motor vehicle (CMV) parking facilities, electric vehicle and natural gas vehicle infrastructure eligible for federal funding. It also requires the USDOT to survey states within 18 months of enactment regarding their CMV traffic and their capability to provide CMV parking. The USDOT must periodically update this survey and must post the results on its website. Projects eligible to receive funding include:

- Construction of safety rest areas with truck parking.
- Construction of truck parking areas adjacent to commercial truck stops and travel plazas.
- Opening existing facilities to truck parking, including inspection and weigh stations and park-and-ride facilities.
- Promoting availability of publicly or privately-provided truck parking on the NHS.
- Construction of turnouts along the NHS for commercial motor vehicles.
- Making capital improvements to public truck parking facilities closed on a seasonal basis that will allow those facilities to remain open all year.
- Improving the geometric design of interchanges on the NHS to improve access to truck parking facilities.

Special Permits during Periods of National Emergency

The FAST Act allows states to issue divisible load permits to overweight trucks exclusively carrying relief supplies for up to 120 days following a Presidential declaration of a major disaster.

Freight Eligibility under Grant and Loan Programs

Below is a list of several federal grant and loan programs that provide funding for eligible freight improvements.

- *National Highway Freight Program (NHFP)*: The NHFP is funded at an average of $1.2 billion per year and is distributed to the states by formula. Also, the Nationally Significant Freight and Highway Projects, a discretionary program, is funded at an average of $900 million per year. Certain non-highway projects may be eligible for funding under either program.
- *Infrastructure for Rebuilding America (INFRA) Grants:* This competitive grant program advances the Fostering Advancements in Shipping and Transportation for Long-term Achievement of National Efficiencies (FASTLANE) grant program. Established in the FAST Act, it provides dedicated, discretionary Federal financial assistance for highway and freight projects of national or regional significance. The FAST Act authorizes the INFRA program at $4.5 billion for fiscal years 2016 through 2020. These grants are available to states, MPOs, localities, political subdivisions of state or local governments, special purpose districts or public authorities with a transportation function, Federal land management agencies, tribal governments, and multi-state or multi-jurisdictional groups of public entities. Awards under the INFRA program are made to both large and small projects. For a large project, the INFRA grant must be at least $25 million. For a small project, the grant must be at least $5 million. For each fiscal year of INFRA funds, 10% of available funds are reserved for small projects.
- *Surface Transportation Program (STP):* Under the FAST Act, the STP is a block grant program that provides much greater autonomy to states and regional agencies to select and fund projects.

There is continued eligibility for truck parking and surface transportation infrastructure improvements in port terminals for direct intermodal interchange, transfer, and port access.

- *Highway Safety Improvement Program (HSIP)*: Offers eligibility for truck parking.
- *Congestion Mitigation and Air Quality Improvement Program (CMAQ):* Allows use of funds for a project or program to establish electric vehicle charging stations or natural gas vehicle refueling stations.
- *Projects of National and Regional Significance (PNRS):* Continues program with some changes (currently unfunded).
- *Transportation Infrastructure Finance and Innovation Program (TIFIA):* Restricts use of loans for freight rail projects to direct intermodal. There is reduced funding for TIFIA loans under FAST Act, compared to MAP-21.

Metropolitan and Statewide Planning

The FAST Act continues encouragement for freight shippers and providers of freight transportation services to participate in metropolitan and statewide transportation planning processes. It also continues the requirement that planning processes provide for consideration of projects and strategies to increase the accessibility and mobility of people and freight; enhancing the integration and connectivity of the transportation system, across and between modes, for people and freight. Freight plans must be completed and updated at least every five years.

State Freight Policies and Strategies

Virginia statutes and legislative directives set the expectations for coordination and decision-making between the CTB, regional planning partners, and state agencies. The freight plan recommendations are informed by the state's policy emphasis areas and influenced by the requirements and criteria embedded in the statutory decision-making process.

State Decision-Making Process

Virginia passed a law in 2014 that requires a structured and data-driven process for scoring new capacity and safety projects, providing transparent basis for selection of projects for funding. This system is under continual refinement and is now called SMART SCALE.

SMART SCALE

House Bill 2 (HB2), a Virginia law passed in 2014, amended the Virginia Code (§33.2-214.1) to mandate the development and implementation of a prioritization process for transportation projects funded under the direction of the CTB. The purpose of such a process is to increase transparency and accountability in the allocation of state funds. The methodology developed, named SMART SCALE, scores projects and prioritizes them based on a set of quantitative measures. SMART SCALE also requires that each project meets an identified need from VTrans2040 for Corridors of Statewide Significance (CoSS), Regional Networks, Urban Development Areas (UDAs), and/or transportation safety.

Once determined to be eligible, a project sponsor (a locality, regional authority, or transit agency) submits a SMART SCALE application, which is then screened, evaluated, and scored by VDOT, OIPI, and/or DRPT. Once scored and then ranked, projects are provided to CTB for funding consideration and

submitted for public comment. The score is based on how the proposed project addresses the following weighted factors:

- Safety
- Congestion
- Accessibility
- Environmental quality
- Economic development
- Land use (for areas with a population over 200,000)

Freight considerations are included in SMART SCALE's economic development measures. One measure evaluates how each project addresses improvements to intermodal freight movement access and efficiency. The measure rates projects based on the extent to which the project is deemed to enhance access to critical intermodal locations, interregional freight movement, and/or freight intensive industries. An additional measure evaluates how each project addresses travel time reliability to support the movement of goods. This measure determines the project's expected impact on improving travel time reliability, thereby supporting efforts to retain businesses and increase economic activity.

Weights among the factors are determined by each MPO and district. Once a project has been selected for funding, it will be incorporated into Virginia's Six-Year Improvement Program (SYIP) and be considered a funding priority.

Funding for SMART SCALE projects is divided into two programs: The District Grants Program (DGP), open to localities and transit agencies, and the High Priority Projects Program (HPPP), open to localities, transit agencies, and MPOs. Projects applying for DGP funds compete with other projects from the same construction district, and those applying for HPPP funds compete with other projects statewide. Asset management projects are excluded from the SMART SCALE process, but capacity and operational improvements are eligible for funding through SMART SCALE.

A number of projects submitted to SMART SCALE have been identified as providing a freight benefit. Within the first two rounds of SMART SCALE, several of these projects were selected for advancement and can be found in **Table 5-1**.

Table 5-1: SMART SCALE Freight Projects (Six Year Improvement Plan FY 2016-21)

VDOT District	Description	Total Cost ($2016)
Bristol	Add lane on I-77 (South) at Exit 80 in Wytheville	$9,100,000
Bristol	I-81 Exit 19 Ramp Improvements	$9,735,983
Fredericksburg	I-95 Rappahannock River Crossing (southbound)	$125,000,000
Fredericksburg	Commuter Lot Expansion I-95 E of Exit 140	$9,719,246
Hampton Roads	I-64 Capacity Improvements – Segment III	$647,448,358
Hampton Roads	I-64 WB Off-Ramp Exit 282A Terminal Improvement	$9,300,000
Northern Virginia	Modify I-95 SB Off-Ramp at SR 784, Add Signal	$1,684,000
Northern Virginia	Arlington TDM Strategies serving I-66 Corridor	$500,000
Richmond	I-95/I-64 Overlap: Corridor-wide Lighting	$7,199,224
Richmond	I-95 Auxiliary Lanes (NB & SB) between Rte. 288 and Rte. 10	$28,770,000
Richmond	I-95/I-64 Overlap: Emergency Pull-Offs	$7,665,612
Richmond	RTE 95 – Improve Interchange at Rte. 10	$50,500,000
Richmond	RTE 64 – Extend Accel/Decel Lanes	$4,100,000
Richmond	RTE 64 EB – Pavement Marking	$1,500,000
Richmond	RTE 95 – Improve Ramp Area at Franklin St.	$3,148,000
Richmond	RTE 95 - Extend NB Decel Lane at Hermitage Rd.	$2,720,000
Richmond	RTE 95 – Extend NB Accel Lane at Belvidere St.	$5,783,000
Richmond	Improve Broad St. Exit Area	$28,042,650
Richmond	RTE 95 – ITS Low Bridge Warning System	$822,140
Richmond	RTE 95 – Reconfigure Ramps	$10,229,243
Richmond	RTE 95 – Improve Interchange at Maury St.	$9,191,250
Salem	I-81 Southbound Safety Improvements MM167.4 to MM169.5	$5,834,264
Salem	I-81 Southbound Auxiliary Lane between Exit 143 and Exit 141	$32,168,111
Staunton	I-81 Exit 296 Accel/Decel Lane Extensions	$997,481
Staunton	I-81 Exit 315 NB Decel Lane Extension	$643,134
Staunton	I-81 Exit 300 SB Accel Lane Extension	$3,437,422
Staunton	RTE 81 – Safety Improvements, Exit 213	$2,688,439
Staunton	I-81 Exit 245 NB Off-Ramp Realignment	$3,923,707
Staunton	I-81 Exit 222 NB Accel and SB Decel Lane Extension	$4,270,000
Staunton	I-81 Exit 323 NB Accel and SB Decel Lane Extension	$3,450,904
Staunton	I-81 Exit 220 and Exit 221 Decel/Accel Extensions	$5,612,938

Source: Virginia Department of Transportation

Virginia Six-Year Improvement Program (SYIP)

The SYIP is an annual list developed by the CTB of all transportation projects proposed for study or construction throughout the Commonwealth that are to be funded over the next six fiscal years. All projects in the SYIP eligible for federal funding are also included in the Statewide Transportation Improvement Plan (STIP), which lists all Virginia transportation projects that will use federal

transportation funding or require approval from the USDOT. Every fall, the CTB conducts a series of public meetings across Virginia to garner public feedback on transportation projects and priorities. A draft SYIP is then developed, based on public input, available funding, and identified needs. The draft is then released for public comment, and a final SYIP is approved by the following June 30 (prior to the first day [July 1] of the next fiscal year).

The SYIP details the funding allocation for the first fiscal year; however, the remaining five years are estimates of future allocations. Hence, the need for an annual update to the program, as studies are completed, designs are developed, and/or project schedules, costs, or resources may change.

Highway and Bridge State of Good Repair (SGR)

The Virginia Department of Transportation allocates capital improvement funds for pavement and bridges based on current and forecast asset conditions, passenger vehicle and truck volumes and available resources. Funding sources for highway asset preservations come from state and federal funding programs.

In Fiscal Year 2017, VDOT spent $1.7 billion on routine maintenance, a $100 million increase over the prior year. VDOT also spent $172 million to reconstruct or rehabilitate state and local roads and bridges.

In 2016, the Virginia Department of Transportation completed an assessment of the resources required to attain a 100% state of good repair for the state system's pavement and bridges. The Department concluded that by addressing the backlog of asset management needs in the first year, total costs over the 24 year analysis period could be minimized and the total return on investment could be maximized. The unconstrained need for attaining and maintaining the 100% state of good repair for pavement is $5.2 billion in the first year and $1.2 billion for each year to 2040. For bridges, the SGR needs are $6.8 billion in the first year and $211 million per year for each following year.

Virginia supports off-state system highway and bridge preservation and maintenance through a state-administered local maintenance fund. The distribution of funding is based on lane miles, vehicle miles of travel and truck travel.

Virginia's asset management program includes data collection, a needs assessment, setting of performance targets, and performance-based budgeting. As a part of data collection and needs assessment, an annual survey of bridge and pavement condition is used to estimate the current and project the future pavement maintenance and rehabilitation needs. Virginia also monitors and assesses the effectiveness of maintenance and rehabilitation activities. A performance based budgeting process establishes budget allocations based on scenarios showing the expected system performance that can be achieved at different levels of investment. The performance scenarios explicitly consider impacts to all functionally classified roads and the outcomes are influenced by the truck size and weight expectations extrapolated from data collected at weigh in motion stations.

Rail Enhancement Fund (REF)

Under § 33.1-221.1:1.1 of the Code of Virginia, the Rail Enhancement Fund (REF) was developed within the DRPT in support of the public interest for the preservation and development of railway transportation facilities. The Virginia General Assembly declared it to be in the public interest that the preservation and development of railway transportation facilities are important elements of a balanced transportation system in the Commonwealth. It further declared it to be in the public interest that the

retention, maintenance, improvement, and development of the railways are essential to the Commonwealth's continued economic growth, vitality, and competitiveness in national and world markets.

The Director of DRPT administers the REF program, subject to the review and recommendation and the approval of the CTB. The REF is intended to support the growth of freight and/or passenger rail transportation for purposes of acquiring, leasing, and/or improving railways or railroad equipment, rolling stock, rights-of-way, and facilities.

The CTB supports the use of funds for railroad projects deemed to be important elements of the Statewide Transportation System. Funding is a combination of at least a minimum of 30% cash or in-kind matching contribution from a local source. The other 70% (or balance matched) comes from DRPT funds. Commuter and intercity passenger rail operators, freight rail operators, private businesses that currently utilize rail or are planning to develop railway facilities in the future, regional authorities, local governments, non-profit organization, or any combination of the listed entities are eligible to apply for REF grants.

Local Funding

HB 2313, passed in 2013, enabled Hampton Roads and Northern Virginia to generate local revenue exclusively for regional and local transportation projects. Both region's sales tax was increased by 0.7 percent; however, Hampton Roads' gas tax also increased by 2.1 percent, whereas Northern Virginia's hotel tax increased by 2 percent and a regional congestion relief fee of $0.15 per $100 real estate valuation was incurred. These local funds are to supplement statewide funds received through the CTB.

In Hampton Roads, the revenue is overseen by the Hampton Roads Transportation Accountability Commission (HRTAC). The money is limited to new construction projects on new or existing highways, bridges, and tunnels in the Hampton Roads region, with priority given to projects anticipated to reduce congestion for the greatest number of constituents. HRTAC works with the Hampton Roads Transportation Planning Organization, VDOT, and DRPT for planning, technical, and administrative support.

In Northern Virginia, the revenue is overseen by the Northern Virginia Transportation Authority (NVTA). Thirty percent of the funds are distributed to localities, whereas 70 percent of the funds are reserved for regional projects, as approved by the NVTA. Local projects may include construction of urban or secondary roads, capital improvements aimed at reducing congestion, or public transportation projects. Regional projects are to be projects included in the region's long-term transportation plan, and projects rated and evaluated by VDOT as part of HB 599. Passed in 2012, this bill applies exclusively to Northern Virginia and requires that all regional projects be evaluated in terms of congestion reduction and emergency evacuation. The NVTA partners with the Transportation Planning Board for the National Capital Region, the Northern Virginia Transportation Commission, VDOT, and DRPT for planning, technical, and administrative support.

Statewide Freight Institutions

The following statewide institutions that influence the movement of freight in Virginia are listed below:

- Governor's Office of Intermodal Planning and Investment (OIPI)
- Virginia Department of Transportation (VDOT)

- Virginia Department of Rail and Public Transit (DRPT)
- Virginia Department of Motor Vehicles (DMV)
- Virginia Department of Environmental Quality (DEQ)
- Virginia Economic Development Partnership (VEDP)
- Virginia Department of Aviation (VDA)
- Virginia Department of Emergency Management (VDEM)
- Virginia Department of Mines, Minerals and Energy (DMME)
- Virginia Office of Public Private Partnerships (OPPP)
- Port of Virginia (POV)
- Virginia Department of Forestry (VD)F)
- Virginia Department of Agriculture and Consumer Services (VDACS)
- Virginia Metropolitan Planning Organizations (MPO)
- Counties/Cities

6. Strengths, Challenges, Needs, and Trends

Virginia's economy relies heavily on the multimodal freight transportation system for movement of goods with each modal network having particular strengths and challenges. This chapter documents those strengths and challenges of the freight network, as well as discusses the modal needs and trends impacting freight transportation in the state and the U.S.

Strengths of the Freight Transportation System

Highway Strengths

- Excellent access to ports and major airports
- Accessible to large population centers on Eastern seaboard and the Midwest
- Dedicated funding program with SMART SCALE
- Recent significant investments in Corridors of Statewide Significance
- Strong planning focus on corridor management and mobility
- Support for technology solutions

Rail Strengths

- The Class I rail network provides service and access to key nodes across the Commonwealth including Norfolk, Richmond, Lynchburg, Roanoke, and Alexandria
- Virginia's rail network has access to most major cities east of the Mississippi River

Ports and Waterways Strengths

- Only U.S. East Coast port with congressional authorization for 55-foot depth channels
- Economic impact of $60 billion in total revenue to the Commonwealth
- Highest rail-volume port on the East Coast (CY 2016)
- The Port of Virginia's (POV) location and primary market size positions it perfectly to serve the American Heartland. The POV's market reach is competitive in size to NY/NJ and Savannah: All three ports are able to serve a market potential of 50+ million people.
- National ranking(s) in terms of value – in 2015 ranked 7th in U.S. and 3rd on East Coast
- According to an economic impact study conducted by the Mason School of Business at the College of William & Mary in 2013:
  - $88.4 Billion in spending
  - 530,800 Jobs [Maritime-related direct employment of 296,100 Virginians] – nearly ten percent of the state's resident workforce – are linked to port activity across the six terminals
  - $27.4 billion in Wages
  - $2.7 billion in state and local taxes
  - 10.1% of Virginia Gross State Product

Aviation Strengths

- Virginia's air cargo airports offer a central location on the Eastern Seaboard.

- Unlike some airports, Dulles International Airport (IAD) offers 24-hour operations, no night-time flight restrictions, climate-controlled warehousing, and direct service to 50 international markets.[25]
- Both IAD and Richmond (RIC) are home to a Foreign Trade Zone – which are U.S. Customs and Border Protection supervised free-trade zones, allowing for expedited processes and reduction or avoidance of duties on cargo.
- According to a 2011 study of the impacts of Virginia's aviation system, direct business sales and business activities that depend on airport operations contributed $17.6 billion to the state's economy, excluding visitor spending. Freight-related impacts represent a reasonable fraction of that total[26].

Freight Initiatives by Mode

The following freight-specific initiatives are currently underway throughout the Commonwealth. These initiatives, once implemented, will improve the overall freight transportation system.

Highway Initiatives

- The Atlantic Gateway project will improve portions of I-95.
- I-64 widening between Richmond and Hampton Roads.
- Port and airport access improvements (see below).

Rail Initiatives

- The Richmond to DC High Speed Rail project will improve the efficiency and mobility of freight trains, in addition to supporting passenger rail.
- The Atlantic Gateway project will improve freight rail operations in the I-95 corridor by connecting to Long Bridge across the Potomac River
- Railroads are working to raise clearances to handle double-stack containers on main lines.
- Maintain state of good repair on shortline freight railroads to enhance last mile connectivity for freight movements.

Ports and Waterways Initiatives

- Recent investments
  - The Norfolk International Terminal's (NIT) North Gate Terminal expansion was completed in June 2017. The expansion is a $42M investment, $15M from a TIGER grant and the remainder from port revenues.
  - NIT South Terminal expansion - $350M cash infusion from general assembly, increase capacity by 400K containers (46%). First stacks complete in 2018 with all stacks complete by 2020.
  - The Virginia International Gateway (VIG) container terminal is increasing capacity to 1.2M containers, doubling size of facility.

[25] Metropolitan Washington Airports Authority, "Introduction to Washington Dulles International Airport Cargo," www.mwaa.com/business/welcome-dulles-international. Accessed: October 2016.

[26] Virginia Airport System Economic Impact Study, Virginia Department of Aviation, August, 2011

  - Outside the gates: over $4 billion is being invested in road projects in state that will benefit the port.
- Ports of Virginia and Savannah initiative. On Feb. 27, 2017, the Ports of Virginia and Savannah, Georgia announced that they submitted a proposal to the U.S. Federal Maritime Commission asking federal regulators to let them share information on dockside operations and work together in marketing themselves to shipping services. Under the proposal, the ports of Virginia and Savannah could: jointly acquire operating systems and equipment; meet to share information on cargo handling, gate operations, turn times, staffing, and infrastructure; jointly draft agreements with carriers, shippers, and other terminal operators; and sync marketing materials to attract joint services, alliances, and carrier network agreements.
- The POV is planning ahead to handle the larger ships starting to be deployed. They are halfway through the process of deepening to 55 feet. The POV expects to complete the process of economic justification with the U.S. Army Corps of Engineers (USACE) by the summer of 2018. They then will need to request federal appropriations to do the deepening.
- The POV is positioning to be a "first in, last out" destination.
- Norfolk Southern invested in the Heartland Corridor in 2010 which provided double-stack access and a quicker route to Chicago and the Ohio Valley from the POV.
- CSX is investing in National Gateway, which opened up double-stack access in December 2016. The project is scheduled for completion in 2018.
- Commerce Corridor study – will identify transportation improvement recommendations for the Commerce Corridor study area that will also benefit the Richmond Marine Terminal.

Aviation Initiatives

The initiatives benefitting air cargo in the Commonwealth are listed below:

- Washington Dulles International Airport, Dulles Master Plan 2012[27]
  - Expand Old Ox Road/ Route 606 from 2 to 4 lanes from Evergreen Mills Road to Dulles Greenway to reduce congestion (Route 606 is 4 lanes between Route 50 and Evergreen Mills Road and between Greenway and Route 28) (Loudoun County Comprehensive Plan 2011)
  - Expanding Route 50 from 4 to 6 lanes addressing opportunities to improve median openings, turning movements, lane use controls, channelization, and indirect left turn treatments to reduce congestion (Loudoun County Comprehensive Plan 2011)
  - Future east-west runway (fifth runway). The fifth runway will run parallel to existing runway 12-30 along the south side of Dulles Airport property. The runway would be roughly parallel to U.S. 50, west of Chantilly. It will be approximately 10,500 feet long and 150 feet wide. (Dulles Master Plan 2012)
- Richmond International Airport (RIC) Master Plan Executive Summary, 2010[28]
  - Projects Within 20-Year Planning Horizon
    - Construction of a new, 9,000 feet long by 150 feet wide runway (16R-34L).

[27] http://www.metwashairports.com/iad/d2-projects-future-fifth-runway

[28] http://www.flyrichmond.com/files/1_-_Master_Plan_Update_Exec_Summary.pdf

    - Construction of the new East Airside Development Access Road for circulation of vehicles to access new facilities at the East Cargo Development Area. Construction includes realignment of Beulah Road.
    - Concourse (A, B, and C) and apron expansion totaling over 350,000 square feet of building space and 3.5 million square feet of apron space.
  - Post-Planning Horizon Project
    - Development of future office, industrial, and warehouse space (Airport Business Park) for prospective aerospace/aviation-related firms, as well as non-aviation related firms
- Norfolk International Airport (ORF) Master Plan Update, 2008[29]
  - Construct a new runway parallel to and east of the existing primary runway – Runway 5-23
  - Remove Taxiway F and Taxiway G southeast of existing Runway 5-23
  - Upgrade the Instrument Landing System (ILS) serving existing Runway 5 (future Runway 5L) from Category I to Category II capability
  - Add Remain Overnight (RON) parking positions on the commercial aircraft apron
  - Expand the air cargo aircraft parking apron
  - Construct a remote consolidated receiving facility to security screen deliveries to the Airport destined for the secure airside area
  - Provide reserve areas for long-term development of airline maintenance facilities, fuel storage facilities, general aviation facilities, air cargo facilities, and public/rental car parking facilities
  - Improve roadway signals and outbound signage at Norview Avenue (Norfolk International Master Plan 2008)

Freight Transportation Challenges

Trucking-Related Challenges

Nearly every freight shipment travels by truck at some point in its delivery. Challenges on the highway system can cause ripples through the state's freight transportation system and the economy. Delay, safety, and access issues raise costs for shippers, carriers, manufacturers, and consumers alike.

Overall Condition and Design of Roadway Infrastructure

As the economy grows and new industries are established, the highway system will be expected to carry more freight. Heavy-use truck routes often experience rough pavement, tight turning radii, narrow lane width, short ramps, inadequate merging lanes, lane restrictions, and overall capacity issues. Improvements to address issues can range from small scale intersection improvements to the rebuilding and expansion of long stretches of highway links. Truck bottlenecks, as well as the general condition of the highway system, were identified as a concern for current and future mobility of trucks. This is particularly of concern for oversize and overweight trucks on rural highways where bridges have weight restrictions. Of particular concern for trucks are:

- Roadway and Bridge/Tunnel Conditions,
- Problem Intersections,
- Geometry-related bottlenecks, and

[29] http://www.norfolkairport.com/sites/default/files/ORFMasterPlanUpdate2008.pdf.

- Third Crossing in Hampton Roads.

Truck Size and Weight Limits

Increases in the size and weight of vehicles may improve freight efficiency, but they may also have a lasting impact on roadway quality and may compromise safety. In addition, heavier and larger trucks require route plans that may necessitate the need for lengthy detours due to weight limits or vertical/horizontal clearances. The region's roadway system is relatively well equipped to handle the current truck traffic, particularly in urban areas. In rural areas, however, infrastructure built decades ago may struggle to handle the loads, particularly as the timber industry continues to expand into sites that require access via these roadways and bridges. Because Virginia regularly monitors, inventories, forecasts and estimates maintenance and preservation needs for its roads and bridges, it has been able to make progress towards repairing roads and bridges subject to high freight loads in rural areas back to a state of good repair.

Safety/Incident Management

Incident management describes the coordinated activities of transportation, emergency, and law enforcement agencies to respond to crashes, highway construction, and events such as hurricanes. Proper planning and investment in incident management can decrease the response times to emergencies and can help restore a corridor to pre-incident flow rates quickly. Statewide and regional transportation planning for disasters, emergencies, and significant events provides a framework for comprehensive, multi-jurisdictional, multi-disciplinary preparedness, response, and management for a wide range of incidents that affect freight transportation systems in the region. Providing solutions that address all hazards will support transportation system management, congestion management, and emergency response preparedness. Barriers to better incident management exist within the region such as manpower, funding limitations, lack of best practices knowledge, and bureaucracy/coordination issues. Feedback through the various participating stakeholders identified a high concern for the lack of regional coordination of incident management and a high concern that traffic congestion was the result of slow incident management, opposed to limited capacity on roadways.

Limited Availability of Truck Parking

Hours of service regulations for truck drivers require off-duty times for rest. The limited availability of parking has occasionally resulted in trucks parked on ramps and shoulders, which may present a safety risk. An inventory of parking supply conducted by VDOT in 2015, notes there are 7,464 truck parking spaces provided by 37 publicly-owned and 96 privately-owned facilities. However, the location of truck parking facilities is critical, especially in urban locations where the current supply may not be adequate in high demand locations. The existing conditions analysis revealed a near-capacity condition of the available truck parking in the state. Feedback from the Freight Plan outreach effort identified the demand for truck parking as a concern for the trucking industry.

Intermodal Connectivity

Intermodal connectivity allows the freight system to operate more efficiently by increasing the mode choices and speed at which goods move throughout the region. Issues exist with routes and infrastructure to rail yards, airports, and industry clusters. Improving these connections will increase the velocity of freight, reduce transportation costs, and positively impact freight-reliant industries. In the study area, intermodal facilities are connected to the larger highway system in high congestion conditions. This is a concern for both the mobility and resiliency of intermodal connections.

Environmental Impacts – Emissions, Noise, Land Use Conflicts

With increased trucking and increased population, the potential negative effects of freight activities are magnified. Factors such as truck emissions, fuel consumption, noise, and land use conflicts must be considered in freight system planning and regulation.

Industry Concerns – Driver Attraction/Retention, Training/Education

The trucking industry faces issues of driver attraction and retention and the Commonwealth could be a partner in providing education and training. Similarly, there may be opportunities for the Commonwealth to expand the types of system information it provides to truckers – and for truckers, in turn, to provide more information on travel patterns and other issues back to the Commonwealth.

Time Shifting/Mode Shifting

In the off-peak-periods, much of Virginia's highway system outside the cities has excess capacity, apart from work zone related delays. Many long-haul truckers whose schedules allow them to travel through Virginia's congested urban areas at night will do so. Perhaps more truck travel could occur at night, and perhaps some shorter-haul activity could also occur at night. However, much of the short-haul activity will continue to occur in daylight hours for several reasons: that is when most businesses are open, businesses are located in neighborhoods where off-peak/overnight deliveries would be disruptive, people do not want to receive deliveries at their homes at 3:00 a.m., and truck driver availability. Strategies to encourage greater use of off-peak highway capacity are an important opportunity, but must address not only the truckers, but also consider businesses and neighborhoods.

The Commonwealth has been active in exploring the potential to shift long-haul truck traffic to rail, to the extent this may prove feasible. Several background studies addressing I-81 have been performed including studies addressing truck-rail diversion. The Commonwealth also participated with its I-95 Corridor Coalition partners on the Mid-Atlantic Rail Operations Study, which considers diversion potential on both I-95 and I-81 routings. These opportunities hold promise; determining the real benefits and associated costs is important to develop a basis for public investment decisions. Mode-shifting also applies to passengers – more transit use means fewer cars, which means more highway capacity is available for trucks.

