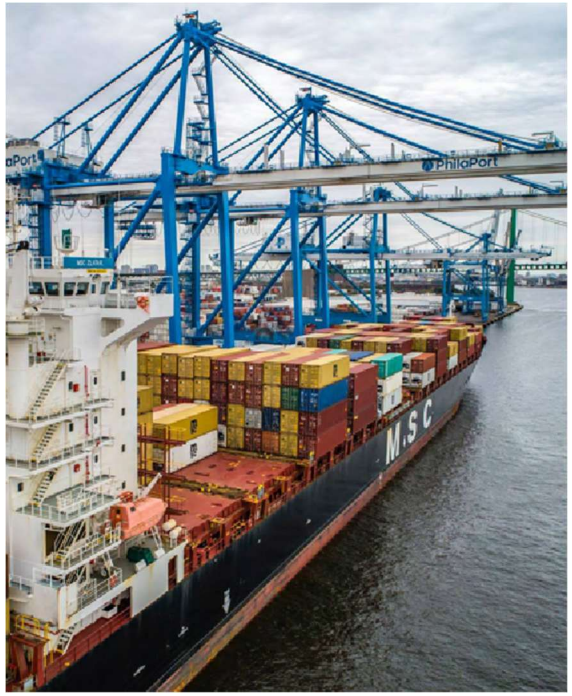


















PENNSYLVANIA

2050 Freight Movement Plan

pennsylvania
DEPARTMENT OF TRANSPORTATION
www.penndot.pa.gov

PUB 791 (XX-XX)

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MESSAGE FROM THE SECRETARY

More than 13 million Pennsylvanians depend – directly or indirectly – on an effective and efficient transportation system to move goods, raw materials, and finished products throughout the Commonwealth and beyond. Because freight mobility and access are essential to our economy and quality of life, the 2050 Freight Movement Plan (FMP) belongs to all Pennsylvanians.

The 2050 FMP is a joint pursuit among public agencies, private sector partners, local communities, and industry stakeholders. Together, we can achieve the plan's goals and objectives to make Pennsylvania's freight network safe, efficient, and competitive for years to come.

Pennsylvania's freight plan embraces a multimodal approach, recognizing that efficient movement depends on seamless integration of transportation networks across jurisdictions and modes. We must strive to leverage the best use of each transportation mode in combination and on their own distinct advantages.

The 2050 FMP addresses the following broad challenges:

1. **Linking Transportation and Future Land Development** – Coordinated transportation and land use is not a new topic. What is new, however, is an emerging trend in which coordinated freight planning with local and regional land use is gaining traction. York County, for example, has developed a Core Freight Network that brings land use and transportation planning together such that freight movement and local land use can be as compatible and complementary as possible.
2. **Integrate Freight into Planning, Programming, and Project Delivery** – Pennsylvania is uniquely positioned to fully integrate freight transportation consideration into the policies, plans, programs, and projects developed by PennDOT, its planning partners, and freight stakeholders. Freight planning got its initial policy vision through 1993 federal legislation. Over three decades later we have the opportunity to integrate freight into all the good work we do to plan, design, construct and maintain/operate our transportation system.
3. **From Planning to Action** – This plan advances a results-driven approach to improving freight system performance, with measurable progress tracked through initiatives such as Pennsylvania's biennial performance report.

Thank you to everyone who contributed to the development of this plan. Its success now depends on our shared commitment to implementation, accountability, and continuous progress toward a more efficient and resilient freight network.

Michael Carroll

Secretary of Transportation

INTRODUCTION

Pennsylvania's 2050 Freight Movement Plan (FMP) was developed to build on the findings, strategic directions, goals and objectives of the 2045 Freight Movement Plan, which was accepted by the U.S. Department of Transportation in December 2022 and formally published by PennDOT in May 2023.