Additional Transportation Funding Mechanisms

The state is not unique in terms of transportation funding shortfalls. Transportation needs far outweigh the resources available and historically, freight needs have not received separate attention from transportation in general. There is a freight specific need for additional transportation funding mechanisms, particularly for highway maintenance and construction. In addition, funding programs are often prescribed for specific types of projects or modes, limiting the ability to fund some high priority projects. Multimodal transportation funds, which can be used for transportation projects on a competitive basis regardless of mode, have begun to gain popularity in other states.

Freight Rail Related Challenges

While the rail system is owned and operated by the private sector, the public sector has an interest in maintaining and improving its viability because rail investments can save money on roadway preservation and capacity over the long run. Addressing the rail system's challenge to improving efficiency can help accommodate expected growth while meeting the safety and performance goals established in this Report.

Rail Chokepoints Paralleling I-95

The CSX rail line paralleling I-95 between Richmond and Washington, D.C. experiences chokepoints related to insufficient rail capacity, restricted geometric design, and passenger rail/freight rail conflicts. These chokepoints severely limit the growth of both passenger and freight traffic in this critical corridor.

Insufficient Rail Capacity Paralleling I-81

The NS rail corridor paralleling I-81 has insufficient mainline capacity. Improvements to this corridor could help reduce or delay the need for improvements to the highway.

Capacity Constraints with Rail Lines Serving the Port

The Port of Virginia anticipates growth in international container traffic. Improving capacity on the existing rail lines serving the Port would allow for increased container movement via rail.

Rail System Modernization

Over the past two decades, the nation's rail system has transformed much of its 19th century infrastructure to serve 21st century markets, with tracks and bridges that accommodate heavier railcars, and with improved double-stack intermodal corridors and railyards. Most of these investments have come from the rail companies themselves.

Terminal Capacity Constraints

Freight rail relies heavily on the intermodal connections with trucks. The transfer of bulk commodities such as grain, coal, and oil require adequate intermodal operations capacity to move goods from production to consumption markets. Intermodal terminal capacity constraints will reduce efficiency, ultimately increasing costs.

Limited Rail Weight Limits

The short line railroads' inability to accommodate 286,000 lb. standard rail cars limits growth and creates chokepoints at rail switching locations with Class I railroads which can accommodate the standard sized rail car. Rail shipments that use these lines require extra planning so as not to exceed weight limits, resulting in more time for processing, and increased costs.

Rail Funding

Although there are some federal funding mechanisms for rail improvements and state funding for rail crossing improvements, there is no state fund set aside for rail capacity improvements. A state rail program to take advantage of federal programs that require a match would help address the 286k track limitations that the system faces. Also, states could assist short line railroads to sponsor rail improvement projects for federal funding. This is permitted in the Passenger Rail Investment and Improvement Act of 2008 (PRIIA).

Intermodal Terminal Development and Multimodal Diversity

Addressing the need for rail access improvements to businesses is a challenge but necessary to compete with other states. Improved intermodal terminal development could improve access to the national rail system and improve the attractiveness of rail to area shippers and receivers.

Port Related Freight Challenges

The Port of Virginia is one of the major economic drivers in the Commonwealth. Channel deepening, aging infrastructure, and anticipated container growth are among the challenges facing the ports and waterways system in Virginia.

Safety and Security

Safety and security of port operations both landside and waterside continue to be a top priority.

Improve Facilities to Accommodate Anticipated Growth

Anticipated container growth over the next 20 years will require improvements to port facilities for handling the increase in freight. Additional warehouses and distribution facilities will also be required across the state.

Preserve/Upgrade Landside Access by Truck and Rail

With strong anticipated growth in the movement of international shipping containers and other commodities through Virginia's ports, maintaining and improving rail service and highways for marine terminals are critical.

"Marine Highway" Initiatives

The USDOT's America's Marine Highway Program is an initiative to move more cargo on the water rather than on crowded highways. Virginia is part of the M-95 Marine Highway Corridor designated by the USDOT Maritime Administration. The 1,925 mile-long I-95 Corridor is the major North-South landside freight corridor on the East Coast. The marine highway initiative seeks to identify opportunities for expansion to marine highways to help address growing congestion, improve air quality, conserve energy, and lower landside infrastructure maintenance costs.[30]

Reduce Port Congestion

While the Port of Virginia has worked with the DMV to reduce the turnaround time for trucks on-port in recent years, the issue of congestion in the immediate port areas continues to be a concern on the part of truckers.

Minimize Reliance on Local Street Access

The linkages between ports and the highway system still involve local streets, such as Hampton Boulevard in Norfolk, which connects the Norfolk International Terminal with the Mid-Town Tunnel and I-664. Improvements that provide more direct connections to the highway system can reduce conflicts and improve safety and reliability.

Air Cargo Related Challenges

Though small in volume, airborne freight exhibits a high value per ton. Typical commodities include goods from the pharmaceutical, automotive, and high-tech manufacturing sectors, as well as the consumer parcel delivery services. Moving goods by air is expensive and the industry responds to the forces of supply and demand.

Anticipated Growth in Air Cargo Tonnage

Virginia anticipates a tripling of growth in air cargo tonnage which will require improvements to both international and domestic air cargo handling services at airports in the Commonwealth.[31]

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[30] http://i95coalition.org/projects/m-95-marine-highway-corridor/. Accessed 8/7/17.

[31] Virginia Department of Transportation – Multimodal Transportation Planning Office. *Virginia Statewide Multimodal Freight Study, Phase 1*. Executive Summary. Page ES-22. Accessed on 7/13/17 at http://www.virginiadot.org/projects/vtrans/resources/VA_Statewide_Multimodal_Freight_Study_Exec_Summ_COMPLETE.pdf.

Needs

A holistic intermodal approach to planning for, investing in, and operating the freight transportation network is necessary for Virginia to foster and expand its freight capabilities, which in turn, strengthens the Commonwealth's economy. A step towards this goal would be identifying intermodal opportunities within the system. Such opportunities would involve analyzing how better to connect the top freight industries within Virginia to their specific markets. In addition, the VDOT 2015 Truck Parking Study found a significant shortage of truck parking spaces throughout the Commonwealth, which translates to a considerable safety concern. A top unmet need identified by the DRPT is addressing rail bottlenecks, as the rail network has difficulty handling peak demand.

National Freight Trends

Panama Canal

The Panama Canal, completed in 1914, created one of the most important trade routes in the world, linking the Atlantic and Pacific Oceans. After nearly a century, the canal underwent a $5 billion expansion to increase capacity and accommodate larger ships. The expanded canal with new locks allows for deeper, longer, and wider "New Panamax" vessels, doubling existing throughput capacity from 5,000 20-foot equivalent units (TEU) on current vessels to (potentially) 13,000 TEU. The expansion, completed in June 2016, helps reduce delays and shipper costs. Access to ports that can accommodate these ships may shift freight rail and truck routes.

Freight Oriented Development

A Freight Oriented Development (FOD) is a development of consolidated freight oriented business such as manufacturing, warehousing, distribution, and freight forwarding operations directly connected to the regional freight network. These types of development cluster similar industrial businesses for improved efficiency while preserving industrial land uses and minimizing impacts to non-freight oriented areas.

Alternate Transportation Fuels

In 2011, transportation use accounted for less than one percent of the natural gas consumed in the U.S. However, natural gas consumption in the transportation sector is expected to grow from 40 billion cubic feet (bcf) in 2012 to 850 bcf in 2040, an increase of over 2,000 percent. Citigroup forecasts that 30 percent of the heavy truck fleet would shift to natural gas by the end of 2020; however, others project growth at a lower rate. Currently, the main obstacle to faster conversion from diesel and gasoline is the higher cost of natural gas powered trucks and the lack of refueling stations for long-haul trips.

Natural gas is currently about 30 to 40 percent less expensive than diesel on a per gallon equivalent basis on the retail market. Consequently, commercial trucking fleets have begun converting to compressed natural gas (CNG) for short-haul operations and liquid natural gas (LNG) for long-haul operations. Companies with large fleets making commitments to CNG/LNG include United Parcel Service (UPS), Waste Management, and AT&T, to name a few.

The U.S. Energy Information Association (EIA) also projects that LNG will play an increasing role in powering freight locomotives in coming years. Several major railroads are considering the use of LNG in their locomotives to lower long-term costs; however, the upfront capital cost in switching to LNG-

powered locomotives is substantial. While experts believe that a switch to LNG to some degree is inevitable, the pace of change and the penetration of change are highly uncertain. The EIA's projections on the use of LNG to meet rail freight energy needs in 2040 range from a low of 16 percent to a high of 95 percent.

Further adoption of natural gas for transportation use will require more filling stations and widespread distribution and awareness by policy-makers. Currently, most filling stations (like those being built by UPS) are paid for and used privately. However, if demand for CNG and/or LNG fueling stations continues to grow, state or local governments may need to consider policies to attract or allow these fueling stations so that more businesses (and, potentially, residents) can access this fuel.

Biofuels also have the potential to reduce carbon emissions, reduce reliance on foreign oil and create rural economic development. For these reasons, biodiesel is an important biofuel for freight transportation. Increasing the use of a biodiesel blend has shown potential to be a short-term, relatively low-cost way to reduce freight-related emissions [including carbon dioxide (CO2), nitrogen oxides (NOx), and particulate matter (PM-10)], which could be attractive to areas that are in nonattainment under the Environmental Protection Agency's (EPA) air quality standards.

Air Quality and Regulation

The U.S. Clean Air Act regulates areas that do not meet the standards for criteria pollutants under the National Ambient Air Quality Standards (NAAQS). In nonattainment areas, federal law requires state and local governments to develop and implement plans for bringing these areas back into compliance. These areas operate under 'maintenance' state implementation plans (SIPs), which often have provisions affecting the transportation network.

As it relates to freight, project delays only prolong bottlenecks for truckers (who carry goods to other parts of the system), and restrictions on traffic in general can also affect trucks. Air quality regulation under the Clean Air Act is yet another factor driving environmental improvements in truck emissions and fuel use.

Additionally, the EPA is adopting more stringent exhaust emission standards for large marine diesel engines; the overall strategy includes adjusting Clean Air Act standards and implementing international standards. By 2030, the measures are expected to reduce annual NOx emissions in the U.S. by approximately 1.2 million tons and particulate matter emissions by 143,000 tons.[32] As trucking companies are required to retrofit exhaust systems or purchase new compliant trucks to meet more stringent requirements, the associated costs will mean higher operating expenses for shippers, which in turn will lead to higher costs to transport goods.

Climate Volatility

Climate volatility is likely to have more impact on the future of surface transportation than any other issue. Anticipated sea level rise, more extreme weather events, and an increase in very hot days/heat waves have the potential to severely impact the freight transportation network. State DOTs may face future challenges and implications for surface transportation, such as meeting changing public

[32] *USEPA Office of Transportation and Air Quality. "EPA Finalizes More Stringent Standards for Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder."*

expectations, adapting vulnerable transportation infrastructure, and addressing greenhouse gas (GHG) reductions.

Emerging Technological Trends Impacting Freight

The freight industry is rapidly changing with advances in technology. These best practices utilize technology to gather data and better understand the transportation system, its operation, and opportunities for efficiencies. Technology is perhaps the category with the greatest potential to change the transportation system and manner of freight delivery. Advances in vehicle technology and logistics operations may require adaptation ranging from federal policy to the specific equipment purchased by a private freight company.

Autonomous and Connected Vehicles

Connected Vehicles (CV) and Autonomous Vehicles (AV) are two terms for advances in vehicle technology that is aimed at making roadway travel safer and more efficient. Connected vehicles are those that utilize short range communications and cellular networks so that the vehicle can exchange information with other vehicles [Vehicle to Vehicle (V2V)] or to the transportation network [Vehicle to Infrastructure (V2I)]. Connected vehicles are not self-driving. These are autonomous vehicles. These vehicles use internal sensors, cameras, GPS, and advanced software to operate all or some functions of a vehicle without driver assistance. Although autonomous vehicles may have some of the connected vehicle technology, it is not required.

The development of autonomous trucks continues to advance significantly. This type of truck uses a system called the Highway Pilot, which enables the human driver to switch control over to the truck's embedded system after entering the flow of traffic and reaching 50 miles per hour. This technology uses a combination of vehicle-to-vehicle Wi-Fi communication, radar, and cameras to operate on Highway Pilot. Although much of the public discussion surrounding autonomous vehicles has focused on passenger cars, many observers believe that the commercial trucking industry is likely to be the first widespread adopter of AV due to its potential for significant cost savings and safety benefits. In fact, one logistics industry CEO recently predicted that virtually all trucks on the nation's highways will be autonomous within ten years, noting that every truck manufacturer is now including autonomous features in their future plans.[33]

AV/CV in Virginia

Virginia is a leading state in the development and testing of Connected and Autonomous vehicles. The Virginia Connected Corridors (VCC) is a new initiative developed in 2014 by the Virginia Tech Transportation Institute (VTTI) in partnership with VDOT. The VCC encompasses both the Virginia Smart Road in Blacksburg, Virginia and the Northern Virginia Connected-vehicle Test Bed, which is located along one of the most congested corridors in the U.S. (I-66, I-495, US 29, and US 50). The VCC is facilitating the real-world development and deployment of connected-vehicle technology using more than 60 roadside equipment units. VTTI, VDOT, and researchers from across Virginia are already implementing connected applications using the VCC, including traveler information, enhanced transit operations, lane closure alerts, and work zone and incident management.

[33] Van Marle, Gavin, 'XPO chief shrugs off Teamsters protest and promotes autonomous trucks', The Loadstar, February 28, 2017.

More recently in 2015, the VTTI in partnership with VDOT, the Virginia Department of Motor (DMV) Vehicles, Transurban, and HERE - a high-definition mapping business, unveiled the Virginia Automated Corridors (VAC). The corridors feature more than 70 miles of interstates and arterials in the Northern Virginia region, including I-66, I-495, and I-95, as well as US 29 and US 50. These roadways comprise one of the most congested corridors in the U.S., with multiple transportation challenges that could be mitigated through the use of automation, including congestion. The corridors also include two test-track environments: the Virginia Smart Road and the Virginia International Raceway. The VACs provide an automation-friendly environment that government agencies, original equipment manufacturers, and suppliers can use to test and certify their systems, providing a system migration path from test-track to real-world operating environments. The VACs will leverage extensive experience in on-road safety research to provide efficient solutions to automated-vehicle testing.

Virginia's Atlantic Gateway project, selected for a federal FASTLANE grant in 2016, will include funding to build pavement for autonomous vehicle enhancement. The Atlantic Gateway project will transform the I-95 Corridor in Virginia into a true multimodal corridor that better manages traffic and increases travel choices for people and goods.

Intelligent Transportation Systems

As technology advances, real time data on parking availability, congestion, and road and weather conditions can be transmitted between vehicles, roadside units, and traffic management centers.

Freight volumes continue to increase and technological advances in dedicated freight infrastructure have the potential to optimize and improve the transportation network. Specifically, advances in intelligent transportation systems (ITS) such as dedicated truck lanes and autonomous freight vehicles may change the safety and efficiency of goods movement along roadways. Variable message boards/signs are one component of ITS currently used in urban areas to monitor highway conditions and inform drivers of traffic slowdowns, delays, and incidents. The USDOT also recently developed an open source architecture package for a Freight Advanced Traveler Information System (FRATIS). FRATIS includes information sharing between the terminal operator, truck dispatcher, and public ITS that provides both real-time and predicted terminal queue time; real-time truck routing and navigation; real-time traffic and weather data. It also includes a drayage optimization algorithm that helps drayage dispatchers plan daily work to maximize loaded moves and minimize unproductive (e.g., bobtail) moves and total mileage.

In addition, applications can include advanced emergency management that aims to reduce congestion on major roadways through monitoring traffic incidents with closed circuit television cameras, dispatching vehicles to remove debris or hazardous materials, communicating the most direct routes to emergency vehicles to help them arrive more quickly at accident scenes, and displaying information on dynamic message signs to alert travelers of any issues.

Dedicated Freight Smart Infrastructure and Platooning

As freight volumes have increased across the U.S. during the past several decades, concepts for dedicated freight smart infrastructure – like autonomous freight vehicles and dedicated truck lanes – have increasingly entered the transportation discussion.

Dedicated truck lanes physically separate commercial vehicles from passenger vehicles or mixed traffic flows. In recent years, states including California, Florida, Georgia, Missouri, and Texas have examined

dedicated truck lane concepts, as have a number of multistate corridor coalitions, such as those associated with I-70 and I-10. While highway lanes dedicated to commercial vehicles may not seem like advanced technology, separating vehicle streams introduces a new level of complexity in highway design (e.g., on-/off-ramps) and operations (dealing with incidents or breakdowns). To date, there are no dedicated truck lanes in Virginia, and those that do exist elsewhere tend to be relatively short routes serving ports or key border crossings. Benefits associated with dedicated truck lanes include significant safety gains, the potential of adopting high productivity vehicle (HPV) configurations, and the possibility of infusing advanced technologies such as Intelligent Vehicle Initiatives (IVI) and the autonomous truck or self-driving truck.

The trucking industry is also confronted with driver shortages. The opportunity to haul more freight per driver has resulted in trucking companies using longer combination vehicles (LCVs) such as triples and long doubles, which are banned from most highways due to safety concerns operating in mixed traffic. Only the smallest class of LCV (twin 28.5 foot trailers, used mostly in rural areas) are allowed to operate throughout the U.S.

Truck platooning is an alternative to the LCVs where trucks operate in closely-spaced, semi-automated platoons of three or more big-rigs, with two-way encrypted communications controlling their spacing. Trucks can reduce fuel usage from 5 to 10 percent by operating 50 to 75 feet apart (instead of today's mandated 300 feet). This requires a level of automation in which the driver still controls steering but the automation controls acceleration and braking. Pilot projects are underway in several states and several more have recently enacted legislation along these lines.

A major hurdle to dedicated truck lanes and truck platooning is operating in mixed traffic. Motorists entering or exiting an interstate may perceive maneuvering through a "wall" of several 3-to-5 truck platoons difficult. Large-scale platooning is anticipated to be more than a decade away. However, the timetable for planning, designing, financing, and constructing dedicated truck lanes could occur in the next 10-15 years.

Electronic Freight Management

The Electronic Freight Management (EFM) initiative is a USDOT-sponsored project that applies Web technologies to improve data and message transmissions between supply chain partners. It promotes and evaluates innovative e-business concepts, enabling process coordination and information sharing for supply chain freight partners through public-private collaboration. In 2007, as part of its EFM program initiative, the USDOT conducted an EFM deployment test in Columbus, OH with partners from

a Limited Brands air cargo supply chain originating in China. Successful supply chain deployments of EFM technologies are delivering benefits along with more efficiency and better customer service. EFM and related visibility technologies provide lasting benefits. Major users of these technologies report better integration with their partners and greater supply chain visibility.

Smart Roadside Program

The Smart Roadside program is a joint modal initiative between the FHWA and Federal Motor Carrier Safety Administration (FMCSA). A component of the vehicle-to-infrastructure element of the USDOT connected vehicle research initiative, Smart Roadside is a system envisioned to be deployed at strategic points along commercial vehicle routes to improve the safety, mobility, and efficiency of truck movement and operations on the roadway. It is a concept where private- and public-sector motor carrier systems will continue to operate as intended and where information collected for one purpose can be shared where authorized to serve multiple stakeholders and uses. The objective is to apply advanced technologies to create more efficient and streamlined processes and to share data in real time or near-real time to maximize its utility. The primary focus areas of Smart Roadside safety research are in various stages of operation and deployment:

- **Electronic Screening (E-Screening)** is a key component of the information collection systems and communications networks that support commercial vehicle operation, referred to as the Commercial Vehicle Information Systems and Networks (CVISN). E-Screening involves automatic identification and safety assessment of a commercial vehicle in motion. With E-Screening, safe and legal vehicles are allowed to continue on their route. Enforcement resources can be used to target unsafe vehicles and carriers. Currently, E-Screening occurs at fixed stations and on-demand verification sites.
- **Virtual Weigh Stations/Electronic Permitting** was the focus of an Enforcement Technologies Study conducted in 2008 and 2009. The focus of the study was to develop the foundation for roadside technologies that can be used to improve truck size and weight enforcement. Outcomes of this study included development of a Concept of Operations for Virtual Weigh Stations and led to development of recently completed Virtual Weigh Station/e-Permitting Architecture. The Virtual Weigh Station (VWS) concept will further increase the number of electronic screenings and, depending upon the virtual weigh station configuration, will provide a more enhanced safety and credentials assessment. VWS have now been deployed in several states; they typically involve weigh-in-motion (WIM) and truck identification systems that relay data to enforcement personnel using a laptop, mobile device, or desktop computer. The goal is to provide a means to focus limited enforcement resources on trucks that are likely to be overweight, or to more effectively monitor known weigh station bypass routes. There are no VWS in Virginia, however neighboring state North Carolina has deployed them on I-73/74, I-77, and US 421.
- **Wireless Roadside Inspection Program** research is being done to increase the number and frequency of safety inspections at the roadside and obtain data about the commercial vehicle and its driver. The program is examining technologies that can transmit safety data directly from the vehicle to the roadside and from a carrier system to a government system. The safety data being considered for transmission include basic identification data (for the driver, vehicle, and carrier), the driver's hours of service record, and sensor data that provide information on

weight, tire, and brake status. Enforcement systems and staff will use this data to support E-Screening and inspections at locations such as staffed roadside sites, virtual weigh stations, and on-demand verification sites.

- **Truck Parking** research and ITS-based project deployments will provide commercial vehicle parking information so that commercial drivers can make advanced route planning decisions based on hour-of-service constraints, location and supply of parking, travel conditions, and loading/unloading.

E-commerce/Drone Delivery

According to the U.S. Department of Commerce, online sales accounted for more than a third of total retail sales growth in 2015. When factoring out items not normally bought online, such as fuel and automobiles, e-commerce accounted for more than 10 percent of all of retail sales. Web sales totaled $341.7 billion for the year, a 14.6 percent increase over 2014's $298.3 billion. As e-commerce or online retail purchases continue to increase, the demand for moving those shipments will also increase. E-retailers have quickly realized that last mile delivery is becoming a critical differentiator and a strategic priority. According to a survey by Accenture in 2016, two-thirds (66%) of online consumers now choose a retailer based on the number of delivery options, with another three-quarters (76%) looking at a retailer's return policy before completing an order.

Major delivery companies such as Amazon, Google, DHL, and UPS are now working on meeting the demand for faster, cheaper package deliveries by looking for efficient, time saving methods for home delivery including drone delivery. In June 2016, the Federal Aviation Authority (FAA) approved rules governing small commercial drones. Commercial uses such as package delivery are not yet allowed under the rules. However, the FAA is working to expand commercial uses for drones. Retailers and delivery companies have expectations that drone deliveries will allow drivers to make more deliveries per hour without driving additional miles. Amazon is piloting a drone delivery program called "Prime Air" that will deliver packages weighing less than 5 pounds to customers within 30 minutes from centrally located warehouses. Google parent company Alphabet and DHL are also working on their own drone delivery programs. Although drone delivery has several hurdles to overcome such as weather restrictions, FAA rules, and public acceptance; it has the potential to disrupt the trucking industry.

Logistics Management Systems

Shippers, carriers, and third party logistics providers (3PLs) are increasingly using sophisticated logistics management systems to model and analyze their supply chains. These systems provide the ability to analyze freight routes, travel times, infrastructure capacity, and inventory levels/location, often in real-time or near real-time. This is enabling just in time 'pull' supply chain planning where inventory and supply inputs arrive only when needed and freight vehicles effectively become mobile warehouses. This reduces inventory carrying costs and allows for improved situational awareness and decentralized access to supply chain information. While such systems can cut costs considerably, they also require predictability and reliability, which may increase shipment frequency especially in urban areas. Public agencies therefore need to focus on maintaining system reliability and efficiency, and identifying and addressing bottlenecks. While the private data leveraged by these systems would be invaluable for planners, it is often proprietary. If agencies and data owners can find ways to remove business sensitive information from these databases, it could be used to identify and mitigate freight congestion hotspots, especially those on lower classification facilities for which data are frequently unavailable.

Positive Train Control

Positive train control (PTC) refers to technologies designed to automatically stop or slow a train before certain accidents can occur. PTC is designed to prevent collisions between trains and derailments caused by excessive speed, trains operating beyond their limits of authority, incursions by trains on tracks under repair, and by trains moving over switches left in the wrong position. The Rail Safety Improvement Act of 2008 required railroads to place PTC systems in service by December 31, 2015 on all rail main lines over which regularly-scheduled commuter or intercity passenger trains operate, and on all Class I railroad main lines with over 5 million gross ton-miles per mile annually over which any amount of toxic/poison-by-inhalation hazardous materials are handled. In late 2015, Congress extended the PTC implementation deadline to December 31, 2018.

State Freight Trends and VTrans2040 Scenario Planning

Demands on Virginia's transportation system for handling freight are changing as a result of the technology trends discussed in the preceding paragraphs. In the VTrans2040 Scenario analysis, several trends were explored further to identify potential outcomes in a baseline 2040 scenario and four alternative scenarios:

- Industrial Renaissance – a high-growth scenario with a focus on manufacturing
- Techtopia – a high-growth scenario with a focus on the technology sectors in production and services and accelerated adoption of AV/CV technologies
- Silver Age – a moderate-growth scenario (similar to baseline forecasts) with an older demographic and related impacts to demand for goods and services (more services such as health care, and fewer durable goods)
- General Slowdown – a lower-growth scenario based on reduced government spending, also with delayed adoption of AV/CV technologies

Baseline Forecast - Industry Supply Chain Models

Supply Chain models are evolving as new technology for freight and logistics are being developed that provide greater efficiency, flexibility, and reliability. These trends are expected to continue, and to anticipate future changes it is helpful to understand 1) supply chain model differences across industries and firms, and 2) emerging freight-related technologies enabling lower costs and operational improvements. Examining these trends in more detail helps inform expectations regarding vehicle fleet composition, distribution channel (e.g. e-commerce retail, omnichannel retail) responsiveness, modal cost competitiveness, and ultimately changes in traffic volumes and vehicle miles travelled (VMT). The supply chain developments are assessed here for how they will likely evolve in the context of the four VTrans2040 Plan scenarios, including potential changes that could significantly affect freight movements in the state. This discussion extends to commentary on emerging technologies (e.g. autonomous and connected vehicles), how these innovations may affect transportation demand.

Industry supply chain characteristics vary greatly. This is because each supply chain is tailored to best serve specific business and customer needs, as well as expectations unique to the product markets served. As those needs and expectations change, so do the supply chains that serve them. Agriculture, mining, and manufacturing industries have very-specific transportation requirements that reflect the locations, shipment volumes and dimensions of the products they buy and sell. The supply chain partners that provide their transportation optimize their investments, operations and technology

adoption to most efficiently match the product transportation requirements. Although knowledge-oriented service sectors do not produce physical goods, many, including healthcare industries, rely on supply chains providing critical inputs of consumables, equipment, and other supplies. Manufacturers closely monitor their supply chains to ensure on-time arrival of components and to ensure reliable shipments to customers. Increasingly the economy is seeing industries transformed because of shifting consumer preferences and innovations. These are leading to significant revisions to supply chains and the warehousing and distribution practices, such as increasing home deliveries from the retail sector. These shifts are changing how freight is transported and demands for use of transportation networks.

The differences in Virginia's population, workforce, energy, and technology use of place types under the four scenarios have implications for economic growth and for the future freight demand and supply chains in the state.

VTrans2040 Plan Scenarios

For use in the VTrans2040 Plan, the four scenarios can inform likely anticipated changes in demand on Virginia's network to handle freight volume and vehicle miles travelled (VMT). Freight volume can be used as an indicator of the relative growth or decline of industries, adjusted for changes to the commodities being shipped themselves (that can alter the weight and/or cubic dimensions of the products being shipped.) How the volumes of freight are loaded in or on the transportation equipment used affects how many units of equipment are required. The shift in equipment quantity that results helps determines the network capacity used by freight equipment. For truck freight, VMT can be correlated with changes in freight volume, as well as changes in a supply chain operations that result in a change in truck sizes and/or loading practices. Depending on relative magnitudes and timing, the changed composition of the truck fleet, combined with operational changes such as increases in direct-to-consumer deliveries, may increase, decrease, or have no net impact on changes in overall transportation network demand. With some exceptions, changes in volume and VMT have a mostly linear relationship with changes in employment, assuming few major changes in the structural relationships between buyers and suppliers that would alter the geographic distribution of pick-ups and deliveries.

Commentary on the consequences of changes in freight that reflect the differences in circumstances under the baseline and four scenarios assessed in the VTrans2040 Plan follow.

Baseline 2040 Scenario

Several of the trends discussed earlier in this section are not likely to vary much scenario-by-scenario, yet will influence the future pattern of freight demand on Virginia's transportation networks:

E-Commerce and Home Delivery: Last-Mile deliveries associated with e-Commerce and Omni-Channel retailing is shifting retail freight towards smaller parcel deliveries with changes in delivery fleet mix using small to medium size trucks, cargo vans, and even personal vehicle delivery drivers. An example is Amazon.com's Flex program where vehicle owners can sign up to be on-demand delivery drivers. Freight VMT may increase even more than expected if the nature of last-mile deliveries continues to see further reductions in promised elapsed delivery times (e.g., from 2-day to next-day to same-day to 4-hour) that force inefficient loading and truck tours with unused capacity just to meet delivery time commitments. These "last-mile" retail deliveries are replacing what was previously a customer visit to a store. However, net household trips and VMT may not change, as new trips to recreational locations,

restaurants, or other personal related trips may offset or replace previous retail oriented trips within consumers 'travel budgets' for total driving.

Coal and Petroleum: Carbon fuel shares of energy consumption across the economy, not just for transportation use, are likely to continue to shift away from coal and petroleum toward alternative fuels. Natural gas-powered freight equipment exists for all land-modes already and electric-powered propulsion is under development. Electricity generation from natural gas moved by pipeline or from alternative energy sources is replacing coal demand within Virginia, the U.S., and overseas. More fuel-efficient vehicle technology is reducing demand for motor gasoline and diesel fuels for that portion of the transportation equipment fleet that retains internal combustion propulsion. While it takes many years for the technologies to work through equipment fleets with lifecycles of many years, there are financial aspects of fleet rotation that contributes to the pace of change. The depreciation of the equipment as an asset for the owner influences how long the equipment is in operation, where the economic life of equipment may halt its operation even when it still has physical life left. Fuel prices also affect fleet turnover, as lower operating costs for equipment that depends on the growing distribution of alternative fuels and greater battery range (as well as more availability of charging stations) influences demand for conventional equipment powered by gasoline and diesel fuels. The energy technologies and fuel-switching implications of these trends are clear, with these changes resulting in fewer bulk movements of coal and petroleum products on the network. Fewer local deliveries by fuel trucks from petroleum terminals, fewer coal trucks in the coalfields, and less coal and oil long-distance train traffic dampens growth in freight VMT.

Manufacturing: The drive to reengineer and design products with smaller form factors (size and weight) continues. Examples are efforts to market more concentrated detergents that remove water content and continued long-term electronic product miniaturization. There are separate trends in packaging and logistics technology to achieve reductions in materials used and reduce the cubic space of packaging required to safely and reliably deliver their contents. The combination of these two trends will continue to yield a decrease in the cubic volume and weight associated with shipping manufactured products. The net impacts of improved packaging and product density are reductions in per-unit freight capacity and greater freight network productivity for the same capacity. There is a secondary impact which is a reduction in waste associated with using less packaging material and even less waste at the end of product lives when it is time for them to be recycled or disposed. Product packaging material innovation (e.g. biodegradable, collapsible) has the potential to reduce truck movements associated with waste shipments to consolidation centers and landfills.

Other Factors: There are other factors influencing manufacturing affecting freight transportation. These include the increasingly specialized nature of production, where technology, consumer tastes, and expanding global markets encourage greater and greater numbers of products. This product "proliferation" in manufacturing is linked to the increasing complexity of supply chains and the distribution channels that deliver the products to customers. Other factors influencing manufacturing that affect freight use include higher levels of automation that are increasingly integrated to input component and finished product handling. This places increasing demands on the service level of the last mile delivery system that is largely truck-served. The growth in regulatory requirements and customer-driven transparency into environmental and safety practices of manufacturers add to information requirements of transportation providers to monitor 'chain of custody' of products. This

requires collection of information streams for traceability that extend to freight transportation operators and prods faster adoption of newer-technology in freight equipment.

Industrial Renaissance Scenario

Advanced manufacturing relies upon transportation to receive crucial inbound freight for production and to deliver finished goods to customers. The growth in advanced manufacturing is expected to increase freight volume and VMT in industries associated with the advanced manufacturing sectors as production levels increase. Most of this increase in inbound and output freight will be dominated by trucking; however, there may be a shift in fleet composition towards smaller-size truck use (including an increase in use of the integrated parcel carriers and less-than truckload (LTL) shipping) associated with high-tech manufactured products. In addition, this scenario includes growth in international trade which expects inbound shipment volumes and associated VMT to increase with the growth in the economy and associated consumption increases.

Techtopia Scenario

While service-oriented businesses do not produce physical goods, they require specific types of commodity inputs necessary for providing services. Increases in sales in these industries will result in increases in inbound freight volume and VMT. Local markets are expected to be served with increased product variety associated with 3D printing. As production runs by 3D printing are usually going to be limited in size, it is likely that shipment sizes will be smaller than average for manufacturing in the same sector using conventional manufacturing technology. This would likely result in a greater share of shipping via truck and within trucking, likely smaller average shipment sizes. This shift would potentially generate greater VMT using more vehicles for the equivalent demand as would be the case with only conventional production methods. The increase in local truck VMT may be offset by the reduction in long-haul trucking of the finished goods. Overall state traffic volume impacts may be neutral while long distance large truck VMT would be expected to decrease and shorter distance small truck deliveries would increase. By place type, the urban areas would see a relative increase in the final-delivery of the 3D printed goods while rural areas with considerable pass-through freight could see a reduction in truck VMT. Net changes in truck VMT are likely to see an increase in suburban areas, depending on the shift in the supply chain delivery associated with local and customized manufacturing locations.

Silver Age Scenario

The magnitude of freight declines in volume and VMT associated with deferred retirements and patterns of consumption spending out of household discretionary spending associated with deferred retirements. Declines in freight are driven by greater emphasis on service-oriented purchases (e.g., health-care services) linked to older age cohorts deferring their retirements. Typically, older age population cohorts also will have a lower level of consumption (spending) on household goods and supplies due to smaller average household sizes for older households. However, the scenario would include more reliance on on-demand delivery (e.g., for basic services like food and retail purchases) as a substitute for individual driving. There would be an offset to the latter as CV/AV technology allows more older drivers to have greater individual mobility based on improved crash avoidance and local street navigation capabilities of on-board person vehicle technology. With a greater share of the population being older households, the initial pace of adoption of technology affecting retail purchasing is slower and the pace of change to retail supply chains is also a little slower as brick-and-mortar big box stores and chains retain a greater share of retail sales (and therefore fewer direct-to-home deliveries) than

under the other scenarios. Supply chains serving retail then evolve more slowly than under scenarios with faster technology adoption with younger demographics to the state's population.

General Slowdown Scenario

A significant decline in military spending would weaken demand for freight volume and consequently would reduce VMT in one of the most concentrated industries in Virginia. Any future freight growth is extremely weak due to a downturn in the economy led by significant decline in the military sector spending. Slower retail sales in a weaker economy would reduce the pace of evolution of supply chains serving those markets. This would dampen the pace of change in truck fleet composition and even freight modal competition, leaving network demand more as it is, with less change in comparison with today. This scenario includes weak technology adoption and exposure to volatile energy prices, which could also slow the pace of investment in new supply chain technology and equipment.

Conclusions

Trends affecting the manufacturing, energy, and service sectors, combined with trends affecting technology in the movement of goods, will lead to dramatic changes in the movement of freight in Virginia. The VTrans2040 Scenario Analysis points to several conclusions, some of which may vary depending on the future growth trends and deployment of technology advances in Virginia. Overall, there will be countervailing trends in goods movement driving towards greater efficiency as a result of technology and information systems, and reduced efficiency as a result of rapid response delivery and more localized production and supply trends. These trends are anticipated to increase the demand for freight on roads, rail, and air in Virginia, but the patterns of demand will vary depending on the growth sectors in the economy. The stronger the growth in manufacturing, the more balanced the freight demands are likely to be with potentially more long-haul freight demand. The stronger the growth in the service sector, the greater freight demand will be at the delivery end, potentially contributing to higher VMT and congestion in urbanized areas. At the same time, the ability of the Port of Virginia to handle the largest ships on the East Coast will ensure that large quantities of freight will continue to move through Virginia via rail, truck, and barge regardless of technological advances.

7. Condition and Performance of Virginia's Freight System

Virginia has consistently focused on freight needs in its capital improvement program, to the benefit of passenger and freight transportation. However, accommodating increasing demands and addressing the needs of aging infrastructure is a concern for all freight modes will continue to be a concern. Assessing the freight system's condition and performance helps inform and focus future investment strategies.

Highway Condition and Performance

Pavement and Bridge Condition

VDOT continually monitors the condition of the state highway and bridge system to maintain safe and reliable travel conditions for passenger vehicles, trucks and other vehicles. The Department obligates funds from state-derived sources and various federal programs to maintain or attain levels of performance it has established for roadway pavements and bridges. Federal regulations established in early 2017 set minimum performance standards for pavements and bridges eligible for federal aid.

Roughness (International Roughness Index or IRI) is one indicator of pavement condition[34]. Most of the locations with poor ratings, indicating the roughest pavement conditions, occur on interstate and secondary roads within the boundaries of Virginia's major urbanized areas. Overall, most of the state's NHS mileage is in good condition (**Figure 7-1**). According to VDOT's 2016 statewide performance index, 85 percent of the interstate and primary roadway's pavement is in good or better condition, against a target of 82 percent.

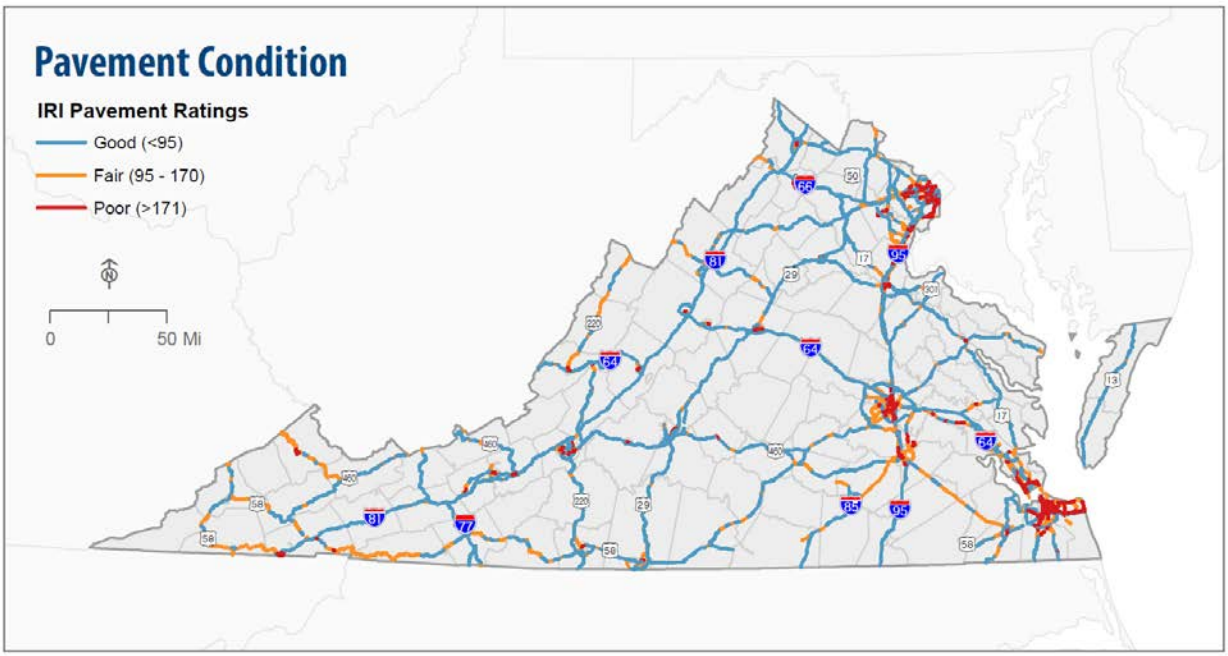
Bridge sufficiency measures the overall adequacy of a bridge to carry traffic. The sufficiency rating for each bridge is composed of dozens of data items that in total provide a blended assessment of the adequacy of the structure, as well as the adequacy of the bridge from a capacity and design perspective[35]. Bridges with sufficiency ratings under 50 generally indicate a need to consider addressing a design, capacity, or structural need, but in the vast majority of cases do not indicate an immediate safety concern.

Overall, bridge sufficiency ratings are good on the interstate system (**Figure 7-2**). A handful of bridges in major urban areas are rated below 50, indicating a need to be addressed that could improve truck freight operations. According to VDOT's 2016 statewide performance index, over 94 percent of Virginia's federal-aid bridges are in non-deficient (a related measure) condition, against a target of 92 percent.

[34] Other indicators used in assessing performance and needs include rutting (grooves or depressions), cracking, and faulting (difference in elevation, between two sections, usually at a pavement joint).

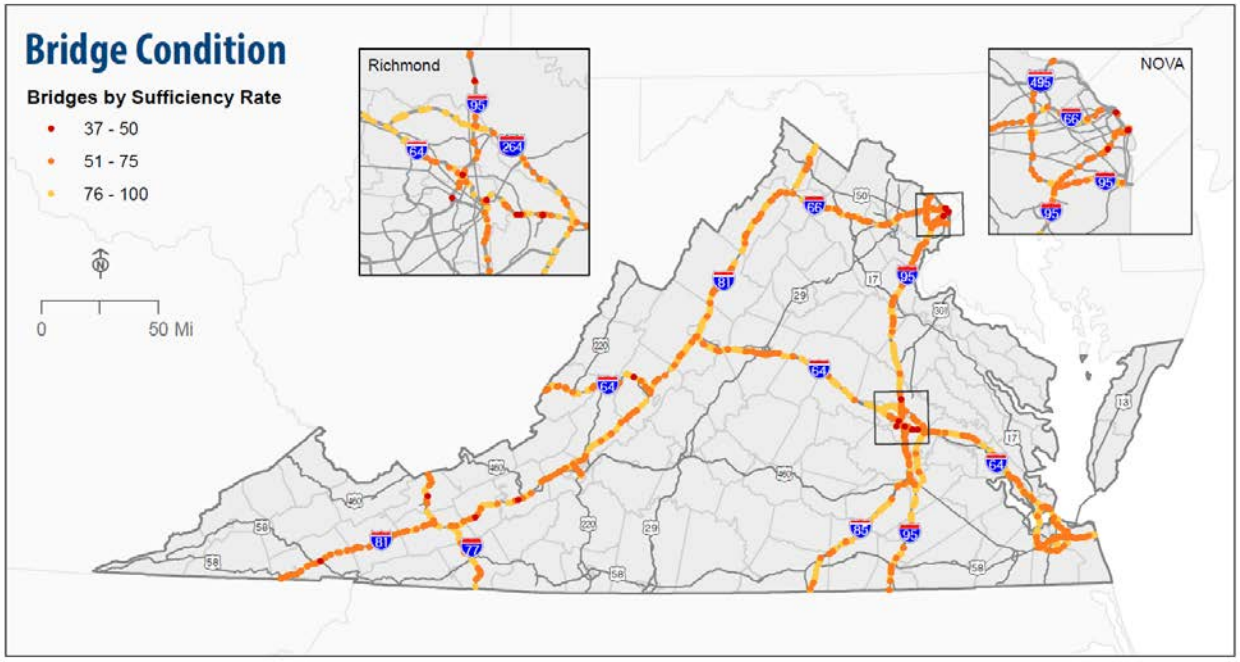
[35] Bridges with serious structural deficiencies are posted, meaning that they are closed to travel by trucks or to all traffic.

Figure 7-1: 2015 NHS Pavement Condition (International Roughness Index)



Source: Virginia Department of Transportation and CDM Smith.

Figure 7-2: 2015 Interstate Bridge Sufficiency Rating



Source: Virginia Department of Transportation and CDM Smith.

Truck Safety

Truck safety is a particular concern because of the disparity in size and weight between most passenger vehicles and commercial vehicles. According to the Insurance Institute for Highway Safety, passenger vehicle occupants suffer the highest facilities in crashes involving trucks. This section presents commercial motor vehicle, safety and crash data compiled from state, sheriff, and local police agencies between 2011 and 2015. Crash data is shown in different ways to identify existing trends and opportunities to enhance safety.

Crash Frequency

Between 2011 and 2015, commercial vehicle crashes represented 3.8 percent (23,348) of all motor vehicle (612,111) crashes. Between 2011 and 2015, the number of all motor vehicle crashes increased 4.4 percent while the number of commercial vehicle crashes increased by 14.3 percent; however, the relative number of commercial vehicle crashes to all motor vehicle crashes rose slowly rising during this period (**Table 7-1**).

Table 7-1: Commercial Vehicle and All Motor Vehicle Crashes by Year (2011 – 2015)

Year	Commercial Vehicle Crashes	All Motor Vehicle Crashes	Proportion of Commercial Vehicles to All Vehicle Crashes
2011	4,384	120,486	3.6%
2012	4,379	123,480	3.5%
2013	4,656	121,601	3.8%
2014	4,918	120,744	4.1%
2015	5,011	125,800	4.0%
Total	**23,348**	**612,111**	**3.8%**

Source: VDOT and CDM Smith.

Crash Severity

Vehicular crashes are categorized as fatal, injury, or property damage only (PDO) based on the most severe impact to the driver(s) or passenger(s). For example, a crash that results in a fatality and one injured person would be categorized as fatal, a crash that results in three injured persons would be categorized as an injury crash, and a crash that results in no fatalities or injured persons would be categorized as a property damage only crash, or PDO.

There were 23,348 crashes involving a commercial vehicle between 2011 and 2015 (**Table 7-2**). The percentage of crashes that resulted in a fatality, injury, or property damage was 1.9 percent, 68.2 percent, and 30.0 percent, respectively.

Table 7-2: Commercial Vehicle Crashes by Severity (2011 – 2015)

Year	Fatal	Injury	PDO	Total
2011	92	3,185	1,107	**4,384**
2012	90	3,022	1,267	**4,379**
2013	96	3,100	1,460	**4,656**
2014	100	3,249	1,569	**4,918**
2015	77	3,356	1,578	**5,011**
Total	**455**	**15,912**	**6,981**	**23,348**

Source: VDOT and CDM Smith.

Between 2011 and 2015, 247 pedestrians were killed or injured in a commercial vehicle crash. The breakdown of these fatalities and injuries is shown in **Table 7-3**. As the urbanized areas' proportion of total state population grows, the opportunity for truck and pedestrian conflicts is likely to grow. While it may be difficult to discern a permanent trend in these few years' worth of data, the lower number of pedestrian fatalities and injuries in 2015, despite the resurgence in truck vehicle miles of travel, is a positive and encouraging sign.

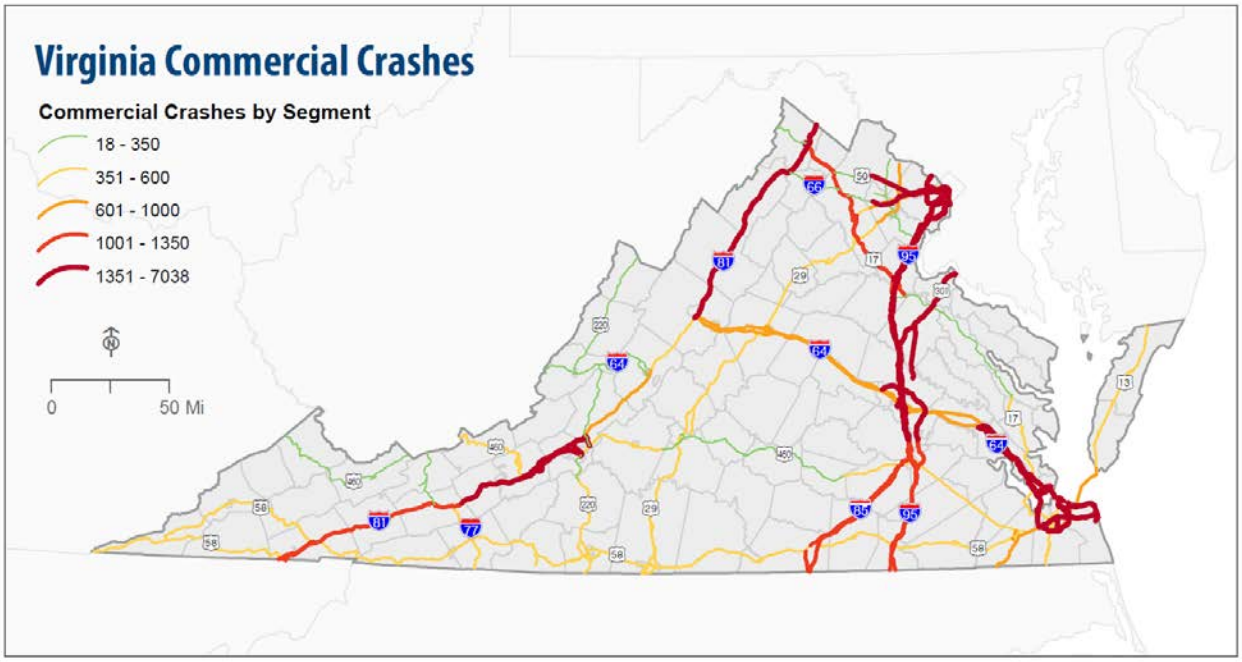
Table 7-3: Commercial Vehicle Crashes Involving Pedestrians by Severity (2011 – 2015)

Year	Fatal	Injury	Total
2011	7	39	**46**
2012	11	48	**59**
2013	6	41	**47**
2014	19	43	**62**
2015	7	36	**43**
Total	**40**	**207**	**247**

Source: VDOT and CDM Smith.

Figure 7-3 summarizes the truck crash discussion and displays the distribution of 2011-2015 crashes over the National Highway System in Virginia. Portions of Virginia's interstate system with the highest percentage of trucks experienced the highest number of crashes involving trucks, and more generally, the NHS system in the most populated, congested, and commercially active regions (Northern Virginia, Hampton Roads, and Richmond). Other high accident locations include: I-81 between north of I-64 and south of US 460; I-95 between Richmond and Petersburg and between Richmond and Northern Virginia; US 301 north of Richmond; and I-64 west of Hampton roads.

Figure 7-3: Commercial Vehicle Crashes Involving Trucks (2011-2015)



Source: Virginia Department of Transportation and CDM Smith.

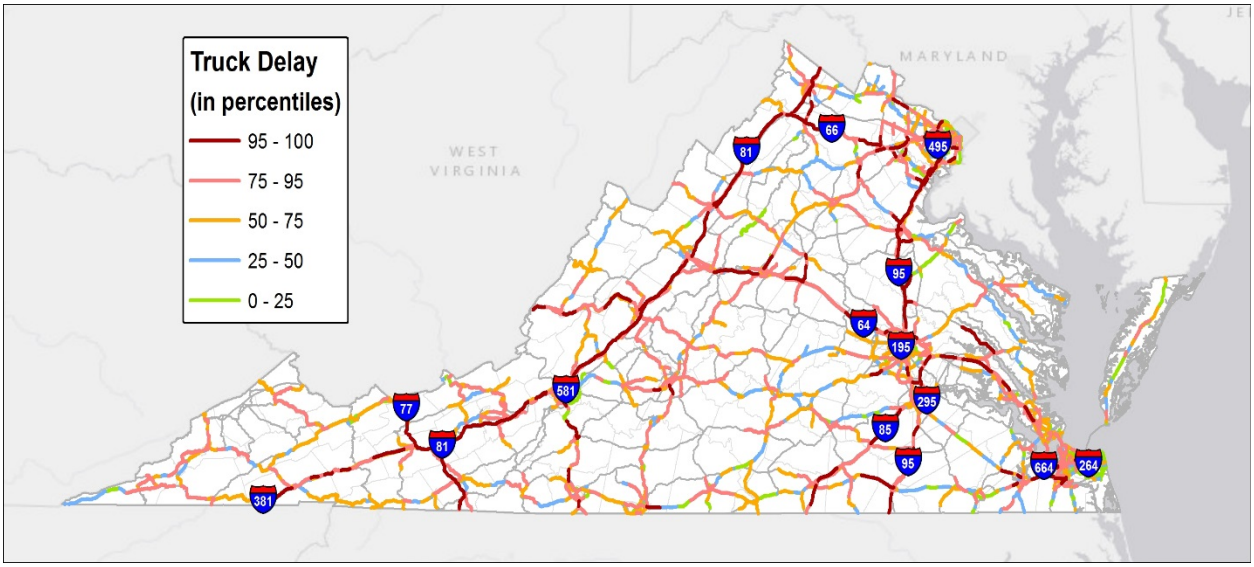
Truck Bottlenecks

Highway congestion challenges shippers to deliver cargo to destinations within time window commitments. Unreliable travel conditions create inefficiencies and increase costs that are often passed on to the consumer. Additionally, in the stop and go conditions that are typical of highly congested highway corridors, trucks cause additional delays to other vehicles because the time it takes a tractor-trailer to decelerate and accelerate is considerably longer than for passenger vehicles.

Truck delays are highest on the Interstate system, and for the most part, around urbanized areas. Interstate 81, which carries a large proportion of through travel and high truck volumes, is the exception to this. The locations of greatest delay incurred by trucks, from continuous truck speed data collected in 2016 on the National Highway System, are (**Figure 7-4**):

- I-95 between Richmond and Northern Virginia
- Portions of I-64, east and west of Richmond
- I-66 west of the Capital Beltway
- Sections of I-295 (Richmond), I-495 (Northern Virginia), and I-664 (Hampton Roads)

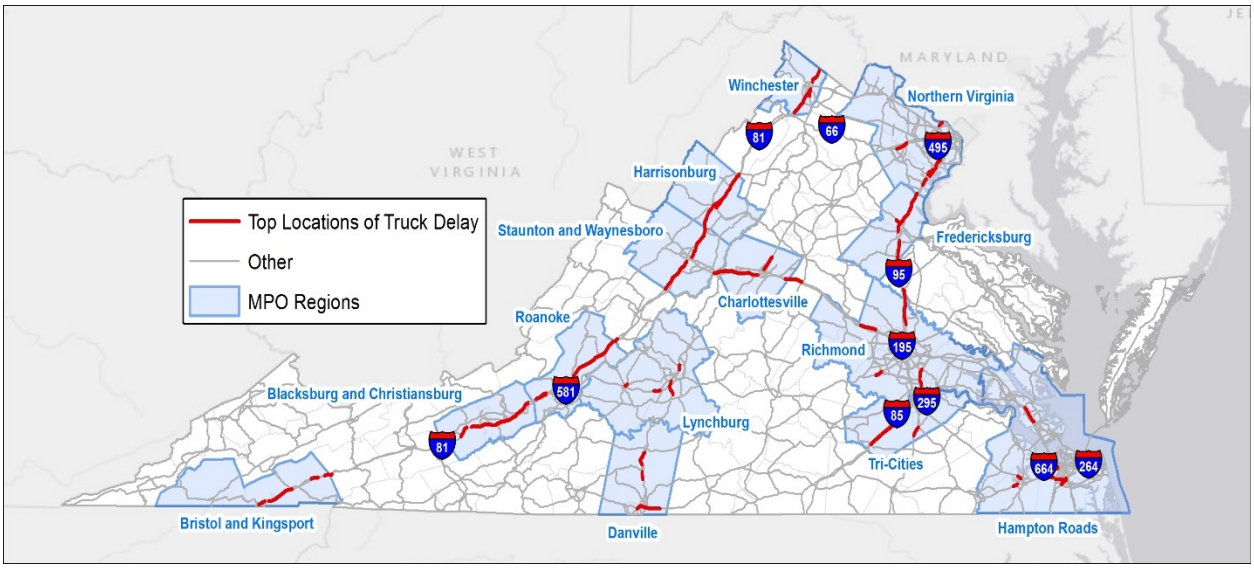
Figure 7-4: Truck Delay on National Highway System, by Percentile, 2016



Source: National Performance Management Data Set, Virginia Department of Transportation and CDM Smith.

When viewed from the perspective of the highest truck congestion locations within MPO regions, the results are consistent with those at the statewide level. **Figure 7-5** shows the most highly congested locations on the National Highway System, as measured by truck delay, within each MPO in Virginia. The results clearly show that the cumulative delays experienced by trucks were greatest on the Interstate system and on the major corridors connecting the most densely populated regions in the Commonwealth.