Pennsylvania is home to many companies that engage in the production and transportation of freight. Freight-intensive industries critical to the state's economy include manufacturing, wholesale trade, transportation & warehousing, agriculture & forestry, and mining & extraction. Data from the Pennsylvania Center for Workforce Information & Analysis indicates that these industry groups collectively employed nearly 1.2 million people and paid more than $90 billion in wages in the Commonwealth in 2024. The manufacturing sector alone employed approximately 564,000 workers with an average annual compensation of more than $77,000.

Emerging trends since the development and publication of the 2045 FMP include the following:

- Freight networks are adapting to **supply chain disruptions**, and rapidly changing influences of tariffs and global geopolitical instability through a growing emphasis on system resiliency. These influences, combined with general population growth and demand for goods and services, put increasing pressure on transportation system resiliency, freight corridors, intermodal connections, and local transportation networks.
- **Aging infrastructure** across highways, rail networks, ports, and intermodal facilities continues to constrain freight efficiency and reliability. Bottlenecks at bridges, interchanges, grade crossings, and terminals can have systemwide impacts. Maintaining a state of good repair and strategically addressing multimodal bottlenecks remains a foundational consideration for freight mobility.
- Rapid advances in **freight transportation technologies** – including automation, artificial intelligence, connected vehicle systems, and data analytics – are changing the way freight is moved and managed. Public agencies must anticipate infrastructure readiness, policy implications, and data integration needs for these rapid changes driven by private sector industries in the fields of technology development and vehicle manufacturing.
- **Truck parking and safety considerations** remain a persistent operational and safety challenge across the nation. Pennsylvania is at the forefront of efforts to implement new parking capacity while collaborating with public and private industry representatives to address this cross-cutting issue that involves trucking industry operations, safety and driver fatigue, land use, and hours-of-service regulations in the trucking industry.
- **Freight planning** is becoming increasingly **data-driven**, with greater reliance on national and state freight datasets, performance measures, and visualization tools. The use of USDOT/BTS Freight Analysis Framework (FAF) data and other emerging datasets supports improved understanding of freight flows, trends, and future conditions. This trend highlights the need for ongoing data collection, analysis, and monitoring rather than one-time plan updates.

The FMP is structured to ensure its efficient and results-oriented implementation. The plan's goals and objectives set a clear direction, and PennDOT will carry out actions and initiatives in coordination with freight stakeholders to make systematic progress. The FMP includes a list of projects aimed at improving goods movement by and between transport modes. PennDOT will regularly track implementation progress and expand freight-related performance measures in Pennsylvania's biennial Transportation Performance Report (TPR).

Implementation also entails continued work with regional metropolitan planning organizations and rural planning organizations as well as freight stakeholders to develop capital programs and transportation investments with a focus on freight.

PennDOT thanks the individuals and organizations that provided input to the development of the plan and welcome their continued participation and feedback to promote the achievement of the goals and objectives that will strengthen our transportation system, programs, and services long into the future.

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Freight Movement Plan Strategic Directions Summary

The plan's six goals and objectives are listed below. They are discussed in more detail beginning on Page 55.