Figure 7-5: Locations of Highest Truck Delay in MPO Regions, 2016



Source: National Performance Management Data Set, Virginia Department of Transportation and CDM Smith.

Truck Parking

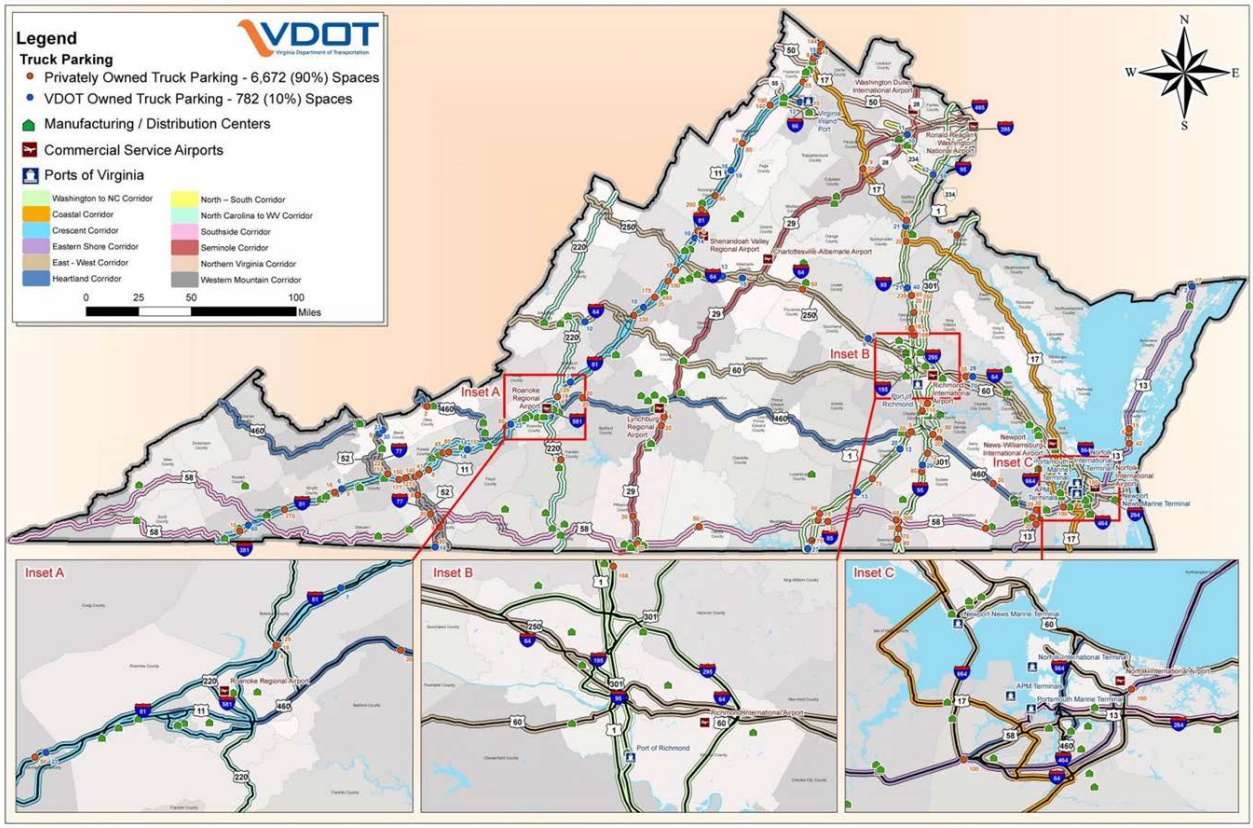
Within Virginia, there are 37 publicly-owned and 96 privately-owned facilities with dedicated truck parking sections. These 133 facilities have a total of 7,464 truck parking spaces – 90 percent of which are

provided by the privately-owned facilities. The truck parking locations, as well major truck parking generators, are shown against the Corridors of Statewide Significance (CoSS) in **Figure 7-6**. A CoSS is a corridor which:

- Involves multiple travel modes or is an extended freight corridor
- Connects regions, states, and/or major activity centers
- Carries a high volume of travel
- Provides a unique state function and/or addresses statewide goals

There are twelve assigned CoSS within the Commonwealth. As the figure shows, most of the truck parking locations that have been identified are located along one of the principal CoSS corridors, generally corresponding to the corridors that attract the highest volumes of truck freight. However, in urbanized areas, truck parking locations are relatively scarce. Additionally, there are many warehouse and distribution facilities located away from the CoSS and along roadways for which access, operational, design, and capacity accommodations may be more difficult to address.

Figure 7-6: Truck Parking Locations with Distribution Centers, 2015



Source: Virginia Truck Parking Study, July 2015.

Within the Northern Virginia, the Hampton Roads, and the southwest Virginia regions, pass-through freight accounts for nearly 65 percent, 8 percent, and 90 percent of tonnage moving, respectively[36]. The accessibility and availability of truck parking to these pass-through long-haul or regional truckers can be

[36] Virginia Truck Parking Study, July 2015

a deciding factor in route and stop choice and is a significant safety concern. The VDOT Truck Parking Study found that there are nearly 2,800 fewer truck parking spaces throughout Virginia than are needed to address safety and operational needs. As shown in **Table 7-4**, Northern Virginia has the greatest parking deficit, followed closely behind by the southwest region of Virginia.

Table 7-4: Summary of Truck Parking Demand

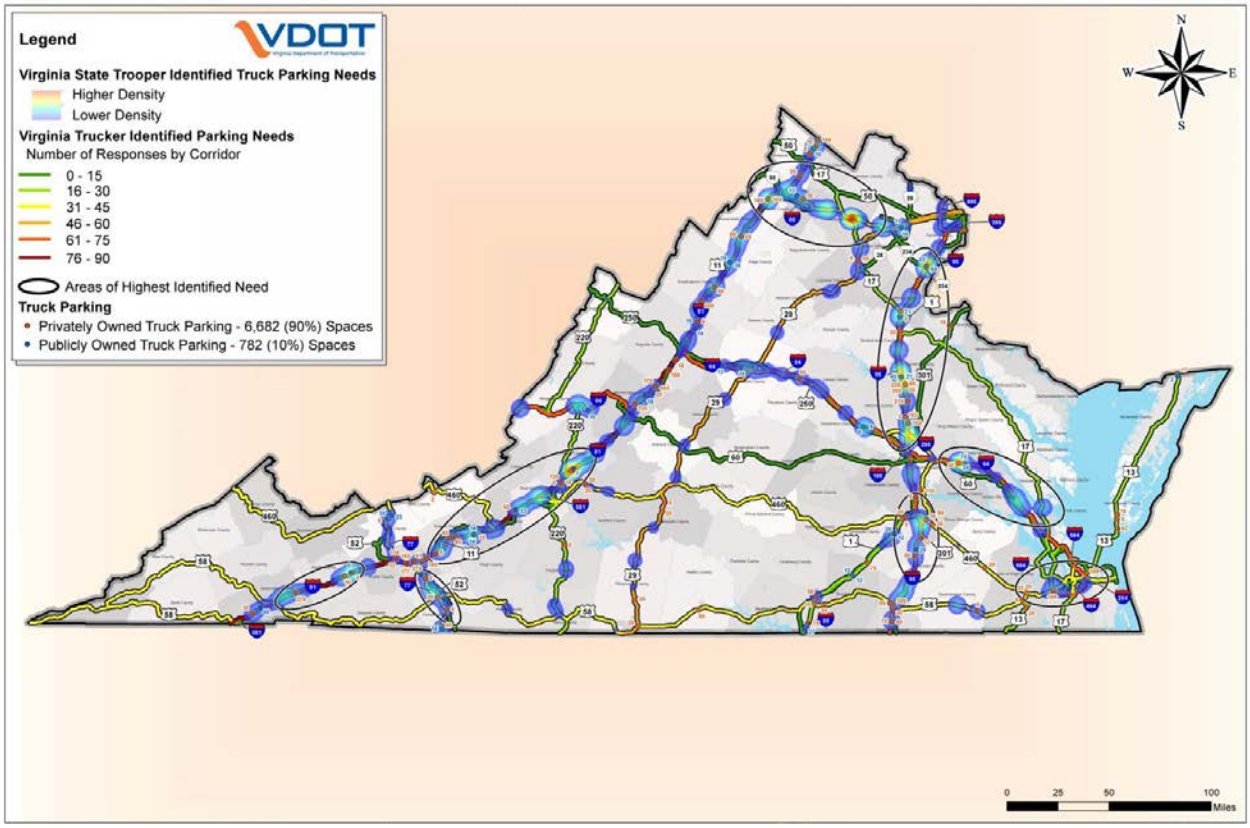
Major Corridors	Truck Parking Spaces (+) Surplus or (-) Deficit
Northern Virginia Region	**-1069**
I-95 (North of Richmond)	-463
I-66	-542
US 29 (North of Charlottesville	-64
Hampton Roads Region	**-671**
I-64 (East of I-95)	-562
US 460 (East of I-95)	-46
US 58 (East of I-95)	+31
US 17 (Tennessee state line to I-95)	-94
Southwest Region	**-1,034**
I-81 (Tennessee state line to I-64)	-692
US 11 (Tennessee state line to I-64)	-32
US 58 (West Virginia state line to US 29)	-9
US 220 (Tennessee state line to I-81)	-111
US 460 (West Virginia state line to I-95)	-190
Total	**-2,774**

Source: Virginia Truck Parking Study, July 2015.

Beyond the regional needs identified in **Table 7-4**, the authors of the Virginia Truck Parking Study met with state troopers and truckers who travel on Virginia roadways for in-the-field insights about parking needs. These stakeholders identified areas with the highest need for additional truck parking; the results of these discussions are displayed in **Figure 7-7**. As reported by the study, areas with the highest reported needs include:

- I-66 in Northern Virginia
- I-64 from Richmond to Williamsburg
- I-95 from Richmond to Washington, D.C.
- I-81 from Wytheville to Roanoke
- I-81 near Bristol
- US 460 in the Hampton Roads area
- I-77, south of I-81

Figure 7-7: Truck Parking Survey Demand



Source: Virginia Truck Parking Study, July 2015.

Railroad Condition and Performance

Rail Safety

Rail safety is a critical issue for rail operators and public agencies that have an oversight role for transportation safety. A combination of federal and state laws determines rail safety provisions. Most safety-related rules and regulations fall under the jurisdiction of the FRA, as outlined in the Rail Safety Act of 1970 and other legislation, such as the most recent Rail Safety Improvement Act of 2008. Many of FRA's safety regulations can be found in 49 CFR 200-299.

Rail safety issues generally fall into the following broad categories:

- Highway-rail at-grade crossings
- Trespassers on rail lines
- Equipment inspection
- Movement of hazardous materials
- Testing of new operating practices

The FRA is primarily responsible for enforcement of these federal regulations. VDOT has responsibility for rail safety focusing on the safety and inspection of highway-rail at-grade crossings along its public roads.

The number of train-related accidents and incidents in Virginia has remained constant over the past decade (**Table 7-5**). Of the 27 fatalities that occurred on the Virginia rail network during 2014 and 2015, 21 were associated with trespassers struck by trains, five fatalities were at highway-rail at-grade crossings (public and private), and one fatality occurred involving an on-duty railroad employee.

Table 7-5: Total Rail-Related Accident/Incidents in Virginia (2007—2016*)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*
Fatalities	5	9	11	10	10	13	10	8	19	9
Injuries	133	135	130	144	133	124	161	146	140	48
Property only	60	61	53	52	45	48	45	52	40	10
Total	**198**	**205**	**194**	**206**	**188**	**185**	**216**	**206**	**199**	**67**

**Partial data through May 2016.*
Source: FRA Table 1.12 – Ten Year Accident/Incident Overview.

Highway-Rail Grade Crossings

Since 1993, the Commonwealth, through VDOT, has received approximately $6.7 million in federal funds under the Railway-Highway Crossings (Section 130) Program administered by FHWA for its portion of the designated Southeast High-Speed Corridor. These funds, with oversight by VDOT, have been used to install lights, gates, and constant warning time devices at 36 crossings; construct a pedestrian overpass over the high-speed corridor in Prince William County; and support design and construction of three grade separations.

Highway-rail at-grade crossings are among the most visible safety concerns to the general public. Motorist actions are responsible for the vast majority of highway-rail at-grade crossing collisions. A freight train moving at 55 miles an hour can take a mile or more to stop. According to a June 2004 report issued by USDOT's Inspector General, 94 percent of all grade crossing accidents are caused by risky driver behavior, and about half of all grade crossing accidents occur at crossings that are already equipped with active warning devices such as bells, gates, and lights.

Currently, there are 1,886 public highway-rail at-grade crossings and 2,751 known private at-grade crossings in Virginia. Of the public at-grade crossings:

- Active warning devices are in operation at 1,499 (79 percent) of the crossings,
- Passive warning devices are in use at the remaining 387 (21 percent) of the crossings,
- VDOT-maintained roads have 1,178 (62 percent) of crossings, and
- Virginia cities and towns maintain the remaining 708 (38 percent) at-grade crossings.

VDOT administers the Highway-Rail Safety Improvement Program, so-called "Section 130", because it is authorized by Section 130 of U.S. Code 23. Projects in this program are 90 percent funded by the federal government and 10 percent funded by the state. Only public crossings are eligible for improvement by Section 130 funds; private crossings are ineligible. At least half of Section 130 funds must be used for

improvements to warning devices at highway-rail at-grade crossings. The remaining half can be spent on additional protective devices or on other highway-rail at-grade crossing safety improvements, including sight-distance improvements, crossing closures or consolidations, and grade-separation projects. Improvement projects are selected based on applicant-submitted proposals on a statewide competitive basis. Projects are ranked by a crossing's "accident prediction value," as calculated by a federally mandated model. Adjustments are made to initial rankings based on field reviews of sight distance, roadway geometry, and adjacent land development.

Funding for the Section 130 program varies by year, but averages about $4.5 million annually. The number of projects completed depends on the type and cost of the projects, but typically between 15 and 40 projects are completed in a year.

Rail Bottlenecks

Over the past 15 years, the industry has generally moved from railcars with a weight and capacity between 256,000-pound to 263,000-pound cars to the current standard of 286,000-pound railcars for transporting heavy bulk materials (like coal, grain, and lumber). Portions of the Class I system have even been designed for 315,000-pound railcars. Studies have shown that the 286,000-pound railcars can operate on rail sections weighing as little as 90 pounds per yard if all the other track components are in good shape with tight rail joints. Given the typically poor soil conditions in Virginia, it is more cost-effective to install a heavier weight rail section to better distribute the loads to the soil and to protect the investment in the rail infrastructure.

Bridges and trestles prove to be more of a constraint to handling larger cars than the track. Whereas operating at slower speeds on lightweight rail will support the movement of heavier cars, older bridges may not be able to bear the heavier loads at any speed.

Single-track railroads are bottlenecks, requiring careful dispatching procedures for safety reasons and potentially causing significant capacity bottlenecks and on-time performance delays. There are many factors that determine the capacity of rail corridors. These factors include the number of tracks, the frequency and length of sidings, the capacity of the yards and terminals along a corridor to receive the traffic, the type of control systems, the terrain, the mix of train types, the power of the locomotives, track speed, and individual railroad operating practices.

At the system level, typical causes of rail bottlenecks include: insufficient line capacity or connectivity; restrictive dimensional (height or weight) standards or geometric design; presence of at-grade crossings; coordination of passenger and freight rail traffic on a common line (in which passenger traffic usually has priority); and yard capacity. Based on available information, some of the Commonwealth's major freight rail bottlenecks are summarized in **Table 7-6**.

Table 7-6: Freight Rail Bottlenecks

Corridor	Railroad	Freight Mobility Issues
Washington to NC Corridor (Richmond, Washington, D.C., and Fredericksburg)	CSX	There are significant capacity constraints in the Virginia CSX network, particularly on the approach and crossing of the Potomac River into Washington D.C., and on the RF&P Subdivision from Washington south to Richmond. Constraints are greatest north of Fredericksburg, where the commuter train territory to Washington begins, and in the railroad subdivisions near to the Richmond area.
Washington to NC Corridor (Long Bridge)	CSX	The Long Bridge is the largest bottleneck between Washington, D.C. and Richmond, Virginia. The Long Bridge has the highest volume of trains per day in this corridor and across the CSX network.
Washington to NC Corridor and East-West Corridor (Richmond-South)	CSX	Capacity constraints are present in the Richmond area, specifically the progressive eastbound movement from the Rivanna Subdivision to the North End Subdivision. At present, significant planning is required for trains making this move. Additionally, commuter train windows at Staples Mill and Main Street Stations force freight trains to hold out at Acca yard, which dilutes the main line and yard capacity.
Southside Corridor (Norfolk)	CSX	The Portsmouth Subdivision provides the CSX link to the Port of Virginia and will need capacity issues addressed if traffic growth continues at its current pace. The Branchville Siding extension is the start of capacity improvements, which is currently under construction. No other projects have been planned by CSX after this project is completed.

Source: Virginia Statewide Multimodal Freight Study, Draft, 2017.

Hazardous Materials

According to the Association of American Railroads, each year about 1.7 million carloads of hazardous materials are transported by rail in the U.S., amounting to about 5.5 percent of U.S. rail carloads. Recent statistics indicate that greater than 99 percent of rail hazardous materials reach their destinations without a release caused by a train accident. Rail hazardous material accident rates have declined by 91 percent since 1980. Toxic inhalation hazard materials (TIH) are a subset of hazardous materials and are particularly threatening if released into the atmosphere. Each year, railroads carry about 75,000 carloads of TIH and are subject to a common carrier obligation to transport TIH materials. Per USDOT requirements, railroads conduct risk analyses of their primary TIH routes and potential alternative routes. Railroads must use the safest routes based upon these analyses.

In October 2014, the rail industry shipped a record 35 million barrels of crude oil and that same year, the number of crude oil rail car spills peaked. One well publicized 2014 derailment of a train carrying crude oil in Lynchburg, Virginia, probably due to a broken section of rail, brought renewed attention to the need for improvements in rail system resilience and maintenance, as well as for improved communication between local authorities and rail operators.

Operation Lifesaver

Operation Lifesaver is a non-profit, international, continuing public education program. It was first established in 1972 to end collisions, deaths, and injuries at places where roadways cross train tracks and on railroad rights-of-way. Operation Lifesaver programs are sponsored cooperatively by federal, state, and local government agencies; highway safety organizations; and the nation's railroads. DRPT is an active participant in Virginia Operation Lifesaver Inc., a non-profit organization established in 1979 to address the need in Virginia to eliminate death and injuries at highway-rail grade crossings and on railroad rights-of-way and properties. Virginia Operation Lifesaver is made up of volunteer presenters who give free presentations regarding highway-rail grade crossing safety and trespass prevention on railroad rights-of-way and properties to schools, drivers training classes, professional drivers, school bus drivers, public safety personnel, civic groups, and any other organization that has an interest.

Rail Security

As the 9/11 Commission noted in its final report, "Surface transportation systems such as railroads and mass transit remain hard to protect because they are so accessible and extensive[37]." The U.S. Department of Homeland Security (DHS) is the primary federal agency responsible for security in the transportation sector, including rail. In 2009, DHS initiated the development of the National Infrastructure Protection Plan, a component of which is the Transportation Systems Sector-Specific Plan. The focus of this Plan is to develop strategies to reduce risks to critical transportation infrastructure from known and unknown terrorism threats. DHS has established mode-specific councils, including rail and mass transit coordinating councils, composed of public and private sector representatives. The councils are charged with developing plans and policies to improve the security and resiliency of the nation's surface transportation system. Within the Plan, the security component includes a cycle of activities that begin with setting protection and resiliency goals, then identifying assets, systems, and networks, assessing risks, prioritizing focus areas, developing and implementing programs and strategies, and measuring effectiveness. In the Commonwealth, the Virginia Critical Infrastructure Protection and Resiliency Strategic Plan has been developed as a local application of the broader policies established by the National Infrastructure Protection Plan. The primary Virginia state agencies responsible for the Plan are the Office of Commonwealth Preparedness, the Department of State Police, the Virginia Department of Emergency Management, and VDOT. The Virginia Plan follows a similar framework as that of the National Infrastructure Protection Plan. The National Infrastructure Protection Plan is updated every three years.

Port and Waterway Condition and Performance

The Commonwealth of Virginia has invested heavily to expand port operations and capacity as demand continues to rise. In a $1.0 billion expansion effort now underway, the Port of Virginia will:

- Deepen the harbor to a depth of 55 feet, enabling Panamax-sized container ships to dock at the port
- Build a new, semi-automated marine terminal at Craney Island, on the Elizabeth River

[37] *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States,* New York: Norton, 2004, p. 391.

- Improve truck access, increase rail capacity, and install state-of-the-art cranes to increase the speed and capacity of operations at the Norfolk International Terminals (NIT), a 567-acre facility in Norfolk.

Volumes at the Port of Virginia and the rail lines serving the port continue to grow. As the port and rail operations expand, so too will rail-highway conflicts at at-grade crossings. There are several locations in Portsmouth, and in particular Suffolk, that are the source of significant delays because of these conflicts. Local officials, the Commonwealth, and rail companies have worked together to identify and address freight-induced congestion issues in Norfolk, Portsmouth, and Suffolk. To that end, there are several projects in the state Capital Improvement Program for rail-highway conflicts in the Hampton Roads region. Addressing rail-at grade crossing issues in south side Hampton Roads will bolster the region's efforts to garner community support for continued expansion of port and rail operations.

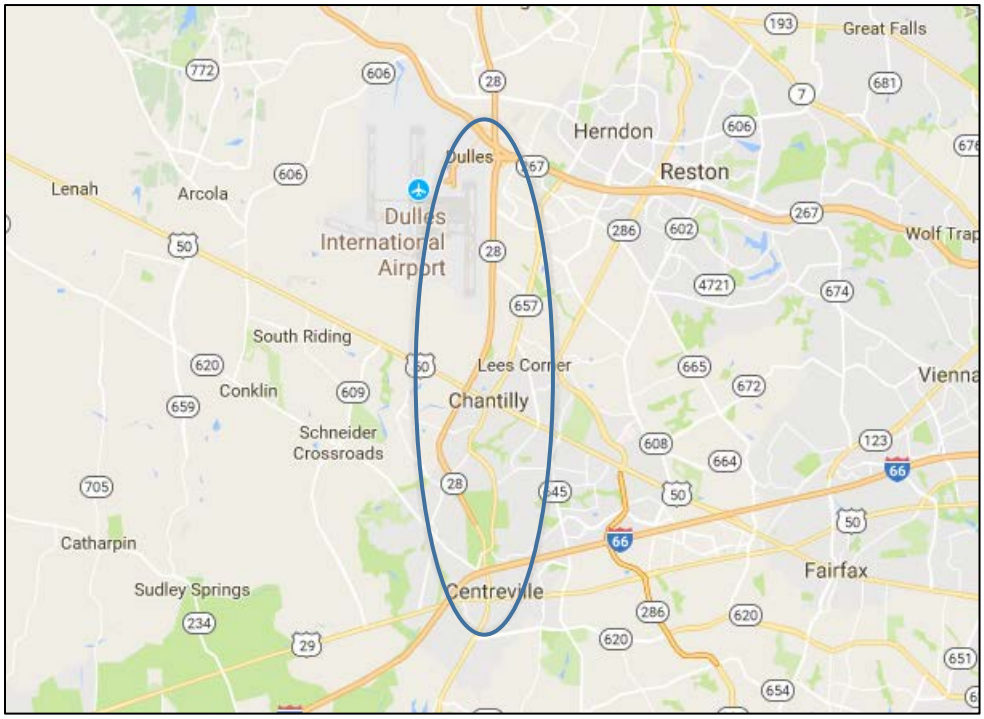
State officials in North Carolina and Virginia recognize the need to upgrade traffic flow on US 17 and improve highway connections between the Port of Virginia and Hampton Roads to Raleigh, NC and the greater Research Triangle. Plans are to upgrade US 17 to an interstate standard through Virginia and into North Carolina, creating a truck route between the two regions. The estimated cost of the project is $1.0 billion; however, no funding has been allocated to the project.

Aviation Condition and Performance

At this time, landside access is the most significant issue facing Virginia's airports at the Dulles, Richmond, Norfolk, and Roanoke all-cargo locations. As the Commonwealth grows in population and economic activity, the demand for roadway capacity on roads leading to and through the airports will increase. These four airports are served by road systems that accommodate non-aviation travel, as well as air passenger travel.

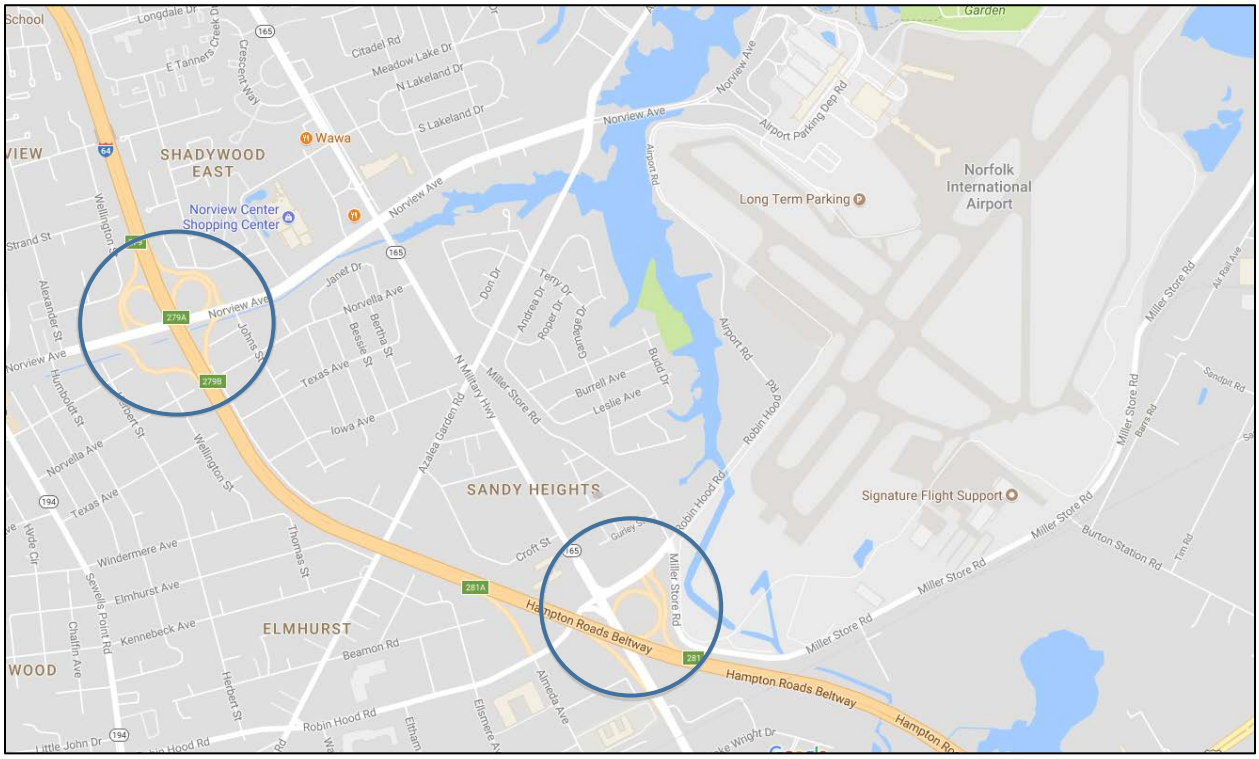
- **Washington Dulles International Airport.** Truck freight access to the airport is limited, and a single interchange ramp accommodates access at I-66 and Route 28. There are plans for a loop road, comprised of upgrades to existing roads that will help accommodate forecasted growth in air cargo and the need for improved access. However, there remain concerns about the ability of the road system to accommodate demand from the west and southwest, as well as from the east and southeast (**Figure 7-8**).
- **Norfolk International Airport**. The airport has plans to expand the customs facility. Some intersections and road expansion projects west of the airport will address the anticipated traffic increase; however, there are concerns that congestion on portions of Norview Avenue and N. Military Highway (shown as circled in **Figure 7-9**) will worsen.

Figure 7-8: Congested Locations near Dulles International Airport



Source: Virginia Aviation Authority, Google Maps, 2017.

Figure 7-9: Congested Locations near Norfolk International Airport



Source: Virginia Aviation Authority, Google Maps, 2017.

Virginia, through its aviation systems plans and the facility master planning process, has identified runway and other capital investment needs to maintain air cargo and operations and capacity. At this time, the plans appear to account for the anticipated rates of cargo growth. The growth in belly cargo (freight stored in the cargo hold of scheduled commercial flights) may absorb some of the demand for on-airport cargo capacity. Information about the volume and value of belly cargo shipments is not publicly available.

8. Stakeholder Engagement

The Virginia Freight Element was developed with input from several types of stakeholder outreach; including committees, direct outreach, and coordination. Stakeholders and their responsibilities include the following:

- A steering committee composed of representatives from VDOT, VDRPT, and POV met every two weeks to discuss policy emphasis areas, the status of the plan, and the continuing outreach and coordination with stakeholder groups.
- The Multimodal Working Group (MMWG) composed of state transportation agency planners met each month in a VTrans oversight role and were focused on ensuring that the statewide plan update considered the needs of each of the state's rural regions and urbanized areas, as well as all transportation modes.
- OIPI created the Multimodal Advisory Committee (MAC) as a sounding board for VTrans goals, needs, policies, and recommendations. The MAC represents transportation modal agencies, regional planning, and local government interests. MAC membership also includes deputy secretaries and appointees from non-transportation state agencies, transportation industry representatives, and interest groups including environmental and transportation modal advocates.
- The MAC assumed a freight-focused role as the Virginia Freight Transportation Technical Committee (VFTTC). VFTTC membership includes direct representatives of freight industries including: trucking, rail, and aviation representatives; shippers; freight forwarders; Class I railroads; and major Virginia industries. This group met three times during the development of the Freight Report, in addition to meeting prior to the Freight Element effort in which the VTrans2040 Vision, Goals, Objectives, and Guiding Principles were developed and progress on the Virginia Multimodal Transportation Plan was discussed.
- The Virginia Freight Advisory Committee (FAC) met at an early stage of Vtrans2040 to help the study team understand the issues of highest importance to the private sector community. The FAC is composed of the Virginia Secretary of Transportation, managers of modal agencies, private sector representatives, and the Office of Intermodal Planning and Investment. The discussions from that early meeting helped to produce the Virginia components of the Atlantic Gateway project, which is now under development.

The Freight Element was also informed by direct stakeholder interviews and discussions with private sector representatives and public agency modal stakeholders. Discussions with private sector representatives included Class I railroads (CSX/NS) and trucking Associations (Virginia Trucking Association/Owner-Operator Independent Drivers Association). While the VPA, VDOT, and DPRT provided critical data and guidance throughout the development of the VFC, additional data and input were provided through coordination with the DOAV and the Hampton Roads Transportation Planning Organization (HRTPO).

In May 2017, a simple survey was prepared and shared with the trucking industry through the Virginia Trucking Association, which gathered input on needs and constraints. The survey was composed of several questions gauging levels of satisfaction with components of the transportation system, and

several open-ended questions. The plan team reviewed over 160 complete survey responses that helped to inform the plan's discussion of issues and solutions.

In addition to these forms of stakeholder engagement, the VTrans2040 effort included extensive engagement that informed the Vision, Goals, Objectives, and Guiding Principles, as well as the Needs and Recommendations of the VMTP. Specific outreach activities included:

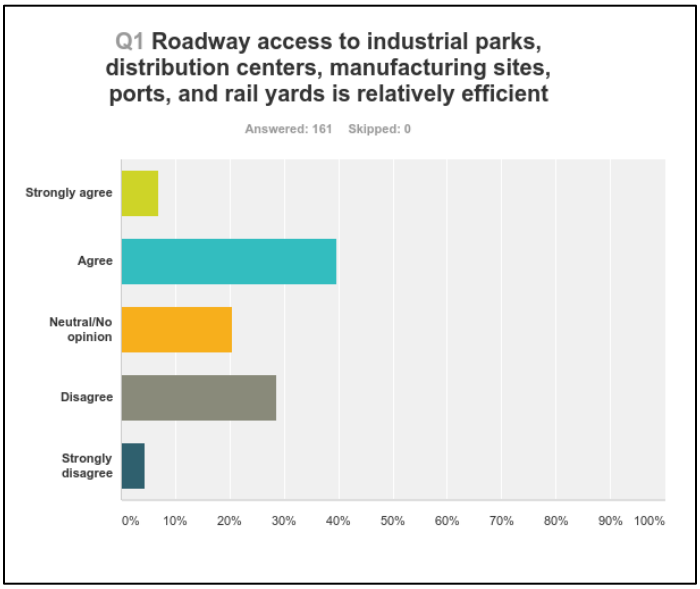
- An online survey regarding transportation and community preferences, concerns about transportation infrastructure, and trends in travel behavior. Over 2,000 responses were received.
- A series of four "Regional Forum" meetings held in four to five locations each. The forums gathered input on: transportation-related values; transportation needs on the Corridors of Statewide Significance, Regional Networks, and Urban Development Areas (UDAs); tiering of the identified needs; and recommendations for the Tier 1 needs.
- Over 75 meetings with regional stakeholders across 15 metropolitan regions to discuss: transportation needs in terms of activity centers, economic activity, and access needs for freight and passengers; reliability, congestion, safety, and multimodal needs; and to review Tier 1 recommendations.

Stakeholder Outreach

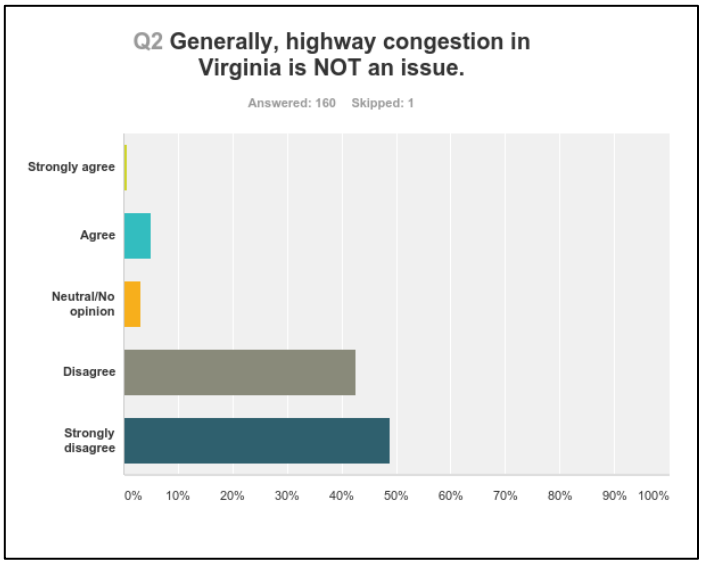
Virginia Freight Truck Drivers Survey

A web-based survey was conducted in June 2017 using SurveyMonkey® to solicit feedback from truck drivers associated with the Virginia Trucking Association (VTA), and the Owner-Operator Independent Drivers Association (OOIDA). The simple 6-question survey was designed to gauge truckers' impressions of the adequacy of the highway system and supporting services and infrastructure, and to obtain quantifiable data about needs. A total of 161 responses were received. The takeaways that emerged from the survey are summarized on the pages that follow.

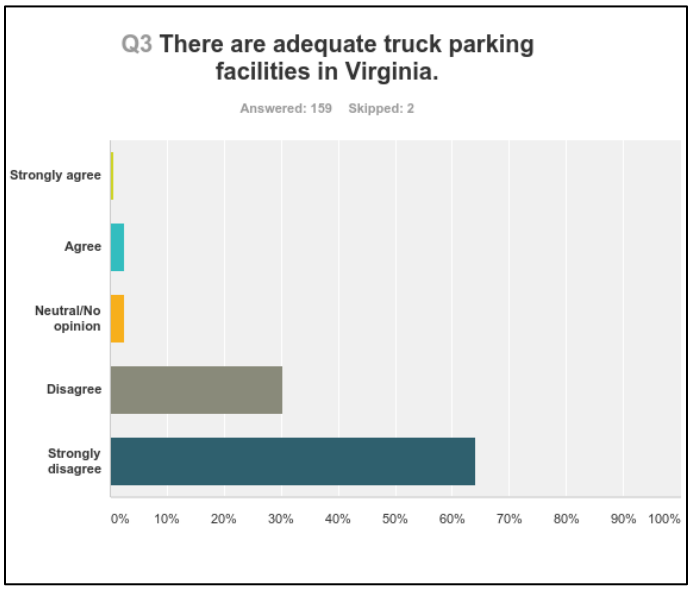
Overall, access to freight destinations and intermodal connections is relatively efficient. The majority of truckers agree that access to their destinations is efficient. Almost 47 percent of responds agree that roadway access to intermodal facilities is relatively efficient, while about 31 percent disagree. These destinations correspond to Virginia's first and last mile connections. It is likely that truckers with schedule flexibility are able to avoid peak congestion periods in the more densely populated areas of the state.

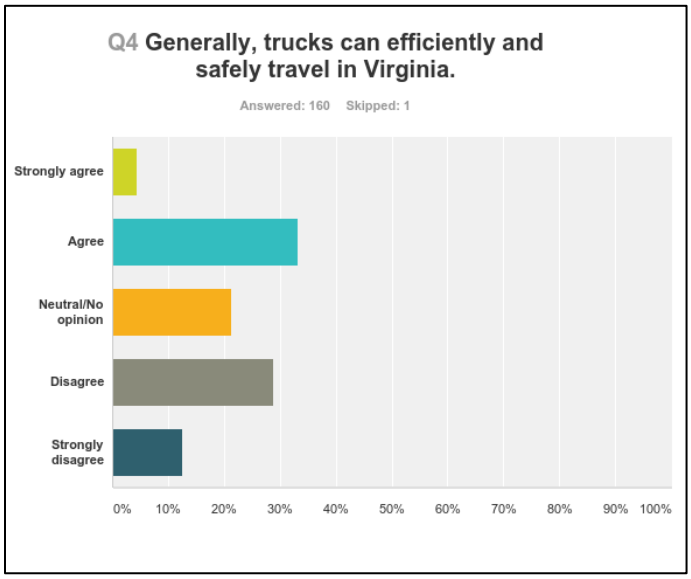


By an overwhelming margin, congestion in Virginia is an issue for truck drivers. Over 90 percent of respondents disagree or strongly disagree that highway congestion is not an issue (i.e., they agree that highway congestion ***is*** an issue). This response indicates some level of frustration with the ability to move freely across roadways and, at times, to meet schedule commitments.



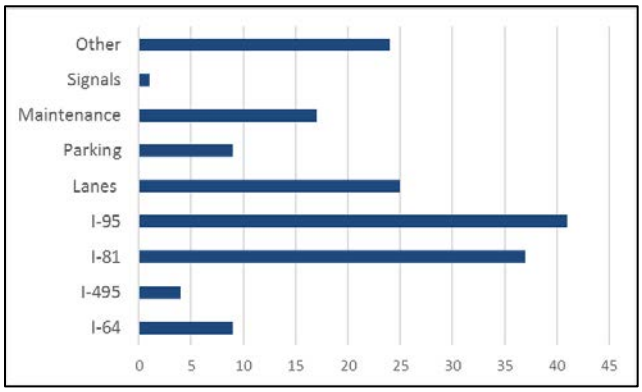
The survey confirms that parking is inadequate. About 93 percent of respondents disagree or strongly disagree with the statement that truck parking is adequate in Virginia. This corroborates a 2015 study completed by VDOT that found a shortage of 2,000 truck parking spaces.



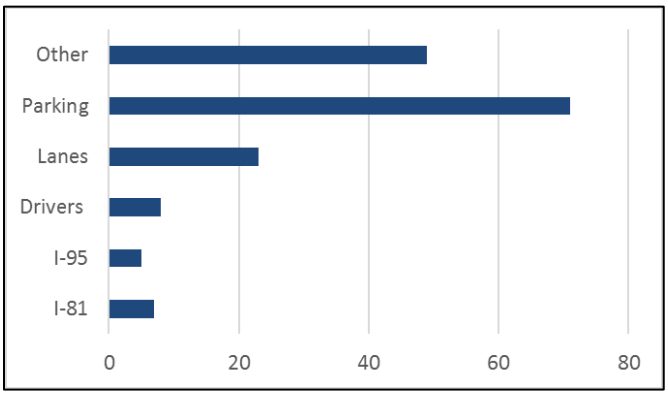


Slightly more truck drivers disagree that trucks can travel safely and efficiently in Virginia, than agree. About 35 percent of respondents agree that truck travel is safe and efficient, while 41 percent disagree. Concerns over safety on the Interstate system, where most accidents involving freight-carrying trucks occur, may have weighted the response towards the negative.

The survey also offered a few open-ended questions that asked drivers to identify the key issues of concern to them.



Interstates are a major concern. Several of the major interstate corridors in the state, including I-95, I-81, and I-495, were identified as the top infrastructure problems in the open-ended responses. Additional problem corridors mentioned were the Hampton Roads Bridge Tunnel, I-64 and I-66, and the Northern Virginia and Hampton Roads regions overall. Most of the infrastructure concerns mentioned were congestion, roadway/bridge maintenance, lack of truck only travel lanes, lane restrictions, and lack of acceleration/deceleration lanes on/off interstates. Another major issue repeatedly mentioned was the lack of truck parking/rest areas across the state.



By a large margin, fixing the parking issue is top-most on the list of issues that drivers would address. When asked what drivers would fix, the top issue by far was inadequate truck parking/rest areas parking. Also mentioned were congestion, increasing capacity by adding lanes, truck only lanes, and eliminating tolls. Several comments mentioned the need for improved automated/weigh-in-motion weigh stations. There were several mentions of conflicts between personal vehicle drivers and truck drivers, including distracted drivers, educational awareness of trucks, and increased enforcement of traffic laws.

Drivers had more to say. While most of the responses to the last question were mentioned in the previous question summaries, the following concerns/issues were also mentioned:

- Incident management, emergency response
- Driver concerns with electronic logging devices (ELDs) legislation
- Allow 72 feet length trucks on some roads which are limited to 65 feet length
- Improve parking in cities to allow for efficient product delivery and pickup
- Improve management of fuel tax revenues
- Hold times at ports and businesses impact driver times
- Improve road signage

9. Economic Context of Freight

Understanding the economic context for freight is fundamental to understanding the role that freight transportation has in Virginia's economy. Unlike passenger transportation that can have many purposes and roles including leisure purposes, freight transportation's only purpose is to serve commerce. Freight transportation exists to fulfill the need to move goods that people and businesses want moved. In doing so, freight transportation serves every resident, business, and public agency in the state. The demand for goods drives the demand for freight transportation where the amount and types of goods demanded depends on economic conditions. Because of the economy's importance in determining the needs for freight transportation, FHWA requires an assessment of the economic context for freight in state freight planning.

This section presents an overview of the relationship between freight movement and Virginia's economy. A set of economic corridors in Virginia are used as examples of the types of needs met by freight transportation around the state.

Highlights

Freight transportation plays a critical, enabling role for businesses, workers, and residents.

The quality of life for every Virginia resident depends on the performance of the freight network to provide food, energy, and other products consumed on a daily basis. Jobs depend on supplies being available and products that are made being delivered to keep businesses running.

In 2015, Virginia's $481 Billion economy[38] ranked 12th in the country, essentially unchanged in rank from a decade ago. Virginia had nearly $192 Billion in business sales attributed to industries that are reliant on freight shipments as inputs to production or to transport finished goods to customer markets outside of their regional economy. This $192 Billion comprises over a quarter (26 percent) of the entire state economy. Across all business sectors, outbound freight transportation dependency represents $71 Billion of the state economy while inbound freight transportation dependency represents $90 Billion of Virginia's economy[39].

The service sectors, comprising 70% of Virginia's economy, depend on freight transportation for critical business supplies and for energy and food to supply its workers.

As is common throughout the United States, service industries comprise a large majority of the value of the economy. [40] Though the service sectors are generally less intensive users of freight transportation than are manufacturing, agriculture, or resource extraction sectors, the competitive service sector industries rely on reliable and high-service freight transportation for rapid delivery of supplies and materials. Without these resources, service sector businesses could not function, even if freight transportation only makes up a small share of expenditures.

[38] Measured in terms of Gross State Product by the U.S. Department of Commerce.

[39] The remaining $31 Billion is reliant on internal Virginia freight shipments.

[40] The services industries include finance, insurance, real estate, rental, leasing, retail trade, professional and business services, education, healthcare services, and government.

Currently adequate freight performance means many take the freight system for granted.

The current relative overall efficiency and reliability of Virginia's freight transportation system means many state residents take for granted the deliveries of millions of products daily with little regard for how that happens. It is only during times of weather emergency-related disruptions to transportation that many Virginians give any thought to availability of goods they expect be able to find in stores or to have delivered to their homes.

Forecasts of growth place future freight performance and the state's economy at risk.

The changing economy and forecasted economic growth put increasing demands on Virginia's freight system. These changes put the past performance and competitiveness of the state's businesses and the associated jobs at risk. The health and the development to its potential of the Virginia economy relies on freight transportation services being available and dependable.

Forecasts for 84% growth in the value of Virginia freight from 2012 to 2040.

The total value of freight transported in Virginia was $760 Billion in 2012 and is forecasted to increase to $1.4 Trillion by 2040, or 3 percent annually. This pace of growth is close to the 3.1 percent growth forecast for the entire United States over this same period.[41]

A wide range of Virginia industries forecasted for growth in sales depend on freight transport

Individual industry sectors in the state are forecasted to see growth with manufacturing closely tied to freight transportation demand. A variety of industry sectors providing employment around the state are projected to see growth, contingent on the freight transportation system being able to accommodate the growth and meet the increased demand.

The artificial/synthetic fibers, motor vehicle parts, semiconductors, other chemical products, and paperboard mills manufacturing sectors (between $1.3 Billion and $2.5 Billion in business sales) are the top industry drivers of the 3.2 percent average annual compound growth in the Virginia Primary Manufacturing Sector forecasted from 2012 ($23.1 Billion) to 2040 ($55.8 Billion). Upcoming industries (currently between $15M and $878M in business sales) forecasted to grow between 5.1 percent and 5.3 percent annually include truck trailers, motor vehicle bodies, plastics (pipes, packing, laminated, & un-laminated), and polystyrene foam manufacturing business sectors.

Tobacco products, ship building, poultry processing, breweries, heavy duty trucks, and pharmaceutical manufacturing industries (between $1.5 Billion and $6.5 Billion in business sales) are the top performing sectors in the Secondary Manufacturing Sector in Virginia (between 3% and 13% of all industries) which is forecasted to grow from $51 Billion in 2012 to over $84 Billion by 2040, an average annual growth rate of 1.8 percent. Upcoming industries (currently between $142 Million and $743 Million in business sales) forecasted to grow between 4.1 percent and 5.9 percent annually include in-vitro diagnostics, biological products, medicinal & botanicals, plastics, toilets, paint & coatings, and tire manufacturing business sectors.

[41] Comparison of the VTrans2040 forecast of value of Virginia freight with the forecast from the U.S. Department of Transportation Freight Analysis Framework, ver. 4 for the entire U.S.

Manufactured commodities are top inbound and outbound commodities shipped to and from Virginia

Reflecting consumption and production patterns by the residents and businesses in Virginia and in areas with which Virginia trades, Warehouse and Distribution Center & Freight of All Kinds (FAK), motor vehicle equipment, and refined petroleum products are among the top inbound and outbound commodity categories shipped to and and from the state. These represent 18 percent of inbound and 13 percent of outbound shipments, to and from Virginia, respectively.

Industry Structure of the Virginia Economy

The economy of Virginia, as for the entire United States economy, is dominated by the services sector, rather than goods producing sectors such as Manufacturing, Agriculture or Mining. At the end of 2014, just 5.8 percent of employment in Virginia was in manufacturing, while 92.5 percent of non-farm employment was in the services sectors.[42] Freight transportation serves all industries in the state, but Manufacturing remains the most directly dependent on freight transportation besides the Transportation Services sector itself. [43] Virginia's $481 Billion economy (2015) has nearly $192 Billion in business sales attributed to industries that are reliant on freight shipments as inputs to production or rely on freight services to transport finished goods to customer markets. Within the past decade, the Great Recession of 2008-2009 resulted in a downturn in the state's Manufacturing, Wholesale, and Retail Trade and Warehousing and Distribution sectors. In Virginia, the Wholesale and Retail Trade and Warehousing and Distribution sectors have recovered and now exceed pre-recession levels of output. The Manufacturing sectors have struggled to recover and are still below pre-Recession peaks. The state's Agriculture and Utility sectors experienced smaller impacts from the Great Recession, although they have since grown slowly.

Industries Affected by Freight in Virginia's Economy

Freight flows are associated first in most people's minds with manufacturing. Virginia has seen growth in recent decades in advanced manufacturing sectors, which are dependent on the condition, capacity, and reliability of Virginia's transportation system. However other industries such as freight transportation service providers, knowledge-oriented services, and retail are also directly affected by the volume and efficiency of the transportation system, as well as how distribution channels are changing.

Private Sector Transportation Providers

Freight transportation services in the economy are provided by private sector companies (with the exception of the parcel delivery services of the U.S. Postal Service.) The business of moving goods is integrated into the national and international freight networks in which much of the infrastructure, excluding railroads and pipelines, is provided by the public sector.

Virginia is a not only an origin and destination for freight shipments, but also serves as an international gateway for import and exports, primarily through its marine ports and airports. Freight transportation services are required for transporting imports and exports from their points of origin to their destinations. Those origins and destinations can often be outside of Virginia. The geographic location of Virginia, with the ports of Hampton Roads and Richmond, and with major national highways, railways,

[42] Virginia Employment Commission data on industry employment, year-end 2014.
[43] Data for Virginia Gross State Product (GSP) from U.S. Bureau of Economic Analysis (BEA) 2015.

and pipelines crossing the state from north to south, much freight travels across Virginia to and from other locations. The handling of this pass-through freight provides business for freight service providers in Virginia, benefitting the state economy. The state's freight-transportation service providers play a vital role as contributors to Virginia's economy, serving Virginia residents and businesses, as well as shippers outside of Virginia.

Industries directly involved in the movement of people and goods using Virginia's transportation system account for $15 billion of output (sales), $7.1 billion worth of Gross State Product, $4.9 billion worth of wage income, and over 78,000 jobs in Virginia's economy (**Table 9-1**). In addition to this direct economic contribution, spending by the transportation firms and their workers also provides additional stimulus to the state's economy. This economic activity includes spending on fuel distributors, transportation equipment manufacturers, service providers, and other businesses that provide materials for the freight transportation industry.

Table 9-1: Contribution of Transportation Industries in Virginia (2016)

Industry	Business Output ($M)	Value Added ($M)	Jobs (#)	Wage Income ($M)
Truck Transportation	$5,838	$2,651	40,151	$2,143
Transit & Ground Transp.	$904	$546	18,331	$560
Air Transportation	$4,214	$1,894	13,087	$1,076
Rail Transportation	$2,475	$1,036	5,607	$661
Water Transportation	$1,650	$995	1,658	$453
All Modes	**$15,080**	**$7,123**	**78,834**	**$4,893**

Source: U.S. BEA and BLS data as reported by IMPLAN (2016).

The level of economic contribution from each mode of freight transportation reflects the structure of Virginia's current freight transportation system, combining road, rail, maritime, air, and pipeline freight. The freight transportation modes are linked together with hand-offs of goods between them common in freight shipping. Therefore, freight transportation modes can be considered "reliant" on other modes of freight transportation. For example, truck transportation often supports the "last-mile" pick-up and delivery for rail-intermodal and air cargo shipments to and from rail and airport terminals. Rail and truck services are also required to move marine-based shipments either inland or to the port for import and export shipments. The Norfolk Southern and the CSX railroads in Virginia both cite the trucking industry as their largest customer.

As the volume of freight flowing to, from, and through Virginia continues to grow, transportation industries are poised to respond and grow. Awareness of the economic contribution of these industries provides important perspective for planning, especially with other states looking to expand their own freight handling business in a bid to gain market share from Virginia. The state's efficiency and reliability in transportation matters in this competition, although the freight sector also relies on a wide variety of other industries such as professional services (e.g. legal, accounting, scheduling, finance) in their businesses, as a consequence of the inter-connected nature of business across Virginia's economy.

Trends and Forecasts

In this report, forecasts for freight transportation demand are based on forecasts of economic activity in the state, in consideration of the growth or decline in population, workforce size, business sales, and foreign trade. Business activity forecasts are detailed by industry and by the related commodities produced or used in those industry sectors. This approach also reflects growth in sectors such as high technology businesses that are expected to continue to see greater than average growth than the economy as a whole.

Structural changes in the economy, as a consequence of trends in retail and wholesale distribution, also play a significant role in the reorganization of transportation demand. The growth of e-Commerce, on-line retailing, and the growing complexity of retail sales channels is shifting the dynamics of the retailing industry in Virginia. Retailers are changing the structure of fulfillment and the associated warehousing, distribution, and management of retail goods with the growth of on-line sales for home delivery. These changes are following changes in consumer shopping behavior, with continuing shifts towards on-line purchases and reductions in traditional store traffic. This reflects national trends where, in just the four years from 2011 to 2015, U.S. e-Commerce sales grew from 4.9 percent to 7.2 percent of total sales.[44] The e-Commerce share of sales that exclude food and energy products is even higher because these total retail sales figures include spending at restaurants and for products such as vehicle fuel that are as-yet not commonly sold online. The shift to e-Commerce is resulting in growth of 3rd party parcel delivery of manufactured consumer goods.

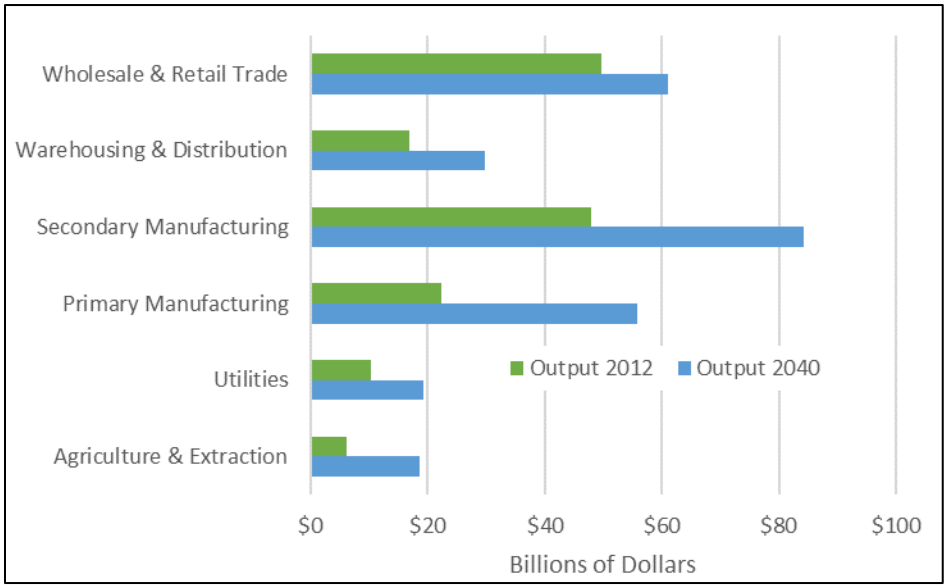
The growth in small parcel deliveries is leading to changes in the nature of freight transportation and associated goods distribution businesses and employment. Fewer in-store purchases that are replaced with home deliveries affects the potential for growth in businesses providing those services. The forecasts for growth in overall retail sales is not for drastic change, yet the shifts in distribution are changing the outlook for retail stores and their employees versus the outlook for warehousing and logistics businesses and their employees. The shifts in demand at the industry sector level have been incorporated into the forecasts of Virginia commodity and modal freight demand used in the Plan.

Forecasts for Virginia's Manufacturing sectors, both Primary and Secondary Manufacturing sectors[45], expect sales to grow 3.3 percent and 2.0 percent respectively, per year through the year 2040. Wholesale and Retail Trade are also expected to see gains, albeit at a slower pace of 0.7 percent per year. Although smaller in scale to the Manufacturing sector, Agriculture and Extraction and Utilities sectors are forecasted to grow by 4 percent and 2.2 percent respectively, per year in Virginia. These sectors are in a more mature phase of development and, although they are not projected to grow as rapidly as new technically-oriented sectors in manufacturing, there remains growth potential despite competition, regulations, and availability of land challenges. Comparisons of output by industry group in 2012 versus 2040 shown below in **Figure 9-1**, highlight the long-term importance of Manufacturing (45% of total output) and Wholesale & Retail Trade (33% of total output) to Virginia's economy.

[44] U.S. Census Annual Retail Trade (2015). http://www2.census.gov/retail/releases/current/arts/sales.xls

[45] Primary Manufacturing transforms raw materials into industrial materials. Secondary Manufacturing produces goods for final consumption from industrial materials and components.

Figure 9-1: Trends in the Major Industry Sector Shares of the Virginia Economy, 2012-2040



Source: EDR Group from TREDIS and Moody's Analytics.