LAND USE & ECONOMIC DEVELOPMENT	Align freight mobility initiatives, programs and projects with economic development and land use.	• Manage and refine a core Pennsylvania highway freight network and improve mapping of the network. • Develop industrial land use and transportation planning guidance for MPOs/RPOs and municipalities. • Collaborate with other organizations to assemble recommended industrial site development standards and ordinances.
FREIGHT MOBILITY	Advance project investments that enhance freight mobility.	• Continue to identify, measure, and improve truck bottlenecks. • Preserve and enhance major freight transportation assets, including waterways, railroads, major truck corridors, intermodal terminals, and air cargo facilities. • Pursue opportunities to expand truck parking capacity and safety infrastructure.
ANALYTICAL TOOLS & PROCESSES	Provide planning, data, and analytical tools for improved decision-making and collaboration with freight stakeholders. Reaffirm State Freight Data Repository components and solicitation efforts.	• Develop and expand analytical tools, data, and forecasting techniques to measure costs and benefits of freight-related transportation initiatives, programs, and projects. • Identify data resources for air cargo volumes and industrial development at airports across Pennsylvania. • Examine key topic areas related to oversized/overweight truck operations. • Develop expanded freight performance measures for Pennsylvania's future biennial Transportation Performance Report (TPR) publications. • Refine existing PennDOT freight bottleneck and corridor analyses to improve granularity and measure freight mobility constraints on secondary roads for local planning needs.
OPERATIONS and SAFETY	Improve and enhance multimodal freight transportation operations and safety.	• Continue working to measure and reduce truck-related crashes, injuries, and fatalities statewide. • Continue to document reportable incidents, injuries, and fatalities statewide from Federal Railroad Administration (FRA) resources, with the aim of reducing the frequency and severity of these incidents. • Measure and reduce non-recurring delays on Pennsylvania's highway system. • Enhance interoperability of the transportation network with neighboring states.
ENVIRONMENTAL STEWARDSHIP and SYSTEM RESILIENCY	Mitigate adverse environmental impacts of freight transportation and enhance resiliency of the freight system.	• Adapt to advances in truck electrification, alternative fuels, and other technologies. • Mitigate the severity of impacts of extreme weather and natural disasters on freight mobility. • Reduce freight movement-related emissions and its impact on local air quality. • Reduce the impact of freight movement on flooding and stormwater runoff. • Reduce impacts on loss of wildlife and habitat related to freight transportation. • Promote growth in non-truck mode share for ground-based freight transportation.
INSTITUTIONAL & ORGANIZATIONAL CAPACITY	Enhance PennDOT's professional capabilities and stakeholder collaboration in freight transportation.	• Identify new initiatives for PennDOT's Freight Work Group (FWG). • Conduct regular engagement with MPO and RPO representatives to provide updates on FMP implementation progress. • Expand and enhance training and education of PennDOT staff on freight issues.

Context:

What, Why, How, and Who

SECTION CONTENTS

FMP Essentials

Public and Stakeholder Involvement



Freight Movement Plan Essentials

This statewide Freight Movement Plan (FMP) is designed to assist policymakers and planners in identifying Pennsylvania's multimodal freight transportation needs and prioritizing investments in freight infrastructure to support the Commonwealth's consumers and businesses. The plan's goals and objectives provide a balanced direction for addressing various freight challenges and opportunities appropriate for public-sector support.

The 2050 FMP complies with the federal requirements originally established in the Fixing America's Surface Transportation (FAST) Act of 2015 and expanded in the 2021 Infrastructure Investment and Jobs Act (IIJA). The FAST Act and IIJA included important provisions related to establishing a national freight transportation policy and achieving goals related to the nation's freight transportation system. The national freight goals, which are documented in **Appendix 1: National Multimodal Freight Policy**, are aimed at identifying infrastructure improvements, policies, and innovations to strengthen the U.S. economy; improving industrial productivity; reducing congestion on U.S. freight infrastructure; and improving infrastructure safety, security, efficiency, and resiliency. The IIJA largely carried over the provisions of the FAST Act, with new formula and discretionary funding programs, and more opportunities for local governments and other non-traditional entities to access new funding. Current annual allocations to Pennsylvania under the National Highway Freight Program exceed $60 million.

The FAST Act requirements for state freight plans were established under 49 U.S.C. § 70202 and supplemented with provisions of the 2021 Infrastructure Investment and Jobs Act (Public Law 117-58). A compliant FMP must include the following:

- An identification of significant freight system trends, needs, and issues with respect to the state;
- A description of the freight policies, strategies, and performance measures that will guide the freight-related transportation investment decisions of the state;
- A listing of critical urban and rural freight facilities and corridors in the state;
- A description of how the plan will improve the ability of the state to meet the national multimodal freight policy goals;
- A description of innovative technologies and operational strategies, including freight intelligent transportation systems, that improve the safety and efficiency of freight movement, under consideration for the state;
- A description of improvements that may be required to reduce or impede the deterioration of roadways subject to excessive deterioration due to oversized/overweight vehicles;
- An inventory of facilities with freight mobility issues, such as bottlenecks, and a description of the strategies the state is employing to address the freight mobility issues;
- Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion or delay;
- A freight investment plan that includes a list of priority projects and describes how funds would be invested and matched;
- Consultation with the state freight advisory committee, if applicable;
- The most recent commercial motor vehicle parking facilities assessment conducted by the state;
- A description of supply chain cargo flows in the state;
- An inventory of commercial ports in the state;
- Consideration of findings or recommendations made by multi-state freight compacts;
- Considerations of military freight;
- Impacts of e-commerce on freight infrastructure; and
- Goals and strategies to address impacts of freight movement on the environment.