Domestic and International Production and Consumption Forecasts

The consumption and production forecasts (by value) for the all commodity categories from 2012 to 2040 for Primary Manufacturing are shown in **Table 9-2**. Over the long-term, commodity consumption is expected to see growth of between 2.2 to 2.3 percent per year while commodity production is expected to see growth of between 3.7 to 4.1 percent per year. The percentage growth in foreign goods consumption is slightly higher than domestic consumption and growth in commodity production for domestic markets is expected to grow slightly faster than growth for products shipped to international destinations. Domestic markets account for 91 percent to 93 percent of goods purchased or produced.

Table 9-2: Growth in Commodity Consumption and Production in Virginia 2012-2040 ($Billions)

Year	Commodity Consumption		Commodity Production	
	Domestic	Foreign	Domestic	Foreign
2012	$24.4	$1.9	$38.3	$3.7
2040	$41.2	$3.2	$101.1	$8.7
Avg. Growth	2.2%	2.3%	4.1%	3.7%

Source: Transearch 2012 data and Moody's Analytics Forecasts.

Growth in Virginia production and consumption of goods from 2012 to 2040 is measured in millions of U.S. tons in **Table 9-3**. Dominance in domestic markets is evident in freight movements in volume terms. Expected growth in commodity consumption is slightly lower (1.9% - 2.2%) while growth in commodity production is slightly higher (4.4% - 4.5%) when compared to forecasted growth rates measured by value.

Table 9-3: Growth in Commodity Consumption and Production in Virginia 2012-2040 (millions of tons)

Year	Commodity Consumption		Commodity Production	
	Domestic	Foreign	Domestic	Foreign
2012	27.9	1.1	23.8	1.7
2040	44.3	1.8	67.0	5.0
Avg. Growth	1.9%	2.2%	4.4%	4.5%

Source: Transearch 2012 data and Moody's Analytics Forecasts.

Virginia Freight Corridor Segments

To illustrate the importance and variety of the functions provided by the Virginia freight transportation system, a series of ten freight corridor segments were examined in detail as part of the Freight Report. These ten Virginia Freight Corridor Segments were selected to illustrate the wide variety and different economic roles that freight corridor segments serve around Virginia. The segments were not chosen using a ranking of quantified size or use characteristics. The ten Freight Corridor Segments were selected from among hundreds that could have been identified across Virginia. Collectively, the importance of freight to Virginia's economy is better understood by examples highlighting how businesses, jobs, and regional economies within the state are served by freight transportation.

Freight corridor segments that serve industries reliant on surface modes of freight transportation are primarily trucking and rail. Characterizing freight movements provides a better understanding of the critical role of freight and the degree to which businesses rely on freight shipments. Reliance on freight transportation is used to describe the economic activity that depends on the transportation system to procure inputs for production, as well as to deliver finished goods to customer markets both inside and outside Virginia. Each corridor segment first was profiled across a variety of freight characteristics to highlight unique differences in value and directional flow. Secondly, additional detail for each segment was prepared to include commodity profiles, economic reliance on freight by industry sector, inputs used, and commodities produced.

The corridor segments identified as examples were selected because they illustrate the facilitation of freight movements within, to, and from Virginia or passing through as part of the national freight network. As shown in **Table 9-4**, each corridor segment was numbered, but only to differentiate segments from one another. The selections of the corridor segments were not based on ranking or other quantitative criteria. A table in the full corridor segment analysis in **Appendix C** lists the geographic definitions of each corridor segment with all Virginia counties and independent cities for each area through which the corridor segments pass.

There are some conclusions that can be drawn from comparing the corridor segments across descriptive dimensions. It is clear from **Figure 9-2** that I-81, I-95 US-58 and I-66 serve economic activities and provide economic value to businesses beyond Virginia's borders (for the analyzed corridor sections). These corridor segments are dominated by a large amount of pass-through freight using all but two of them. The corridor segments with the largest amount of pass-through and total freight value are selected portions of I-81 (#3) and on I-95 (#6) where between $145B and $180B of freight value is transported annually. Interstates 81 and 95 are both major thoroughfares of the national interstate system. Corridor segments for I-64 (#1) and I-66 (#10) are also on the interstate system and are used to

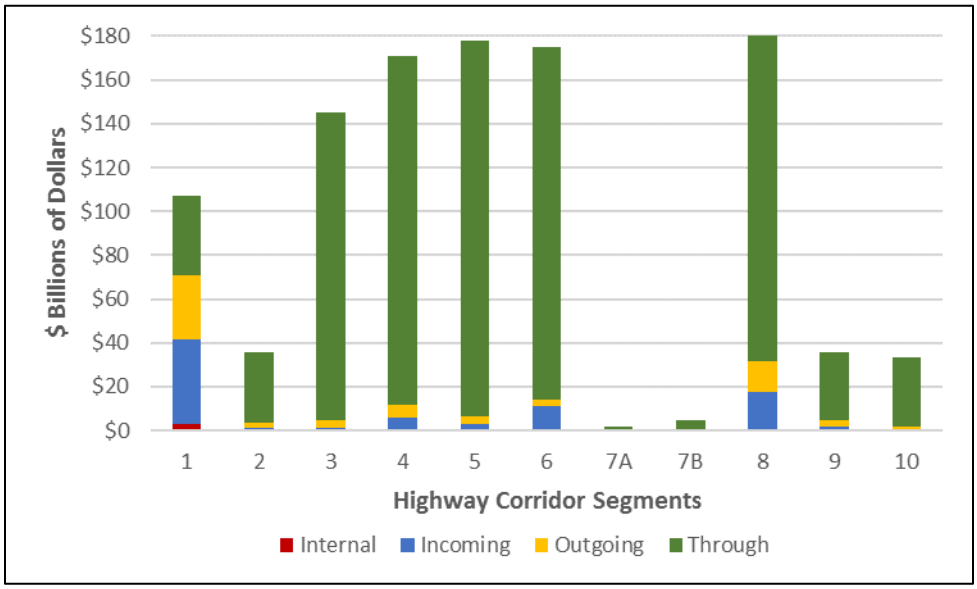
transport $107B and $33B worth of goods, respectively, on an annual basis. The I-66 corridor segment proportionally has the most freight passing through, while I-64 (Hampton Roads) is more balanced across inbound, outbound, and pass-through shipments. The remaining sections are located on the U.S. highway system and while varying in total value, also have a large portion of pass-through freight compared to other directional flows.

Table 9-4: Highway Freight Corridor Segments

#	Highway Freight Corridor Segment
1	I-64 in Hampton Roads
2	US 58
3	I-81 Winchester to Strasburg
4	I-81 Roanoke and Blacksburg
5	I-81 to I-64 through Staunton
6	I-95 between I-495 & Fredericksburg City
7A	Alt US 58 (Abingdon to Wise)
7B	US 23 (Wise to Pound)
8	I-95 Richmond to Petersburg
9	US 58, US 29, & others south of Danville
10	I-66 Strasburg to Gainesville

Source: VDOT.

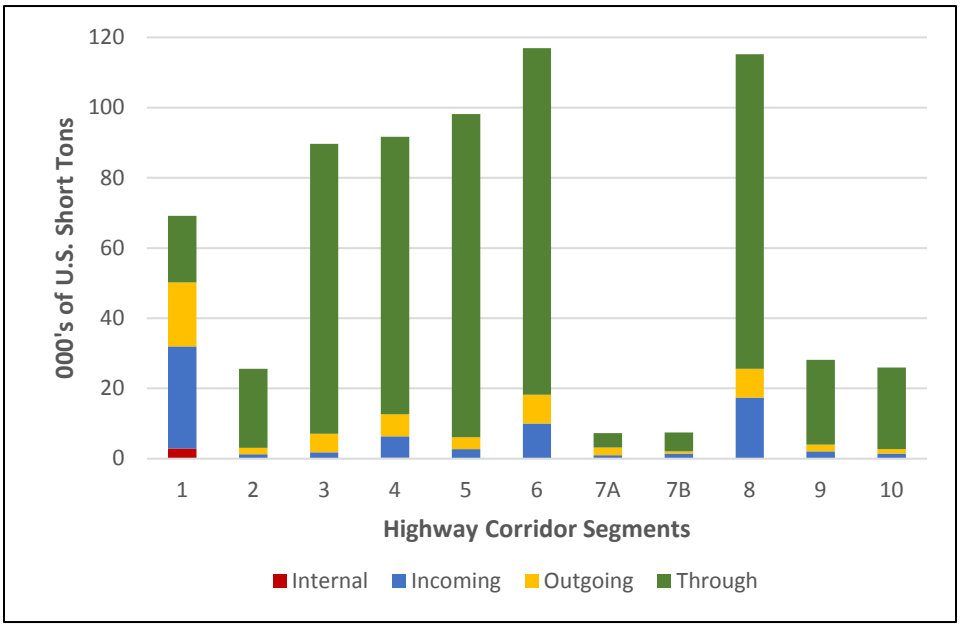
Figure 9-2: Highway Corridor Segments by Value and Directional Flow



Source: Transearch 2012, updated to 2016 using Moody's forecasts.

A similar proportional relationship between corridor segments does not significantly change when measured by tonnage volume, as shown in **Figure 9-3,** indicating higher value-to-volume ratios.

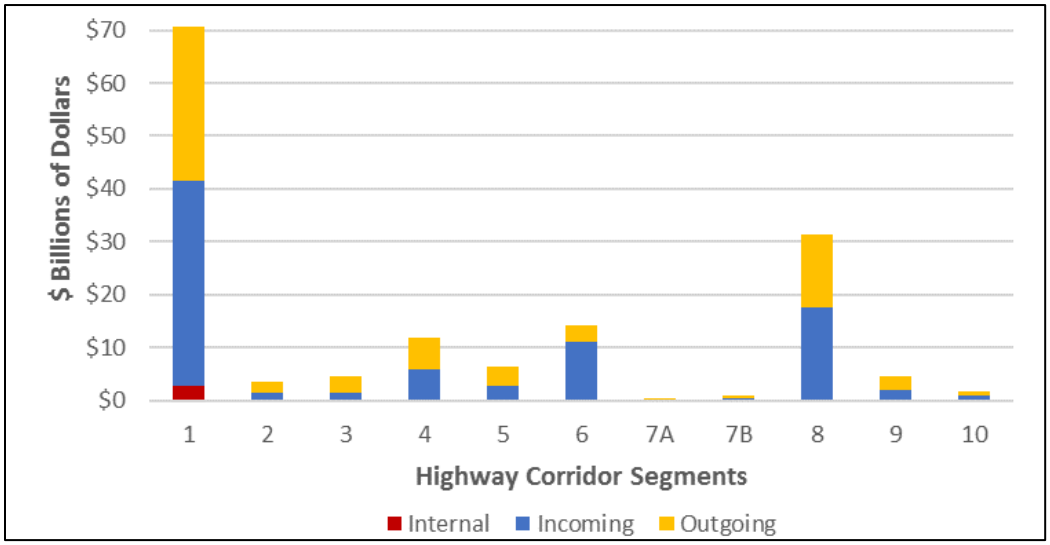
Figure 9-3: Highway Corridor Segments by Volume and Directional Flow



Source: Transearch 2012, updated to 2016 using Moody's forecasts.

Because of the dominance of pass-through freight across the example corridor segments, data associated with pass-through shipments were excluded from **Figure 9-4**, to show more detail for the characteristics of inbound, outbound, and internal movements. In **Figure 9-4** freight shipments (measured by value) are highest in corridor segments on I-64 (#1) and I-95 (#8). Over $70 Billion of freight was transported on this example portion of I-64 through Hampton Roads with slightly more inbound (55%) than outbound (41%), a reflection of the economic activity of the region. The corridor segment for I-95 from Richmond to Petersburg (#8), has the second highest amount of freight value with over $31 Billion. For the remaining corridor segments, portions of I-81 (#4) and I-64 (#10) have nearly equivalent inbound and outbound shipments. Inbound shipments are slightly higher in segments #6, #7a, and #7b, and outbound flows are slightly higher in segments for portions of US 58 (#2), I-81 (#3), I-81 (#5), and the combination corridor segment comprised of US 58, US 29, and others south of Danville (#9). Freight values across corridor segments cannot be added together since freight transported on one corridor segment can also be transported on other corridor segments. Any addition across segments could result in double counting of freight.

Figure 9-4: Highway Corridor Segments by Value and Directional Flow (pass-through omitted)



Source: Transearch 2012, updated to 2016 using Moody's forecasts.

10. Freight Transportation Constrained Investment Plan

VDOT uses the National Highway Freight Program funding to construct freight beneficial projects identified through the State's SMART SCALE process (SMART SCALE is described in **Section 5**). The total amount of NHFP funds applied for Fiscal Years 2018, 2019, and 2020 including carryover funds from Fiscal Years 2016 and 2017 is $133,487,187 as shown in **Table 10-1**. The 39 projects receiving NHFP funds are listed in **Table 10-2**. Further detail on the funding sources including NHFP funds used for the 39 projects can be found in **Appendix D**. Freight beneficial interstate improvements in VDOT's Six-Year Improvement Program (SYIP) are listed in **Table 10-3**.

Table 10-1: National Highway Freight Program Funding for Virginia, FFY 2016 – FFY 2020

Fiscal Year	Projected Obligation Authority	Planned Obligations
Previous (FFY 2016 and 2017)	$55,982,822	$51,044,043
FFY 2018	$28,371,723	$23,492,918
FFY 2019[1]	$33,029,930	$42,220,337
FFY 2020	$36,697,637	$16,729,889
TOTAL	**$154,082,112**	**$133,487,187**

Source: Virginia Department of Transportation. [1] FFY 2019 Planned obligations include carry-over obligation authority from previous years.

Table 10-2: Freight Investment Plan Interstate Projects

District/MPO	Route	Project	Scope	Jurisdiction
Bristol District	I-77 North	#HB2.FY17 Add merging lane on I-77N in Ft. Chiswell	Reconstruction w/ Added Capacity	Wythe County
	I-81	#SGR I-81 Structures 19596 & 19597 over Reed Creek in Wythe	Bridge Replacement w/o Added Capacity	Wythe County
	Various	#SGR FY17/FY18 SGR Interstate	Resurfacing	Bristol District-Wide
	I-81 North	#HB2.FY17 I-81 Exit 19 Ramp Improvements	Bridge Replacement w/o Added Capacity	Washington County
	I-81 North	#SGR - I-81 NBL Smyth Co VA #2034 Federal Structure #17478	Bridge, New Construction	Smyth County
Fredericksburg MPO	I-95 South	#HB2.FY17 I-95 Rappahannock River Crossing (Southbound)	Bridge Replacement w/o Added Capacity	Fredericksburg
	I-95 North	#HB2.FY17 Commuter Lot Expansion I-95 E of Exit 140	Other	Stafford County
	I-95 South	I-95SB Hard/Dynamic Shoulder Running Project	Traffic Management/ Engineering	Stafford County
Hampton Roads MPO	I-64 & I-264	I-64 & I-264 Pavement Rehabilitation - D/B Project #1	Restoration and Rehabilitation	Norfolk
	I-64W Ramp 282A	#HB2.FY17 I64/Northampton Boulevard Interchange Modification	Traffic Management/ Engineering	Norfolk
	I-64 West	HRBT Over Height Detection	Safety	Norfolk
Northern VA MPO	Dale Blvd (Rte 784)	#HB2.FY17 Modify I-95 SB Off Ramp at SR 784 Add Signal	Safety	Prince William County

District/MPO	Route	Project	Scope	Jurisdiction
Richmond MPO	I-64 West	#HB2.FY17 Rte 64 - Extend Acceleration/Deceleration Lanes	Reconstruction w/ Added Capacity	Henrico County
	I-64 East	#HB2.FY17 Rte 64 EB - Pavement Marking	Reconstruction w/o Added Capacity	Henrico County
	I-95 South Ramp 74B	#HB2.FY17 Rte 95 - Improve Ramp Area at Franklin St	Reconstruction w/o Added Capacity	Richmond
	I-95 Ramp 78A	#HB2.FY17 Rte 95 - Extend NB Decel Lane at Hermitage Rd	Reconstruction w/o Added Capacity	Richmond
	I-95 North	#HB2.FY17 Rte 95 - Extend NB Accel Lane at Belvidere St	Reconstruction w/o Added Capacity	Richmond
	Various	#HB2.FY17 Improve Broad St Exit Area	Safety	Richmond
	I-95 Ramp 73A	#HB2.FY17 Rte 95 - Improve Interchange at Maury St	Safety	Richmond
	I-95 North	#HB2.FY17 Rte95 - Improve Interchange at Rte 10	Safety	Chesterfield
	Pine Forest Dr.	Richmond Transportation Operations Center Upgrade	Other	Richmond District-Wide
	I-95	#SMART18 - I-95/I-64 Overlap: Emergency Pull-Offs	Safety	Richmond
	I-95	#SMART18 - I-95 Aux Lanes (nb & sb) b/w Rte. 288 & Rte. 10	Reconstruction w/ Added Capacity	Chesterfield County
New River Valley MPO	I-81 South	#SGR RTE. 81 - Approaches and Bridges over Route 8	Bridge Replacement w/o Added Capacity	Christiansburg
	I-81 South	#SGR RTE. 81 - Mont. Co. Approaches to I-81 bridges over Route 8	Bridge Replacement w/o Added Capacity	Montgomery County
	I-77 North	#SGR F18 SGR Plant Mix Interstate PM2R-017-F18	Resurfacing	Carroll County
Roanoke MPO	I-81 North	#SGR FY17 SGR I-81 NB Bote. Co. Concrete Undersealing	Resurfacing	Botetourt County
Salem District	I-81 South	#SGR FY18 I-81 SB Roanoke County	Resurfacing	Roanoke County
	I-81 South	#SMART18 - I-81 SB Auxiliary Lane from Exit 143 to 141	Reconstruction w/ Added Capacity	Roanoke County
Statewide District	I-95	I-95 Ramp Metering Expansion - PE Only	Safety	Statewide
Staunton District	I-81	#HB2.FY17 Rte 81 - Safety Improvements, Exit 213	Safety	Augusta County
		Edinburg Res. Interstate Plant Mix(PM-8U-16)	Resurfacing	Staunton District-wide
	I-81 NB Off Ramp Exit 245	#HB2.FY17 I-81 Exit 245 NB Off Ramp Realignment	Preliminary Engineering	Harrisonburg
	I-81	#SGR Staunton Dist. State of Good Repair Paving Project (PM-8)	Resurfacing	Rockbridge County
	I-81 North	#HB2.FY 17 I-81 Exit 222 NB Accel and SB Decel Lane Extension	Safety	Augusta County
	I-81 North	#HB2. FY 17 I-81 Exit 220 and Exit 221 Decel/Accel Extensions	Safety	Augusta County

District/MPO	Route	Project	Scope	Jurisdiction
Staunton District	I-81 South	#SMART18 - (St) I-81 Exit 300 Southbound Accel Lane Ext.	Reconstruction w/o Added Capacity	Warren County
	I-81S Ramp 296A	#SMART18 - (St) I-81 Exit 296 Accel/Decel Lane Extensions	Reconstruction w/o Added Capacity	Shenandoah County
Winchester MPO	I-81 North	#SMART18 - (St) I-81 Exit 315 Northbound Decel Lane Ext	Reconstruction w/o Added Capacity	Frederick County

Source: Virginia Department of Transportation.

Table 10-3: Freight-Beneficial Interstate Improvements in VDOT's Six-Year Improvement Program

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
111781	Northern Virginia	Arlington County	0066	#SGR INTERSTATE 66 - REHABILITATION - FED ID 174	Bridge Rehab w/ Added Capacity
77401	Northern Virginia	Arlington County	0395	RTE 395 - 14TH STREET BRIDGE IMPROVEMENTS	Bridge Rehab w/ Added Capacity
111294	Richmond	Richmond	0064	#SGR - BRIDGE REHAB 1-64/5TH ST OVER I-95	Bridge Rehab w/o Added Capacity
111303	Richmond	Henrico County	0064	#SGR - BRIDGE REHAB 1-64 OVER I-95	Bridge Rehab w/o Added Capacity
110595	Fredericksburg	Stafford County	0095	#SGR RTE 95 SB&NB OVER RTE 17 BRIDGE REPLACE ID 18083/18085	Bridge Rehab w/o Added Capacity
111302	Richmond	Chesterfield County	0095	#SGR - BRIDGE REHAB I-95 OVER RTE 608 (REYMET RD) CN ONLY	Bridge Rehab w/o Added Capacity
112046	Fredericksburg	Stafford County	0095	I-95 SB AT RTE 17 - FRED EX CONNECTION	Bridge Replacement w/ Added Capacity
93077	Hampton Roads	Newport News	0064	#SGR Replace Denbigh Blvd Bridge over I-64 and CSX Railroad	Bridge Replacement w/o Added Capacity
97565	Richmond	Henrico County	0064	RTE 64 - REPLACE BRIDGES OVER RTE 156 (FED ID 9760 & 9762)	Bridge Replacement w/o Added Capacity
107114	Bristol	Wythe County	0077	#SGR - I-77 STRUCTURE 19566 OVER COVE CREEK	Bridge Replacement w/o Added Capacity
56899	Salem	Montgomery County	0081	INTERSTATE 81 NB BRIDGE REPLACEMENT AND ROUTE 232 BRIDGE	Bridge Replacement w/o Added Capacity
56900	Salem	Pulaski County	0081	I-81 SOUTHBOUND BRIDGE REPLACEMENT OVER THE NEW RIVER	Bridge Replacement w/o Added Capacity
93074	Salem	Christiansburg	0081	#SGR RTE. 81 - APPROACHES AND BRIDGES OVER ROUTE 8	Bridge Replacement w/o Added Capacity
93075	Salem	Montgomery County	0081	#SGR RTE. 81 - Mont. Co. Approaches to I-81 bridges over Rou	Bridge Replacement w/o Added Capacity
104936	Bristol	Wythe County	0081	#SGR I-81 Structures 19596 & 19597 over Reed Creek in Wythe	Bridge Replacement w/o Added Capacity

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
107117	Bristol	Smyth County	0081	#SGR I-81 STRUCTURES 17470 & 17472 OVER RTE. 686	Bridge Replacement w/o Added Capacity
83164	Hampton Roads	Emporia	0095	I-95 Meherrin River Bridge replacement Fed ID 20236/23237	Bridge Replacement w/o Added Capacity
90347	Richmond	Hanover County	0095	RTE 802/I95 - REPL BRIDGE, RAMPS & AIRPARK RD (FED ID 9596)	Bridge Replacement w/o Added Capacity
93087	Richmond	Richmond	0195	#SGR RTE 195 - BRIDGE REPAIR OVER RTE 76, CSX (FED ID 21552)	Bridge Replacement w/o Added Capacity
111040	Hampton Roads	City of Suffolk	0660	#SGR - Longstreet Lane over Somerton Creek	Bridge Replacement w/o Added Capacity
97555	Bristol	Smyth County	0081	I-81 BRIDGE PROJECT ROUTE 11 PE ONLY #17478 PE CN #17480	Bridge, New Construction
111265	Bristol	Smyth County	0081	#SGR - I-81 NBL Smyth Co VA #2034 Federal Structure #17478	Bridge, New Construction
-11488	Hampton Roads	Hampton Roads District-wide	0264	DT/MT/MLK - Interstate Construction	Bridge, New Construction
103037	Hampton Roads	Hampton Roads District-wide	0264	DT/MT/MLK Interstate Debt Service	Bridge, New Construction
104366	Hampton Roads	Chesapeake	0064	I 64 Environmental Study from I-464 to I-664/264	Environmental Only
67588	Salem	Salem District-wide	0081	RTE 81 - DEVELOPMENT OF NEPA DOCUMENT - TIER II	Environmental Only
96259	Northern Virginia	Fairfax County	0095	Engineering Studies for I-95 NB Ramps & Rolling Rd. Loop Ramp	Environmental Only
80029	Hampton Roads	Multi-jurisdictional: Hampton Roads MPO	0064	RTE 64 - CONSTRUCT NEW INTERCHANGE (CITY LINE ROAD)	New Construction Roadway
93033	Northern Virginia	Fairfax County	0095	I-95 NB DIRECTIONAL OFF RAMP TO NB FAIRFAX COUNTY PARKWAY	New Construction Roadway
96256	Northern Virginia	Fairfax County	0095	DAR Ramps into Fort Belvoir EPG	New Construction Roadway
59175	Hampton Roads	Norfolk	0564	AIR TERMINAL INTERCHANGE - INTERMODAL CONNECTOR	New Construction Roadway
104000	Hampton Roads	Norfolk	0564	I-564 Intermodal Connector	New Construction Roadway
18968	Hampton Roads	Norfolk	R000	R000 - I-564 INTERMODAL CONNECTOR	New Construction Roadway
108952	Statewide	Statewide	0000	#SGR New Rest Areas	Other
103344	Hampton Roads	Hampton	0064	HRBT Switchgear Installation	Other
110577	Hampton Roads	Multi-jurisdictional: Hampton Roads MPO	0064	HRCS Preferred Alternative Refinement	Other

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
105239	Northern Virginia	Northern Virginia District-wide	0066	I-66 PPTA - STUDY ONLY	Other
105500	Northern Virginia	Northern Virginia District-wide	0066	I-66 Tier II	Other
107371	Northern Virginia	Northern Virginia District-wide	0066	I-66 MULTIMODAL IMPROVEMENTS INSIDE THE BELTWAY	Other
108336	Northern Virginia	Northern Virginia District-wide	0066	I-66 MULTIMODAL IMPROVEMENTS INSIDE THE BELTWAY - FFX & ARL	Other
108337	Northern Virginia	Northern Virginia District-wide	0066	I-66 INSIDE THE BELTWAY TOLLING SYSTEMS INTEGRATION	Other
108491	Northern Virginia	Fairfax County	0066	TRANSFORM 66 CONGESTION MITIGATION TRANS MGMT PLAN	Other
110496	Northern Virginia	Northern Virginia District-wide	0066	TRANSFORM I-66 OVERSIGHT PROJECT	Other
108186	Fredericksburg	Fredericksburg District-wide	0095	I-95 Corridor Study	Other
108573	Fredericksburg	Stafford County	0095	#HB2.FY17 COMMUTER LOT EXPANSION I-95 E OF EXIT 140	Other
109482	Richmond	Richmond District-wide	0095	Richmond Transportation Operations Center Upgrade	Other
106025	Northern Virginia	Fairfax County	0495	I-495 NORTHERN SECTION SHOULDER USE DEBT SERVICE	Other
111031	Hampton Roads	Norfolk	0564	CVIS Foundations and Site Utilities	Other
80078	District-wide	Statewide		HEARTLAND CORRIDOR PROJECT IN VA,WV & OHIO	Preliminary Engineering
106724	Hampton Roads	Hampton Roads District-wide	0064	Hampton Roads Crossing Study Supplemental EIS	Preliminary Engineering
107458	Richmond	Henrico County	0064	#HB2.FY17 RTE 64 - MAJOR WIDENING	Preliminary Engineering
107460	Richmond	New Kent County	0064	RTE 64 - INTERCHANGE MODIFICATION STUDY	Preliminary Engineering
109231	Richmond	Goochland County	0064	I-64/ASHLAND RD INTERCHANGE IMR	Preliminary Engineering
54911	Northern Virginia	Northern Virginia District-wide	0066	RTE 66 - PRELIMINARY ENGINEERING	Preliminary Engineering
88659	Staunton	Frederick County	0081	PE for I-81 Exit 307 Inter Relocation\Improvement	Preliminary Engineering
88820	Staunton	Frederick County	0081	I-81 Interchange Study for Exit 313	Preliminary Engineering
108809	Staunton	Harrisonburg	0081	#HB2.FY17 I-81 Exit 245 NB Off Ramp Realignment	Preliminary Engineering

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
86527	Northern Virginia	Fairfax County	0095	NOVA GEC Mega Project Administration	Preliminary Engineering
97175	Hampton Roads	Multi-jurisdictional: Hampton Roads MPO	0264	I-264 DOWNTOWN TUNNEL PPTA DEV. & MGNT. OVERSIGHT DT/MT/MLK	Preliminary Engineering
101852	Hampton Roads	Hampton Roads District-wide	0264	Public Contribution for DT/MT/MLK - Interstate	Preliminary Engineering
103459	Hampton Roads	Hampton Roads District-wide	0264	DT/MT/MLK Project – Rail work FED	Preliminary Engineering
102668	Northern Virginia	Alexandria	0395	OPNS IMPROVEMENTS & BRIDGE REPAIR AT I-395/SEMINARY RD	Preliminary Engineering
108313	Northern Virginia	Statewide	0395	I-395 NORTHERN EXTENSION EXPRESS LANES - STUDY	Preliminary Engineering
104010	Hampton Roads	Norfolk	0564	I-564 Intermodal Connect, EFLHD MOU Activities (PE Only)	Preliminary Engineering
111666	Northern Virginia	Loudoun County	0007	#SMART18 ROUTE 7/ROUTE 690 INTERCHANGE	Reconstruction w/ Added Capacity
104905	Hampton Roads	Hampton Roads District-wide	0064	I-64 CAPACITY IMPROVEMENTS - SEGMENT I	Reconstruction w/ Added Capacity
106248	Staunton	Alleghany County	0064	I-64 EXIT 21 ALLEGHANY CO. INTERCHANGE IMPROVEMENTS	Reconstruction w/ Added Capacity
106665	Hampton Roads	Hampton Roads District-wide	0064	I-64 CAPACITY IMPROVEMENTS - SEGMENT II	Reconstruction w/ Added Capacity
106689	Hampton Roads	Hampton Roads District-wide	0064	#HB2.FY17 I-64 CAPACITY IMPROVEMENTS - SEGMENT III	Reconstruction w/ Added Capacity
106692	Hampton Roads	Chesapeake	0064	#SMART18 - I-64 Southside Widening and High-Rise Bridge Ph 1	Reconstruction w/ Added Capacity
106700	Hampton Roads	Newport News	0064	FT EUSTIS INTERCHANGE	Reconstruction w/ Added Capacity
107459	Richmond	Henrico County	0064	#HB2.FY17 RTE 64 - EXTEND ACCELERATION/DECELERATION LANES	Reconstruction w/ Added Capacity
109790	Hampton Roads	York County	0064	#HB2.FY17 I-64 CAPACITY IMPROVEMENTS - SEGMENT III	Reconstruction w/ Added Capacity
108424	Northern Virginia	Northern Virginia District-wide	0066	I-66 INSIDE THE BELTWAY INITIATIVES	Reconstruction w/ Added Capacity
110741	Northern Virginia	Northern Virginia District-wide	0066	TRANSFORM66 OUTSIDE THE BELTWAY	Reconstruction w/ Added Capacity
103320	Bristol	Wythe County	0077	#HB2.FY17 Add merging lane on I-77N in Ft. Chiswell	Reconstruction w/ Added Capacity
53097	Salem	Botetourt County	0081	RTE 81 - WIDEN FROM 4 TO 8 LANES - PE & RW ONLY	Reconstruction w/ Added Capacity
108906	Salem	Roanoke County	0081	#HB2.FY17 I-81 Auxiliary Lanes from Exit 141 to 143	Reconstruction w/ Added Capacity

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
109419	Bristol	Multi-jurisdictional: Bristol MPO	0081	#HB2.FY17 I-81 at State Route 75 (Exit 17) Interchange Mod.	Reconstruction w/ Added Capacity
109440	Bristol	Washington County	0081	#HB2.FY17 I-81 Exit 19 Ramp Improvements	Reconstruction w/ Added Capacity
111230	Staunton	Harrisonburg	0081	#SMART18 - (St) I-81 EXIT 247 INTERCHANGE IMPROVEMENTS	Reconstruction w/ Added Capacity
111373	Salem	Roanoke County	0081	#SMART18 - I-81 SB Auxiliary Lane from Exit 143 to 141	Reconstruction w/ Added Capacity
101595	Fredericksburg	Fredericksburg	0095	#HB2.FY17 I-95 RAPPAHANNOCK RIVER CROSSING (SOUTHBOUND)	Reconstruction w/ Added Capacity
103222	Statewide	Statewide	0095	I-95 HOV/HOT Lanes Debt Service	Reconstruction w/ Added Capacity
105510	Fredericksburg	Fredericksburg	0095	I-95 Rappahannock River Crossing - Northbound	Reconstruction w/ Added Capacity
108315	Statewide	Statewide	0095	I-95 SOUTHERN EXTENSION EXPRESS LANES PROJECT	Reconstruction w/ Added Capacity
110527	Statewide	Statewide	0095	FRED EX - I95 EXPRESS LANES EXTENSION. EXIT 160 TO EXIT 133	Reconstruction w/ Added Capacity
111466	Richmond	Chesterfield County	0095	#SMART18 - I-95 Aux Lanes (nb & sb) b/w Rte. 288 & Rte. 10	Reconstruction w/ Added Capacity
17630	Hampton Roads	Virginia Beach	0264	#SMART18 - I-264/WITCHDUCK RD INTERCHANGE & RAMP EXTENSION	Reconstruction w/ Added Capacity
106693	Hampton Roads	Norfolk	0264	I-64/I-264 Interchange-Phase III	Reconstruction w/ Added Capacity
108041	Hampton Roads	Virginia Beach	0264	#SMART18 - I-264/WITCHDUCK RD INTERCHANGE & RAMP EXT-C-D RD	Reconstruction w/ Added Capacity
103316	Northern Virginia	Fairfax County	0395	I-395 CONSTRUCT 4TH SOUTHBOUND LANE (2C)	Reconstruction w/ Added Capacity
108361	Northern Virginia	Northern Virginia District-wide	0395	I-395 NORTHERN EXTENSION PROJECT OWNER COSTS (2A)	Reconstruction w/ Added Capacity
110604	Statewide	Statewide	0395	I-395 EXPRESS LANES (P3) EARLY WORKS - AR	Reconstruction w/ Added Capacity
110605	Statewide	Statewide	0395	I-395 EARLY WORKS - FEDERAL	Reconstruction w/ Added Capacity
110739	Northern Virginia	Northern Virginia District-wide	0395	I-395 EXPRESS LANES NORTHERN EXTENSION	Reconstruction w/ Added Capacity
16595	Salem	Roanoke	0581	RTE 581 - VALLEY VIEW INTERCHANGE PHASE II	Reconstruction w/ Added Capacity
111427	Hampton Roads	Chesapeake	0664	Bowers Hill Interchange	Reconstruction w/ Added Capacity
19005	Hampton Roads	Virginia Beach	0044	I-264/LYNNHAVEN INTERCHANGE IMPROVEMENTS (PHASE II)	Reconstruction w/o Added Capacity

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
107461	Richmond	Henrico County	0064	#HB2.FY17 RTE 64 EB - PAVEMENT MARKING	Reconstruction w/o Added Capacity
78827	Northern Virginia	Arlington County	0066	RTE I-66 Spot Improvement 3	Reconstruction w/o Added Capacity
110629	Northern Virginia	Northern Virginia District-wide	0066	I-66 EB INSIDE BELTWAY - TMP - WFC METRO ACCESS	Reconstruction w/o Added Capacity
97856	Bristol	Washington County	0081	INTERSTATE 81 AT EXIT 14 RAMP MODIFICATIONS	Reconstruction w/o Added Capacity
104130	Salem	Botetourt County	0081	I-81NB MM166.5 to 169.5 surface friction and roadway marking	Reconstruction w/o Added Capacity
111054	Staunton	Warren County	0081	#SMART18 - (St) I-81 EXIT 300 SOUTHBOUND ACCEL LANE EXT.	Reconstruction w/o Added Capacity
111056	Staunton	Frederick County	0081	#SMART18 - (St) I-81 EXIT 315 NORTHBOUND DECEL LANE EXT	Reconstruction w/o Added Capacity
111059	Staunton	Shenandoah County	0081	#SMART18 - (St) I-81 EXIT 296 ACCEL/DECEL LANE EXTENSIONS	Reconstruction w/o Added Capacity
111359	Salem	Botetourt County	0081	#SMART18 - I-81 SB Safety Improvements MM167.4 to MM169.5	Reconstruction w/o Added Capacity
107795	Richmond	Richmond	0095	#HB2.FY17 RTE 95 - IMPROVE RAMP AREA AT FRANKLIN ST	Reconstruction w/o Added Capacity
107796	Richmond	Richmond	0095	#HB2.FY17 RTE 95 - EXTEND NB DECEL LANE AT HERMITAGE RD	Reconstruction w/o Added Capacity
107797	Richmond	Richmond	0095	#HB2.FY17 RTE 95 - EXTEND NB ACCEL LANE AT BELVIDERE ST	Reconstruction w/o Added Capacity
108042	Hampton Roads	Norfolk	0264	#SMART18 - RTE 264 - INTERCHANGE IMPROVEMENTS-64 WB TO 264EB	Reconstruction w/o Added Capacity
75910	Salem	Botetourt County	0081	Route 11,220,220A Access Management Project at I-81 Exit 150	Relocation
13558	Fredericksburg	Stafford County	0095	I-95 – REL OF INT @ RTE 630 W SBGPL OPT BETW EXITS 143 & 140	Relocation
111379	Hampton Roads	Newport News	0064	Peninsula Interstate Resurfacing Schedule with T&S Upgrades	Restoration and Rehabilitation
104466	Richmond	Dinwiddie County	0085	I-85 RESTORE EXIST. PAVE NB/SB	Restoration and Rehabilitation
105900	Hampton Roads	Norfolk	0264	ERC Task Order Funding	Restoration and Rehabilitation
107975	Richmond	Richmond District-wide	9999	RESTORE EXISTING PAVEMENT	Restoration and Rehabilitation
107976	Richmond	Henrico County	9999	RESTORE EXIST PAVE - HENRICO	Restoration and Rehabilitation
107748	Staunton	Staunton District-wide	0081	Edinburg Res. Interstate Plant Mix(PM-8U-16)	Resurfacing
107749	Staunton	Staunton District-wide	0081	Lexington Res. Interstate Plant Mix(For 2017)	Resurfacing

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
109198	Staunton	Rockbridge County	0081	#SGR Staunton Dist. State of Good Repair Paving Project(PM-8	Resurfacing
110487	Salem	Botetourt County	0081	I-81 NB Latex Treatment MM 167.4 to 168.5	Resurfacing
110909	Richmond	Mecklenburg County	0085	#SGR PM41-18 RTE 85 ASPHALT RESURFACING, INTERSTATE SYSTEM	Resurfacing
107873	Hampton Roads	Sussex County	0095	I-95 Resurfacing Schedule with T&S Upgrades	Resurfacing
109257	Bristol	Bristol District-wide	9999	#SGR FY17/FY18 SGR Interstate	Resurfacing
110881	Bristol	Bristol District-wide	9999	#SGR FY19 SGR Interstate PM1M	Resurfacing
111372	Northern Virginia	Northern Virginia District-wide	9999	Primary Paving PM-9A-14 Fairfax	Resurfacing
110894	Salem	Roanoke County	PM2Q	#SGR FY18 I-81 SB Roanoke Co.	Resurfacing
102932	Statewide	Statewide	0000	Statewide installation of Reference Location Signs (RLS)	Safety
112474	Northern Virginia	Fairfax County	0001	INTERSECTION ILLUMINATION ON RICHMOND HWY (ROUTE 1)	Safety
105368	Hampton Roads	Multi-jurisdictional: Hampton Roads MPO	0064	I-64 CORR CONGEST IMPROV HRBT CONTROL ROOM UPGRADES	Safety
107043	Hampton Roads	Chesapeake	0064	I-64 WB Exit 296A Ramp Terminal Realignment	Safety
108423	Hampton Roads	Norfolk	0064	HRBT Over Height Detection	Safety
109261	Richmond	Henrico County	0064	I-64 EAST RICHMOND ATMS PROJECT	Safety
110829	Staunton	Warren County	0066	I-66 HIGH FRICTION SURFACE TREATMENT	Safety
105380	Bristol	Bland County	0077	CORR CONGEST IMPROV BWMT TUNNEL LANE CONTROL IMPROVEMENT	Safety
105381	Bristol	Bland County	0077	CORR CONGEST IMPROV ERMT TUNNEL LANE CONTROL MANAGEMENT	Safety
109512	Bristol	Wythe County	0077	I-77 Wythe Co. Median Barrier	Safety
79923	Staunton	Augusta County	0081	#HB2.FY17 RTE 81 - SAFETY IMPROVEMENTS, EXIT 213	Safety
90378	Staunton	Rockbridge County	0081	TMP Assets for I-81 TCL Rockbridge	Safety
99542	Salem	Roanoke County	0081	I-81 Exit 140 Park & Ride Expansion & Construct New Sidewalk	Safety

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
108946	Bristol	Wythe County	0081	Extend accel. lane (exit 72) to decel lane (exit 73)	Safety
109368	Staunton	Augusta County	0081	#HB2.FY17 I-81 Exit 222 NB Accel and SB Decel Lane Extension	Safety
109376	Staunton	Frederick County	0081	#HB2.FY17 I-81 Exit 323 SB Accel and NB Decel Lane Extension	Safety
109377	Staunton	Augusta County	0081	#HB2.FY17 I-81 Exit 220 and Exit 221 Decel/Accel Extensions	Safety
109908	Salem	Botetourt County	0081	I-81 Safety Improvement	Safety
109920	Bristol	Smyth County	0081	I-81 Shoulder Improvements - Smyth Co.	Safety
85623	Richmond	Colonial Heights	0095	I95/TEMPLE AVE - INTERCHANGE IMPR (FED ID 20145, 20146)	Safety
104956	Richmond	Petersburg	0095	I95/85 SB INTERCHANGE SAFETY IMPROVEMENTS (PE ONLY)	Safety
106938	Richmond	Henrico County	0095	RTE 95 - INSTALL ITS DEVICES	Safety
107715	Fredericksburg	Fredericksburg	0095	I-95 SAFETY IMPROVEMENTS AT ROUTE 3	Safety
107769	Richmond	Richmond District-wide	0095	RTE 95 - UPGRADE SIGNS	Safety
107771	Richmond	Richmond District-wide	0095	RTE 95 SB - RE-STRIPING	Safety
107772	Richmond	Richmond District-wide	0095	RTE 95 - INSTALL ITS DEVICES	Safety
108004	Richmond	Richmond District-wide	0095	RTE 95 - IMPROVE TRAFFIC OPERATIONS AND SOUND WALL DESIGN	Safety
108005	Richmond	Richmond District-wide	0095	RTE 95 - IMPROVE TRAFFIC OPERATIONS AND SOUND WALL DESIGN	Safety
109083	Richmond	Richmond	0095	#SMART18 - RTE 95 - ROADWAY LIGHTING	Safety
109278	Richmond	Richmond District-wide	0095	RTE 95 - Improve Traffic Operations	Safety
109319	Richmond	Richmond	0095	#HB2.FY17 RTE 95 - ITS LOW BRIDGE WARNING SYSTEM	Safety
109320	Richmond	Richmond	0095	#HB2.FY17 SB I95 Belvidere St Interchange Safety Improvement	Safety
109321	Richmond	Richmond	0095	#HB2.FY17 RTE 95 - IMPROVE INTERCHANGE AT MAURY ST	Safety
109322	Richmond	Chesterfield County	0095	#HB2.FY17 RTE 95 - IMPROVE INTERCHANGE AT RTE 10	Safety
110561	Statewide	Statewide	0095	I-95 Ramp Metering Expansion - PE Only	Safety
111465	Richmond	Richmond	0095	#SMART18 - I-95/I-64 Overlap: Emergency Pull-Offs	Safety

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
111705	Richmond	Chesterfield County	0095	I-95 AND WILLIS RD INTERCHANGE IMPROVEMENTS	Safety
112051	Richmond	Richmond	0195	I-195 - SAFETY IMPROVEMENTS	Safety
105363	Northern Virginia	Arlington County	0395	I-395 CORR CONGESTION IMPROV UPGRADE RAMP METERING	Safety
106926	Northern Virginia	Arlington County	0395	I-395 AT KING STREET - EMERG RET WALL REHAB - PERM REPAIRS	Safety
107831	Northern Virginia	Alexandria	0395	OPNS IMPROVEMENTS & BR REPAIR AT I-395/SHIRLINGTON RD	Safety
97231	Salem	Roanoke	0581	ARRA - C RTE. 581 - AT ELM AVE (DESIGN BUILD)	Safety
105388	Hampton Roads	Multi-jurisdictional: Hampton Roads MPO	0664	I-664 CORR CONGEST IMPROV COMM UPGRADES MMMBT TUNNEL	Safety
107802	Statewide	Statewide	9999	Incident Management Emergency Evacuation and Detour Plans	Safety
109556	Salem	Salem District-wide	9999	Safety Prescoping - Salem	Safety
110208	Statewide	Statewide	9999	SSP Communications Upgrade	Safety
110526	Statewide	Statewide	9999	Enhancements to the Statewide 511 System	Safety
110545	Statewide	Statewide	9999	Development of a Cloud Based Portal	Safety
110551	Statewide	Statewide	9999	Traffic Video Expansion - Statewide	Safety
111892	Statewide	Statewide	9999	ATMS - Phase 1	Safety
111943	Statewide	Statewide	9999	FY18 Network Operations Center Support 24/7	Safety
112255	Statewide	Statewide	9999	511 Travel Time Enhancement	Safety
107044	Hampton Roads	Norfolk	0064	#HB2.FY17 I64/Northampton Boulevard Interchange Modification	Traffic Management/Engineering
108635	Hampton Roads	Norfolk	0064	I-64 Hampton Rd ATM - Phase I WB	Traffic Management/Engineering
110321	Hampton Roads	Norfolk	0064	I-64 Express Lanes-Segment I	Traffic Management/Engineering
111025	Hampton Roads	Hampton Roads District-wide	0064	Interstate, High Tension Cable Guardrail, Various Locations	Traffic Management/Engineering
111732	Richmond	Henrico County	0064	I-64 AT GASKINS ROAD IMR	Traffic Management/Engineering
108587	Fredericksburg	Stafford County	0095	I-95SB Hard / Dynamic Shoulder Running Project	Traffic Management/Engineering
108658	Richmond	Richmond District-wide	0095	I-95 Richmond ATM	Traffic Management/Engineering

UPC	DIstrict	Jurisdiction	Route	Description	Scope of Work
111788	Hampton Roads	Norfolk	0264	#SMART18 - I-264 W Off-Ramp at Ballentine Boulevard	Traffic Management/Engineering
110728	Northern Virginia	Arlington County	0395	I-395 NORTHERN EXTENSION MULTI-MODAL ACCESS TO PENTAGON (2B)	Traffic Management/Engineering
108666	Hampton Roads	Multi-jurisdictional: Hampton Roads MPO	0664	MMMBT Traffic & Safety Improvements	Traffic Management/Engineering
-18082	Northern Virginia	Northern Virginia District-wide	9999	COMMUTER CONNECTIONS OPERATION CENTER - FY21 to FY23	Traffic Management/Engineering
110912	Statewide	Statewide	9999	Statewide Truck Parking Management System - Phase 1	Traffic Management/Engineering
111613	Statewide	Statewide	9999	Statewide Truck Parking Management System - Phase 2	Traffic Management/Engineering
111652	Northern Virginia	Northern Virginia District-wide	9999	COMMUTER CONNECTIONS OPERATION CENTER - FY19 to FY20	Traffic Management/Engineering
106609	Northern Virginia	Northern Virginia District-wide	DMS	NRO DMS LIFE-CYCLE REPLACEMENT - EXISTING SUPPORT POLES	Traffic Management/Engineering

Source: Virginia Department of Transportation.

11. Freight Improvement Strategies

Supporting goods movement for Virginia businesses is one of the primary motivations behind the VTrans planning process. Identifying freight needs and finding the right solutions are fundamental parts of that support. This *Freight Improvement Strategies* section of the Freight Element thinks ahead towards the policies, programs, technologies, and projects needed to find the solutions that work best for Virginia businesses and residents. Together, these recommendations create a basis for sound decision-making.

The strategies encompass actions to bolster coordination, increase funding, and focus priorities. These strategies reflect Virginia's priorities for freight through dozens of conversations with stakeholders, analysis of data, and an understanding of best practices about how to advance the freight improvement agenda.

The strategies are organized by *policies, programs, technologies, and infrastructure*. There is no hard and fast distinction between them, but they are generally defined as:

- **Policies** that address department initiatives, studies, and the regulatory environment in which freight decisions are made.
- **Programs** that address the eligibility requirements or the framework for decision-making about improvement funds.
- **Technology** that addresses programs or projects exclusively or principally related to meeting information needs for safer and more efficient freight operations.
- **Infrastructure** that addresses capital improvements to specific freight system components, often specific types of capital improvements.

Policy Strategies

Recommendation PO1.
Include freight representation and participation in the state planning process.

> **Discussion.** Virginia created a Freight Advisory Committee that last met in 2014. By re-establishing this committee and holding meetings on a regular basis, public and private sector participants can share information about industry trends, and identify initiatives and areas of mutual interest to improve the velocity of freight.
>
> **Implementation Next Step.** Draft a charter that outlines the mission and responsibilities for the Freight Advisory Committee. Issue invitations to Committee members and hold an initial meeting in the first quarter of 2018.

Recommendation PO2.
Support multi-state coordination of freight infrastructure improvements.

> **Discussion.** Virginia is a member of the Southeastern Association of State Transportation Officials (SASHTO), the I-95 Corridor Coalition, the I-81 Corridor Coalition and the Institute for Trade and Transportation Policies (ITTS). Virginia can advance freight coordination by advancing a freight agenda at regular or special purpose conferences and meetings.

Implementation Next Step. Develop and advance a freight agenda and consider organizing a freight-focused forum with the objective to advance investment opportunities to improve freight movements across member states.

Recommendation PO3.
Update freight modal systems plans on a regular basis.

Discussion. The FAST Act requires state DOTs to update freight plans on a consistent 5 year schedule. For these plans to be truly reflective of a continuing, cooperative, and comprehensive process, some advance coordination with MPOs and RPOs will be needed. VTrans has provided the framework for this coordination, and several MPOs have completed freight plans in consultation with VDOT over the past 5 years. However, a separate, independent initiative may be required for the next plan update if the planning cycles are not aligned.

Implementation Next Step. Develop a work plan for the lead up to the next 5-year freight plan update, including the coordination activities with regional planning partners.

Recommendation PO4.
Support opportunities for intermodal terminal development and multimodal diversity.

Discussion. Increasing the number and capacity of intermodal transfer points increases shipper choice and can improve speed and reliability. However, the projects must show a return on investment and/or public benefit, and be economically justified.

Implementation Next Step. Develop a statewide inventory of rail, port/waterway, and aviation intermodal transfer points and identify potential new facilities informed by economic considerations.

Recommendation PO5.
Develop first/last mile urban freight policies and recommended practices. Where there are deficiencies, improve multimodal first/last mile connections and access to major intermodal centers and manufacturing hubs.

Discussion. First/last mile connectors are widely acknowledged to be a weak link in the freight transportation system. The connectors can be enhanced through a combination of access controls, operational improvements and targeted capacity enhancements, and a careful analysis and vetting process. By providing statewide, consistent guidance about design and right of way protection for first/last mile connections, Virginia can protect and improve accessibility to freight generators.

Implementation Next Step. Develop design and right-of-way guidance and evaluation documents for improving access to and from freight generators.

Recommendation PO6.
Support the strategies and initiatives of the Virginia Economic Development Partnership and collaborate with relevant stakeholders to identify and implement transportation investments that support economic development.

Discussion. Virginia Economic Development Partnership is a state-supported public entity that recruits businesses and works with other public agencies in site selection and obtaining the proper regulatory approvals. Transportation officials and the Partnership can collaborate to identify economic development opportunities and the supporting infrastructure and policies in a strategic planning framework.

Implementation Next Step. Schedule regular (e.g., quarterly) meetings between state transportation and economic development leaders to share information on short-term initiatives. Develop a strategic plan that aligns planned infrastructure improvements with development opportunities.

Recommendation PO7.
Support industry efforts to enhance workforce recruitment and retention in the transportation and logistics industries.

Discussion. Highway safety and industry productivity are directly related to the freight industry's ability to train and retain a high-quality workforce. At the same time, drivers and other operators of freight system components operate in an increasingly complex and information-rich environment. Initiatives such as support for comprehensive training can improve outcomes for the general public and the freight industry.

Implementation Next Step. Investigate the potential for cost-sharing arrangements to improve freight driver training focused on safety and regulatory requirements.

Recommendation PO8.
Seek more opportunities to improve rail freight as a practical modal alternative to help relieve freight congestion on Virginia's highways.

Discussion. Rail freight offers cost and environmental impact advantages, but mostly for specific types of freight movements. Both current initiatives and longer time horizon plans, such as the Virginia rail plan, will help improve the rail network. However, opportunities for improvement, such as portside terminal capacity expansion, removal of rail at-grade crossings, and short line and main line improvements remain.

Implementation Next Step. Once the new Freight Advisory Committee is formed, establish a rail sub-committee to identify the most important rail improvements that can increase rail velocity and/or reduce freight/passenger rail conflicts.

Recommendation PO9.
Collect origin/destination data on a regular basis to understand truck movements from and to large intermodal facilities such as the Norfolk International Terminal and the Virginia International Gateway.

Discussion. Data vendors can track a representative sample of truck movements to construct a profile of origin-destination movements. Such data can be essential in understanding where and how to improve access conditions and to provide alternatives to highway-only transfer points. Virginia has collected some vehicle origin/destination data for planning purposes, and this initiative can be expanded to address additional freight-specific needs.

Implementation Next Step. Conduct a port origin-destination study by 2019.

Recommendation PO10.
Measure and report infrastructure condition, safety, and congestion performance for the Primary Highway Freight Network, the Multimodal Freight Network, and the Critical Urban/Rural Corridors separately from other statewide performance measures.

Discussion. Virginia's and the National Performance Management frameworks provide information about broad system-wide outcomes that can obscure an understanding of freight network performance.

Implementation Next Step. Produce condition and performance information to inform investment decisions that benefit freight by 2019, one year after the federal performance management targets and measures are due.

Recommendation PO11.
Protect high capacity freight corridors and facilities from inappropriate adjacent development.

Discussion. Land use planning and zoning authority reside with local governments, but the state has authority to address access controls on the state highway system. Controlling access can maintain the flow and efficiency of freight-intensive corridors. (See the American Planning Association's Freight Policy Guide https://www.planning.org/policy/guides/adopted/freight/).

Implementation Next Step. Complete corridor management plans for the most freight-intensive highway corridors by 2023. Accelerate planning for improvements on US-58 as a very high priority port corridor.

Recommendation PO12.
Facilitate the sharing of information, best practices, and training among public and private transportation operators, including local emergency response agencies, to improve Traffic Incident Management.

Discussion. Responsibility for responding to roadway emergencies is shared among many organizations, including fire departments, state police, traffic operations control centers, medical personnel, contractors and hazmat teams, and public-sector responders; all of which may serve different jurisdictions with different operating protocols. These teams plan for emergencies and coordinate activities, but currently there is not a performance component to response. While safety is paramount, increased priority and effort are needed to restore the movement of traffic, especially on the interstate and the Primary Highway Freight Network.

Implementation Next Step. Develop a Traffic Incident Management plan with regional response protocols and response time targets for classes of incidents involving freight. Monitor performance quarterly.

Program Strategies

Recommendation PR1.
Maintain and improve the designated Virginia Freight Network to ensure the freight system continues to move toward achieving the transportation goals identified in VTrans2040.

Discussion. Under federal legislation, the Interstate System, the pending National Multimodal Freight Network, and the Critical Urban and Rural Corridors receive special consideration under the National Highway Freight Program. Through matched funding and its own programs, Virginia directs a significant amount of funding to support these freight-intensive facilities, as well as to support the CoSS.

Implementation Next Step. Review freight system performance at the beginning of each VTrans plan update cycle and prioritize projects that address the goals, objectives, and recommendations where achievement is lagging.

Recommendation PR2.
Seek out and implement rapidly-evolving freight data tools to improve freight-related performance metrics.

Discussion. New data collection tools are rapidly being deployed that can improve the understanding of freight origin-destination movements, can help improve existing freight traffic models and can improve the display and communication of information related to freight movements.

Implementation Next Step. Consider hosting a technology conference to bring freight experts, technology exerts, traffic modelers together, to improve the use of freight data and tools.

Recommendation PR3.
Hire a freight expert to coordinate public agency freight planning.

Discussion. Public agency freight planning responsibilities are shared among state modal agencies and regional planning agencies with multiple responsibilities. Staff assigned to focus solely on freight planning and freight-related programming would be able to marshal multimodal resources to serve the state's interests in advancing a truly integrated, multimodal system.

Implementation Next Step. Hire a multi-modal (road and freight) freight expert assigned to the Office of Intermodal Planning and Investment (OIPI). Determine the resource requirements and specific responsibilities of a new multimodal freight planning and programming function with dedicated staff assigned to the OIPI.

Recommendation PR4.
Promote, advance, and implement the Atlantic Gateway as a unified, coordinated, and comprehensive program for all transportation modes.

Discussion. Hundreds of millions of dollars have been pledged to improve multimodal transportation in the I-95 corridor between Virginia and Washington, D.C., but more needs to be done. Virginia has established a planning and administrative process for analyzing priorities for the next phase of improvements to the Atlantic Gateway. Multimodal freight benefits should be a high priority when attention turns to the next phase of these improvements.