PennDOT includes the FMP in its statewide planning and programming process. The FMP establishes direction for Pennsylvania's freight transportation system over a 20-year planning horizon. That direction recognizes that most of the investment in the freight system is made by the private-sector freight industry. There is, however, the need for public-sector infrastructure and programs to be as supportive of freight mobility as feasible.

PennDOT has incorporated freight elements in its long-range plans since the mid-1990s and established its first freight plan under the federal requirements of MAP-21 in 2016 with the publication of PA On Track: PA's Long-Range Transportation (LRTP) & Comprehensive Freight Movement Plan (CFMP).

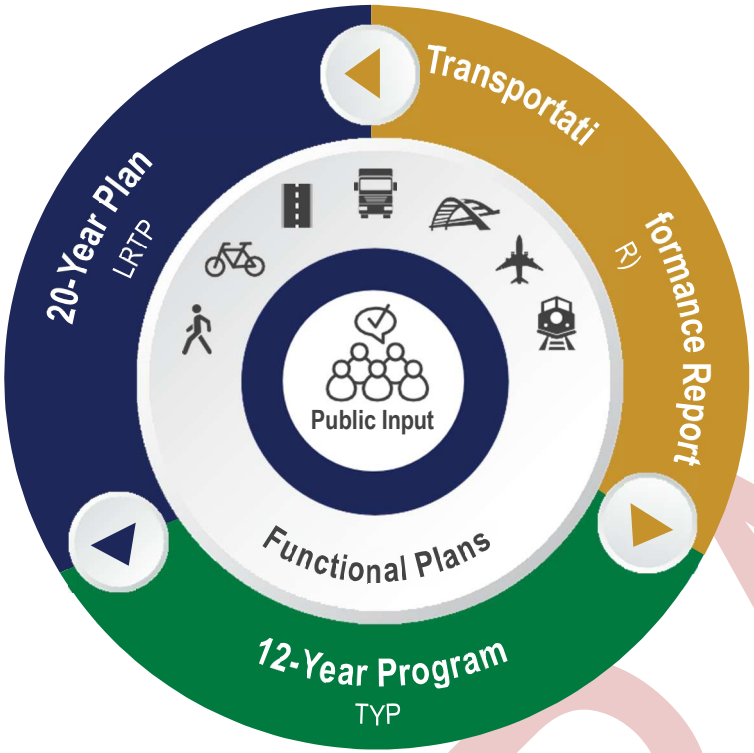
The FMP helps prioritize projects listed on the state's 12-Year Program (TYP), which is updated biennially. The Pennsylvania Transportation Performance Report, produced in odd-numbered years, serves as a report card on progress, by documenting how Pennsylvania's transportation system is performing across a variety of measures.

The FMP is also informed by and helps shape other "functional" plans that PennDOT develops. Examples include the State Rail Plan, Aviation System Plan, and Strategic Highway Safety Plan (SHSP).

Long-range planning functions are also carried out by regional metropolitan and rural planning organizations (MPOs and RPOs). Each of the state's MPOs and RPOs administers its own transportation plans, and planning programs at the regional level, which are guided by the statewide LRTP and FMP. Select elements from the FMP were included in Pennsylvania's most recent (2045) LRTP.

Over the past decade, Pennsylvania's freight planning process has given greater attention and emphasis to asset management, performance measurement, and economic development. Industrial land use and links to the local planning and land development approval process have become increasingly important in developing and maintaining freight transportation infrastructure. These issues and more are addressed as part of this 2050 FMP.

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Transportation Planning Process

The FMP process is conducted under federal requirements in parallel with Pennsylvania's planning processes. The FMP is currently updated at four-year intervals and provides direction on freight-related infrastructure elements in conjunction with the long-range planning process, and the other phases of transportation improvement. Plans guide development of improvement programs established at the regional level. These lists of projects are rolled up into the statewide TYP, which is updated every two years.

PennDOT along with the State Transportation Commission (STC) and Transportation Advisory Committee (TAC) creates a Transportation Performance Report (TPR), every two years in conjunction with the TYP. The TPR serves as a report card on the transportation system, and helps direct future programming to achieve plan goals. Freight transportation is included in the TPR, and this FMP establishes expanded freight transportation performance measures for consideration in future reporting.

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PLANNING

Sets Direction

Long-Range Transportation Plan (LRTP)
20-Year Plan
(Updated every 6-10 years)

Where do we want to go?
Goals ▪ Objectives ▪ Measures

How are we going to get there?
Implementation Strategies
Policies
Priorities
Functional Plans
MPO/RPO LRTPs

PROGRAMMING

Prioritizes Projects

12-Year Program (TYP)

How can we best use available funding?

Lists funded projects for a 12-year period

First four-year period is the Statewide Transportation Improvement Program (STIP)

STIP compiles MPO/RPO Transportation Improvement Programs (TIP)

PERFORMANCE MEASUREMENT

Measures Progress

Transportation Performance Report (TPR)
(Updated in odd-numbered years)

How did we do?
Monitor ▪ Report ▪ Evaluate

Where do measures come from?
State and Federal Requirements

What do we measure?
Safety
Mobility
Preservation
Accountability
Funding

Public and Stakeholder Involvement

Freight Stakeholder Focus Groups

The highly successful and informative focus group process employed for the 2045 FMP was replicated in the Spring of 2026 for the 2050 Freight Movement Plan. This involved a series of **facilitated focus group meetings** oriented around key freight modes, topic areas, and implementation approach. The five main focus group meetings were oriented around the mode and topic areas shown below, with the associated key themes that were discussed in these sessions summarized below. A sixth group meeting was held with MPO/RPO representatives across the Commonwealth, to elicit input from these planning partners on their regional needs and their roles in the FMP implementation process.

Trucking	Freight Railroad	Maritime/Waterborne	Air Cargo	Land Use & Economic Development
• Congestion is a long-standing concern for the trucking industry • Construction-related congestion has become a growing concern over time • Truck parking is a safety, regulatory, and quality-of-life issue for the industry • Bridge strikes and advance signing for low clearances must be addressed • Truck operations on narrow roads and streets in rural areas are a challenge • New warehouse development in areas not suitable for trucks is a growing issue • Connections between central PA and the Philadelphia region are not efficient	• PA's topography limits opportunities for rail-suitable industrial sites • Most greenfield development sites are not served by existing legacy rail network • Growing need for 286,000-lb capacity for freight rail lines • Streams and channels across rail rights-of-way are getting more difficult to deal with as flood plain definitions change; failures of old culverts • More grade crossing surfaces need to be addressed; accelerated wear and tear with more truck traffic • Vertical clearances under older railroad bridges are often insufficient for trucks • Process for securing public funding can be difficult and long • Rail technologies are changing rapidly	• Growing challenges with lock and dam system on inland waterways as traditional commodities decline (e.g., coal) • Dedicated funding sources are needed for large projects • Permit reform needed at state and local/county levels to help streamline approvals and construction. • Growing focus on freight at the Port of Erie • Growth in containerized cargo on the Great Lakes • There is some talk of dredging to 50 feet at some anchorages at Philadelphia • The Allegheny is now considered a "low use" river due to declining freight volumes	• Aging airport infrastructure is a challenge at major cargo hubs like Philadelphia • Prioritize funding for aviation infrastructure investments • Small airports are hosting air cargo activity for a growing market of specialized freight: medical devices, pharmaceuticals, etc.; this has been driven partly by the development of new medical facilities across PA • Developing warehouse facilities in close proximity to airports is a challenge • P3 arrangements may be an ideal option for air cargo development • Address needs related to emerging aircraft technology	• Challenges of measuring growth in industries with high levels of automation • Educating the public and decision makers on freight issues • Difficulties of planning with emerging technologies (e.g., data centers) • Direct investments in freight bottlenecks • Address truck parking and staging capacity needs in the development process • Last-mile infrastructure gaps • Need for regular engagement of public and private stakeholders • Match industrial development with suitable workforce