Implementation Next Step. Assign a high priority to the Atlantic Gateway project. Include this as a regular topic in future Freight Advisory Committee meetings to receive input and to monitor implementation progress.

Recommendation PR5.
Develop an Industrial Development Area (IDA) Grant Program to improve the economic potential and intermodal opportunities for freight within areas of industrial development.

Discussion: The IDA Grant Program could assist industrial development sites to realize their economic development potential by identifying and addressing infrastructure needs, barriers to development or redevelopment, obstacles to workforce development, and concerns from nearby communities. The IDA Grant Program could operate similarly to the existing Urban Development Area (UDA) Grant Program, but with differing criteria.

Implementation Next Step: OIPI should develop criteria and accept IDA applications under the UDA program.

Recommendation PR6.
Prioritize economic and transportation studies across the Commonwealth in the Urban Crescent.

- Promote, advance, and implement the recommendations outlined in the 2017 Commerce Corridor Study in the Richmond Region.
- Facilitate additional regional economic and transportation studies in the Urban Crescent similar to the Commerce Corridor Study in the Richmond Region.

Discussion. Economic and transportation studies produce comprehensive multimodal strategies that address existing and future transportation challenges within industrial corridors or regions. Through improvements to connectivity and accessibility, the economic development potential of the area and the freight-intensive transportation investments can be realized.

Implementation Next Step. Prioritize economic/transportation studies in the Urban Crescent.

Recommendation PR7.
Prioritize project selection criteria that support funding first/last mile connectors in locations with regional, statewide, and national significance. The new Office of Freight Planning should prioritize the most significant first/last mile connectors in the state as part of SMART Scale.

Discussion. The Smart Scale evaluation measures address safety, congestion mitigation, accessibility, environmental quality, economic development, and land use coordination. The most relevant congestion measure addresses "person hours of delay". Excluded are freight investment benefits that are not an explicit part of the SMART Scale process. In particular, last mile connector improvements can provide substantial benefits to freight movement as they reduce delay and improve reliability.

Implementation Next Step. Incorporate explicit consideration of freight economic factors in project evaluation and develop guidance for submitting first/last mile connectors, and for evaluating them in Smart Scale applications and scoring.

Recommendation PR8.
Leverage Public-Private-Partnerships for funding freight transportation improvements.

Discussion. In Virginia and at the national level, there is a shared need to leverage public sector financial support and innovation for private sector investments in transportation infrastructure. There is also a need for long-term maintenance of transportation assets to ensure their condition remains adequate. Virginia has the legal and administrative structure in place for P3 financing of transportation projects. There are positive examples of P3 finance fulfilling its potential in the significant projects now under construction in Virginia. With new federal support for P3 financing, more can be done.

Implementation Next Step. Identify freight-beneficial projects with sufficient potential for P3 Implementation Next Step.

Recommendation PR9.
Increase the amount of funding available to the DRPT Rail Enhancement Fund to increase rail investment.

Discussion. The Rail Enhancement Fund (REF) has supported some of the Commonwealth's most significant rail investment, including the Heartland Corridor and the Atlantic Gateway projects. Project selections are based in part on benefit-cost considerations. The program is projected to obligate $117 million in state funds between 2016 and 2021.

Implementation Next Step. Advocate to increase REF funding by 20 percent, by FY2020.

Recommendation P10.
Address safety and security issues with at-grade rail crossings through accelerated investments and increased collaboration between the public- and private-sector. Consider appropriating a separate funding source to eliminate or improve a selected number of high priority at-grade rail crossings.

Discussion. At-grade rail crossings in the Hampton Roads region and near the Front Royal inland port cause traffic delays and safety concerns. Federal and state programs are limited in their ability to address existing needs.

Implementation Next Step. Identify a lead agency to initiate cost-sharing discussions with railroad operators to identify and address issues at the worst rail at-grade crossing bottlenecks. Develop a prioritization process for identifying and justifying improvements.

Technology Strategies

Recommendation TE1.
Develop and expand partnerships with public- and private-sector stakeholders to implement proven freight-focused technology solutions and invest in emerging transportation technologies. Continue to invest in the development of sophisticated real-time information systems and increase the dissemination of dynamic travel information to improve freight movement mobility and reliability.

Discussion. Technologies to track the movement of freight, monitor congestion and infrastructure condition, and operate vehicles autonomously are a principal theme of VTrans and the VFC. A 2017 charrette hosted by OIPI highlighted state agency strategies for

incorporating connected and autonomous vehicles into Virginia's regulatory, planning, and programming environment, leading to a strategic plan for policy, research, and initiatives related to technology.

Implementation Next Step. Complete a freight technology Implementation Next Step deployment plan within the next 12 months that focuses on support for multimodal technology solutions. Adoption of technologies for automating permitting, inspection, and detection of oversize/overweight vehicles, as well as providing parking and routing information.

Recommendation TE2.
Partner with local, state, and federal agencies to expand programs that support fuel efficiency and alternative fuel options in the transportation industry.

Discussion. Improving and increasing rail intermodal connections will increase the competitiveness of fuel-efficient rail. There are a number of actions that Virginia can take to reduce truck idling, especially in the state's urbanized areas.

Implementation Next Step. Initiate a study of cost-beneficial investments to improve the environmental performance of Virginia's freight system.

Infrastructure-Related Strategies

Trucking

Recommendation INF-T1.
Increase the supply of truck parking in the Interstate system.

Discussion. Lack of adequate truck parking has consistently been cited as an issue by the trucking industry and a 2015 state parking study confirmed the need for nearly 2,000 additional parking spaces. While the current phase of the Atlantic Gateway project intends to add dozens of new parking spaces in the I-95 corridor, more needs to be done.

Implementation Next Step. Initiate discussions with land owners to increase parking supply in each of the CoSS in Virginia. Increase Interstate rest area truck parking capacity commensurate with traffic growth statewide.

Recommendation INF-T2.
Prioritize improvement or replacement of functionally obsolete and structurally deficient bridges on the Commonwealth's Strategic Freight Network. Repair deficient pavement on the most significant freight corridors to ensure safe and efficient goods movement.

Discussion. System-wide, Virginia is meeting its goals in bridge and pavement preservation, but there may be heavily traveled truck routes that operate below peak efficiency due to posted or outdated bridges or due to deficient pavement.

Implementation Next Step. As part of Virginia's performance management program, monitor and report on bridge and pavement conditions relative to targets on the Interstate system, Critical Corridors, and intermodal connectors.

Recommendation INF-T3.
Invest in addressing the highest freight value tunnel and bridge bottlenecks in the Hampton Roads region to increase capacity/velocity for freight to/from the Port.

> **Discussion.** VDOT is in the procurement phase of plans to add a third lane to the Hampton Roads Bridge Tunnel.
>
> **Implementation Next Step**. Include explicit consideration of truck freight movements in the detailed design evaluation of the tunnel expansion and include the freight community in the evaluation process.

Recommendation INF-T4.
Implement multimodal corridor improvements to improve freight movement along key freight corridors (e.g. I-81, I-95, I-64 and US-58).

> **Discussion.** The National Highway Freight Program (NHFP) provides improvement funds for the Interstate system, as well as critical corridors (which are under development) and the Virginia portions of the National Multimodal Freight Network. There is no formalized process for prioritizing needs and directing funds at this time.
>
> **Implementation Next Step.** Establish and document a process for prioritizing NHFP needs and directing funds based on benefits to freight movement in Virginia.

Recommendation INF-T5.
Consider a new Interstate route between Hampton Roads and North Carolina (I-87).

> **Discussion.** Congress has authorized the I-87 designation for a planned Interstate route between Raleigh and the port terminals in Norfolk, following a route along US 64 in North Carolina and US 17 in Virginia. The route will strengthen trade ties between the two states and regions to the south and west. North Carolina has completed design studies for US 64.
>
> **Implementation Next Step.**
> Initiate an alternatives analysis for the new I-87.

Recommendation INF-T6.
Invest in improvements to facilities at the Port of Virginia to accommodate anticipated growth.

> **Discussion.** Through long-range planning efforts and design studies, several potential improvements to terminal landside access have been identified, but funding is not available.
>
> **Implementation Next Step.** Adapt current project selection processes to prioritize needed freight improvements more explicitly.

Recommendation INF-T7.
Complete the widening of I-64 from Richmond to Hampton Roads.

> **Discussion.** Construction of a third lane of I-64, from Newport News to the west towards Williamsburg and James City County, is scheduled for completion in 2017. The section of I-64 to the west, towards Richmond, remains two lanes and can experience extreme congestion

weekdays and weekends. Designs have been completed for the remaining sections, but the project has not been funded.

Implementation Next Step. Fund the completion of the I-64 widening and include it for consideration in Smart Scale funding and other state and federal grant opportunities.

Recommendation INF-T8.
Improve I-81 along the Crescent Corridor (Primary freight network) and provide dedicated truck lanes, bypass interchanges, and truck climbing lanes along I-81.

Discussion. VDOT and the I-81 Corridor Coalition have examined design, technology-focused, financing, and rail solutions for adding capacity to I-81, which accommodates high volumes of multi-state truck traffic through hilly terrain. Several potential improvements have been identified as VTrans needs and several have been approved in SMART Scale. However, a consensus has yet to be reached on a comprehensive and definitive strategy for addressing capacity, operational, and safety needs on I-81.

Implementation Next Step. Include this as a topic for the I-81 coalition. Include as an agenda topic once the Freight Advisory Committee is formed in 2018.

Recommendation INF-T9.
Permit I-81 hard shoulder running.

Discussion. I-81 experiences significant congestion throughout the length of the corridor. Currently, motorists drive on the shoulders to circumvent accidents. Planning and design work is needed to determine whether this is a safe option for I-81 and if so, what the operating and design modifications should be.

Implementation Next Step. Complete a planning and design feasibility study to analyze I-81 hard shoulder running.

Recommendation INF-T10.
Improve the section of I-81/I-77 overlap.

Discussion. Near Wytheville, in Southwest Virginia, I-81 and I-77 merge. This convergence of the two interstates is a source of a significant and persistent bottlenecks. In 2012, the Commonwealth Transportation Board approved a redesign that adds one travel lane in each direction of the overlap, but funds have not been allocated for the project. The VMTP 2025 Recommendations identify four projects as needs on the overlap:

- Creation of an incident quick-clearance program
- Addition of an auxiliary lane between Exit 80 and Exit 81
- Relocation of frontage roads at Exit 77 and Exit 80
- Improvements to ramps at Exit 80

Implementation Next Step. Reconsider a full lane addition of the overlap as a VTrans need.

Recommendation INF-T11.
Complete the I-95 Express Toll Lanes.

Discussion. The Atlantic Gateway project will address the completion of the I-95 toll lanes to Fredericksburg, completing the longest continuous express lane facility in the U.S.

Implementation Next Step. Monitor the schedule for contract letting and construction.

Recommendation INF-T12.
Add an extra lane in each direction to SR-164 between VIG and I-664.

Discussion. The Virginia International Gateway will double in size by CY2020. The recently expanded Midtown Tunnel and MLK Freeway expansion have increased automobile traffic on State Route 164. State Route 164 (Western Freeway) connects the northern parts of Suffolk and Portsmouth with I-664. This, combined with the future Craney island Marine Terminal that will connect SR-164 via a new access road, justify the need for expansion now.

Implementation Next Step. VDOT should partner with the HRTPO to help document the needed expansion, through the use of cutting edge modeling and data tools such as Streetlight.

Recommendation INF-T13.
Improve US 58 in Hampton Roads. Upgrade US 58 to "limited access" and evaluate a potential bypass on abandoned rail ROW. Prioritize through-movements on US 58, from HR region to I-95. Double-track railway through Suffolk to eliminate bottlenecks.

Discussion. US 58 connects I-664 in the Hampton Roads region with areas to the west and is designated as a high profile corridor by the Hampton Roads Transportation Planning Organization (HRTPO). It is a major truck access route to the region and, after I-64, carries the highest volumes of freight in the region. Due in part to the anticipated growth in containerized freight at Hampton Roads port terminals, highway demand forecasts indicate that portions of the road will experience the highest levels of truck delay in the region. A US 58 corridor feasibility study has been completed and a corridor management study is underway.

Implementation Next Step. Make US-58 a statewide focused project due to its importance to the success of the Port and statewide economic impact and to assist with knowledge transfer from VDOT central to the Hampton Roads district and the TPO due to its statewide significance.

Air Cargo

Recommendation INF-A1.
Invest in local and regional access improvements to support growth of air cargo at the Washington Dulles International Airport.

Discussion. Business leaders and the Metropolitan Washington Airports Authority agree that the potential for Washington Dulles International Airport to be a significant freight generator is constrained by lack of roadway access, particularly from west of the airport. However, there is no political consensus on the most appropriate solution over concerns about significant additions to traffic capacity, urbanization, and its impacts.

Implementation Next Step. Initiate a design study focused on operational improvements to existing facilities to improve freight access to Washington Dulles International Airport.

Freight Rail

Recommendation INF-R1.
Increase investment in railroad system modernization to preserve rail network quality and access to shippers.

> **Discussion**. Virginia has invested heavily in the state freight rail system to improve the speed, capacity, and efficiency of freight movements to the Midwest and the Atlantic seaboard. To remain economically competitive, Virginia will need to partner with the private sector on investments that provide a direct and substantial public benefit.
>
> **Implementation Next Step.** Form a rail subcommittee of the Freight Advisory Committee; review the state rail plan and Port Rail Master Plan, and seek input from the Class I railroads and short haul rail providers to develop an investment plan for the top economic generators with the potential for increased rail movements.

Recommendation INF-R2.
As part of the Long Bridge project within the Atlantic Gateway, complete construction of the fourth main-line track from the south bank of the Potomac River to Alexandria. Work with the District of Columbia on the Long Bridge for CSX.

> **Discussion.** The Phase 1 improvements to the Long Bridge over the Potomac River include the construction of the fourth main-line track.
>
> **Implementation Next Step.** Monitor schedule and progress to complete project by contracted completion date.

Port

Recommendation INF-P1.
Improve landside access by truck and rail to the Port of Virginia to accommodate anticipated growth.

> **Discussion.** The *2065 Port of Virginia Master Plan* identifies the Virginia International Gateway, Norfolk International Terminals, Portsmouth Marine Terminal, Virginia Inland Port, and the Richmond Marine Terminal as likely to see increases in traffic volumes as demand increases.
>
> **Implementation Next Step.** Prioritize landside (port and rail) improvements and Incentivize new intermodal cargo between the Port of Virginia and 50-200 miles inland to shift truck freight to inland rail corridors.

Relationship of Strategies to National Freight Goals

The FAST Act establishes a comprehensive set of national freight policies and related national goals to guide national, state and regional decision-making. The FAST Act refers to two sets of national goals for freight that are very similar in the issues and broad objectives they address, but have different modal emphases.

The National Freight Goals as described below refer principally to highway freight:

National Freight Goals

- (1) to invest in infrastructure improvements and to implement operational improvements on the highways of the United States that:
  - (A) strengthen the contribution of the National Highway Freight Network to the economic competitiveness of the United States;
  - (B) reduce congestion and bottlenecks on the National Highway Freight Network;
  - (C) reduce the cost of freight transportation;
  - (D) improve the year-round reliability of freight transportation; and
  - (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 National Highway Freight Network;
- (4) to use innovation and advanced technology to improve the safety, efficiency, and reliability of the National Highway Freight Network;
- (5) to improve the efficiency and productivity of the National Highway Freight Network;
- (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; and
- (7) to reduce the environmental impacts of freight movement on the National Highway Freight Network.

The National Multimodal Freight Network Goals are intended to support multimodal freight transportation:

National Multimodal Freight Network Goals:

- (1) to identify infrastructure improvements, policies, and operational innovations that—
  - strengthen the contribution of the National Multimodal Freight Network to the economic competitiveness of the United States;
  - (B) reduce congestion and eliminate bottlenecks on the National Multimodal Freight Network; and
  - (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 National Multimodal Freight Network;
- (4) to use innovation and advanced technology to improve the safety, efficiency, and reliability of the National Multimodal Freight Network;
- (5) to improve the economic efficiency and productivity of the National Multimodal Freight Network;
- (6) to improve the reliability of freight transportation;
- (7) to improve the short- and long-distance movement of goods that—
  - (A) travel across rural areas between population centers;

  - (B) travel between rural areas and population centers; and
  - (C) travel from the Nation's ports, airports, and gateways to the National Multimodal Freight Network;
- (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 National Multimodal Freight Network; and
- (10) to pursue the goals described in this subsection in a manner that is not burdensome to State and local governments.

The Virginia Freight Element supports Virginia's goals for freight transportation, and as **Table 11-1** demonstrates, it supports national freight goals as well. **Table 11-1** restates the two sets of national freight goals in to a manageable set of goal areas (or issues addressed), and shows goal areas addressed by each freight element.

Table 11-1: Relationship of Virginia Freight Improvement Strategies to National Freight Goals

National Goal Area	Reliability Congestion, Cost	Safety, Security, Resiliency	State of Good Repair	Advanced Technology	Efficiency	Multi-state Corridor Planning	Environmental Impacts
Policy Strategies							
PO1. Ensure freight representation and private sector participation in the state and MPO planning process.	✓				✓	✓	
PO2. Support multi-state coordination of freight infrastructure improvements.	✓	✓	✓	✓	✓	✓	
PO3. Update freight modal systems plans on a regular basis.	✓	✓		✓	✓	✓	✓
PO4. Support opportunities for intermodal terminal development and multimodal diversity.	✓	✓	✓	✓	✓		✓
PO5. Develop last-mile urban freight policies and recommended practices. Where there are deficiencies, improve multimodal first/last mile connections and access to major intermodal centers and manufacturing hubs.	✓	✓			✓		✓
PO6. Support the strategies and initiatives of the Virginia Economic Development Partnership and collaborate with relevant stakeholders to identify and implement transportation investments that support economic development.	✓				✓	✓	

National Goal Area	Reliability Congestion, Cost	Safety, Security, Resiliency	State of Good Repair	Advanced Technology	Efficiency	Multi-state Corridor Planning	Environmental Impacts
PO7. Support industry efforts to enhance workforce recruitment and retention in the transportation and logistics industries.	✓	✓				✓	
PO8. Seek more opportunities to improve rail freight as a practical modal alternative to help relieve freight congestion on Virginia's highways		✓			✓	✓	✓
PO9. Collect origin/destination data on a regular basis to understand truck movements from and to large intermodal facilities such as the Norfolk International Terminal.	✓		✓		✓	✓	
PO10. Measure and report infrastructure condition, safety, and congestion performance for the Primary Highway Freight Network, the Multimodal Freight Network, and the Critical Urban/Rural Corridors separately from other statewide performance measures.	✓		✓		✓		
PO11. Protect high capacity freight corridors and facilities from inappropriate adjacent development.	✓	✓				✓	
PO12. Facilitate the sharing of information, best practices, and training among public and private transportation operators, including local emergency response agencies, to improve Traffic Incident Management.	✓	✓		✓		✓	
Program Strategies							
PR1. Maintain and improve the designated Virginia Freight Network to ensure the freight system continues to move toward achieving the transportation goals identified in VTrans2040.	✓		✓	✓	✓		
PR2. Evaluate and refine freight-related performance measures as sustainable data streams become available.	✓		✓		✓		
PR3. Establish an Office of Freight Planning to coordinate public agency freight planning	✓	✓	✓	✓	✓	✓	✓
PR4. Promote, advance, and implement the Atlantic Gateway as a unified, coordinated, and comprehensive program for all transportation modes.	✓	✓		✓	✓	✓	

National Goal Area	Reliability Congestion, Cost	Safety, Security, Resiliency	State of Good Repair	Advanced Technology	Efficiency	Multi-state Corridor Planning	Environmental Impacts
PR5. Develop an Industrial Development Area (IDA) Grant Program to improve the economic potential and intermodal opportunities for freight within areas of industrial development.	✓				✓		✓
PR6. Facilitate economic and transportation studies across the Commonwealth.	✓				✓	✓	
PR7. Emphasize project selection criteria in planning process that support funding of first/last mile connectors in locations with regional, statewide, and national significance, including both critical urban and rural connectors. Designate a lead to develop a prioritization process for improving first/last mile connectors as part of the SMART Scale process or as part of a separate program.	✓				✓	✓	
PR8. Leverage Public-Private-Partnerships for funding freight transportation improvements.		✓	✓	✓		✓	
PR9. Increase the amount of funding available to the DRPT Rail Enhancement Fund to increase rail investment.	✓	✓	✓		✓	✓	✓
P10. Address safety and security issues with at-grade rail crossings through accelerated investments and increased collaboration between the public- and private-sector. Consider appropriating a separate funding source to eliminate or improve a selected number of high priority at-grade rail crossings.	✓	✓	✓			✓	
Technology Strategies							
TE1. Develop and expand partnerships with public- and private-sector stakeholders to implement proven freight-focused technology solutions and invest in emerging transportation technologies. Continue to invest in the development of sophisticated real-time information systems and increase the dissemination of dynamic travel information to improve freight movement mobility and reliability.	✓	✓		✓	✓	✓	✓

National Goal Area	Reliability Congestion, Cost	Safety, Security, Resiliency	State of Good Repair	Advanced Technology	Efficiency	Multi-state Corridor Planning	Environmental Impacts
TE2. Partner with local, state, and federal agencies to expand programs that support fuel efficiency and alternative fuel options in the transportation industry.						✓	✓
Infrastructure-Related Strategies							
INF-T1. Increase the supply of truck parking in the Interstate system. Increase Interstate rest areas commensurate with traffic growth statewide	✓	✓		✓		✓	
INF-T2. Prioritize improvement or replacement of functionally obsolete and structurally deficient bridges on the Commonwealth's Strategic Freight Network. Repair deficient pavement on the most significant freight corridors to ensure safe and efficient goods movement.	✓	✓	✓		✓		
INF-T3. Invest in addressing the highest freight value tunnel and bridge bottlenecks in the Hampton Roads region to increase capacity/velocity for freight to/from the Port.	✓				✓	✓	✓
INF-T4. Implement multimodal corridor improvements to improve freight movement along key freight corridors (e.g. I-81, I-95).	✓			✓	✓	✓	
INF-T5. Consider a new Interstate route between Hampton Roads and North Carolina (I-87).	✓	✓				✓	
INF-T6. Invest in improvements to facilities at the Port of Virginia to accommodate anticipated growth.	✓					✓	
INF-T7. Complete the widening of I-64 from Richmond to Hampton Roads.	✓	✓			✓		✓
INF-T8. Improve I-81 along the Crescent Corridor (Primary freight network) and provide dedicated truck lanes, bypass interchanges, and truck climbing lanes along I-81.	✓	✓			✓	✓	
INF-T9. Permit I-81 hard shoulder running.	✓	✓			✓	✓	
INF-T10. Improve the section of I-81/I-77 overlap.	✓	✓				✓	
INF-T11. Complete the I-95 Express Toll Lanes.	✓			✓	✓	✓	
INF-T12. Add extra lanes to Route 164.	✓				✓		

National Goal Area	Reliability Congestion, Cost	Safety, Security, Resiliency	State of Good Repair	Advanced Technology	Efficiency	Multi-state Corridor Planning	Environmental Impacts
INF-T13. Improve US 58 in Hampton Roads. Upgrade US 58 to "limited access" and evaluate a potential bypass on abandoned rail ROW. Prioritize through-movements on US 58, from HR region to I-95. Double-track railway through Suffolk to eliminate bottlenecks.	✓					✓	
INF-A1. Invest in local and regional access improvements to support growth of air cargo at the Washington Dulles International Airport.	✓				✓	✓	
INF-R1. Increase investment in railroad system modernization to preserve rail network quality and access to shippers.	✓	✓	✓	✓		✓	✓
INF-R2. As part of the Long Bridge project within the Atlantic Gateway, complete construction of the fourth main-line track from the south bank of the Potomac River to Alexandria. Work with the District of Columbia on the Long Bridge for CSX.	✓					✓	✓
INF-P1. Improve landside access by truck and rail to the Port of Virginia to accommodate anticipated growth.	✓				✓		

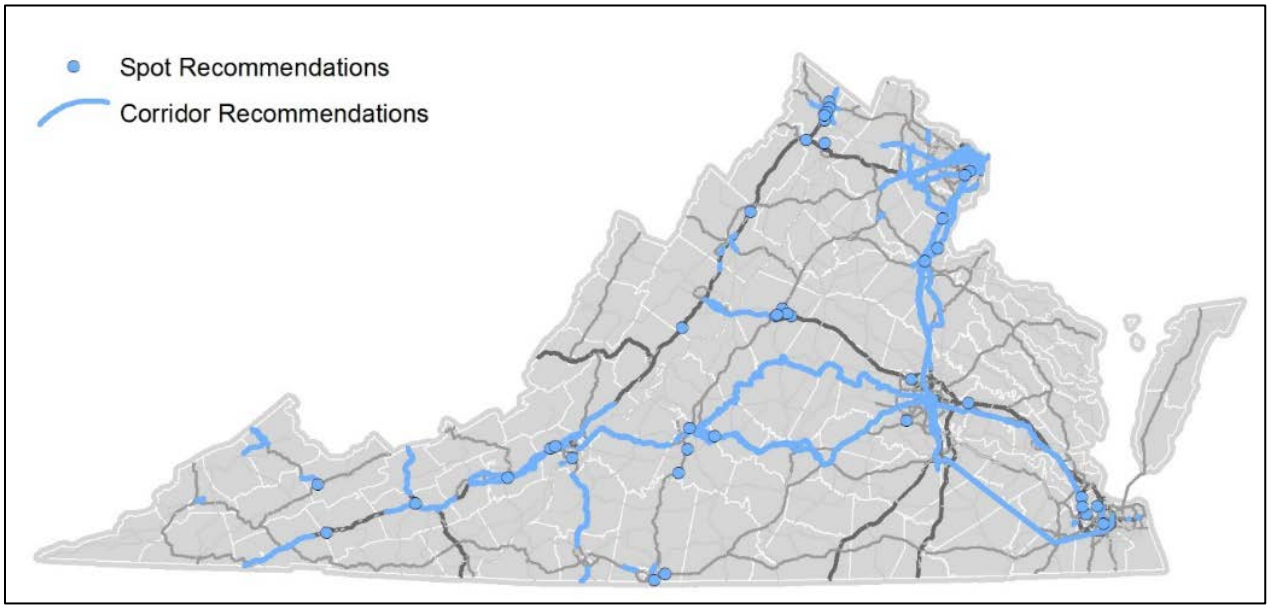
Freight-Serving VTrans Project Recommendations

The 2025 VTrans Multimodal Transportation Plan (VMTP), along with the VTrans Vision Plan, make up the overall statewide Transportation Plan, VTrans2040. One component of the VMTP is a Statewide Transportation Needs Assessment, the key purpose of which is to serve as a screen for projects applying for consideration under the SMART Scale prioritization process. The VMTP Needs Assessment analyzed Virginia's multimodal transportation capacity and operations needs at three travel market scales and included a statewide assessment of safety needs.

The over 800 statewide needs from the Needs Assessment were consolidated across travel markets, resulting in 170 total consolidated needs statewide. The next step combined a data-driven "criticality assessment" of the consolidated Needs with an outreach process to regional and local stakeholders and the public on the correlation of each Need with VTrans goals and the importance and urgency of each Need to individual regions. The result of this process was to classify the Consolidated Needs into three tiers. The tiering of Needs was reviewed by VDOT and DRPT and confirmed with Commonwealth Transportation Board members in each region. From these tiered needs, Recommendations were developed that were summarized by VDOT Districts.

Figure 11-1 identifies the location of 139 VMTP Tier 1 Recommendations that provide a benefit to freight movement in the Commonwealth. The recommendations include spot improvements, which include improvements to bridges, intersections and interchanges, and corridor improvements. Corridor improvements may provide a safety or capacity improvements to highways or rail lines. Examples of corridor recommendations include lane widenings, truck climbing lanes, additional rail line capacity, and access management or technological improvements, including Intelligent Transportation Systems and Active Traffic Management Systems. A full list of the 2025 VMTP Tier 1 Freight Recommendations can be found in **Appendix B**.

Figure 11-1: 2025 VMTP Tier 1 Freight-serving Project Recommendations



Source: 2025 VTrans Multimodal Transportation Plan.

Appendices

Appendix A – Critical Rural and Urban Freight Corridors

Appendix B – 2025 VMTP Tier 1 Freight Recommendations

Appendix C – Economic Context of Virginia and Economic Corridors Analysis

Appendix D – VDOT Freight Investment Plan Project Sheets