Statewide Virtual Freight Forum

A cornerstone of the stakeholder engagement process was the **2026 Pennsylvania Freight Forum** held over two days on April 15th and 16th of 2026. Stakeholders across the state and nation convened to view presentations and discuss a set of important national and regional trends in the context of Pennsylvania's freight transportation needs. This Forum was scheduled to take place after the Freight Stakeholder Focus Groups discussed previously, to expand the stakeholder engagement to a broader audience and reinforce some of the key themes that emerged from the focus group process. The facilitated engagement sessions allowed participants to provide input on potential solutions to freight transportation challenges identified on Day 1, and to rank them for feasibility and effectiveness on Day 2. A summary of the Freight Forum topics is shown below.

Day 1 – 4/15/2026	Day 2 – 4/16/2026
• Freight Forum Objectives - Share challenges, priorities and ideas for improving freight movement - Summary of engagement process - Outcomes • Overview of the 2045 Freight Movement Plan • Highlights of 2050 FMP Freight Focus Groups • Panel: Pennsylvania Transportation Advisory Committee activities - Pennsylvania Aviation System - Truck Parking in Pennsylvania - E-Commerce Study • Stakeholder Input: Emerging Emphasis Areas in Pennsylvania's freight transportation system and needs	• Panel: Freight Technology - Amazon Technology Initiatives - Norfolk Southern: Railroad Technology Implementation - PennDOT's Transformational Technology Division • Stakeholder Input: Review and rankings of Emerging Emphasis Areas presented on Day 1 • Next Steps

PennDOT Freight Work Group (FWG)

PennDOT's **Freight Work Group (FWG)** was established in 2017 to advance the freight-related strategies from PennDOT's planning process, provide guidance on freight-related issues and needs of statewide significance, and facilitate information sharing and coordination among freight stakeholders. Their members have played integral roles in the development of both the 2045 FMP and this 2050 FMP. Regular briefings of the FWG on the 2050 FMP were conducted throughout 2025 and 2026, culminating in their review and input on the proposed Goals, Objectives and Actions at their quarterly meetings in May and August 2026.

Public Comment Period

SECTION TO BE COMPLETED AFTER PUBLIC COMMENT PERIOD.

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Existing Conditions and Trends: Where We are Now

SECTION CONTENTS

- Overarching Trends and Considerations
- Economic Influences
- Trucking
- Freight Rail
- Ports and Waterways
- Air Cargo
- Military Freight
- Critical Urban & Rural Freight Corridors
- Pipelines
- Impacts of E-Commerce



Overarching Trends and Considerations

Pennsylvania has a vast system of highways, railroads, ports, waterways, and airports that accommodates freight movement through multiple transportation modes. This system meets the needs of a full supply chain from producers of raw materials to processing and manufacturing enterprises to distributors, retailers, and "last-mile" package delivery to consumers. Freight transportation has evolved and expanded over centuries, and each transport mode is experiencing distinct trends and opportunities with implications for freight planning.

As diverse as the freight modes are, they share a range of overarching trends, most characterized by increasingly rapid change. Top industry, transportation, and land use trends with implications for freight planning include the following:

- **Supply Chain Reconfiguration and Resilience**
  Freight supply chains are being restructured to improve resilience in response to disruptions such as extreme weather, changes in tariff policy and trade agreements, labor shortages, and global market volatility. There is increased emphasis on reliability, redundancy, and system resilience across all freight modes, resulting in a rise of "Just-in-Case" logistics strategies for shippers. For PennDOT, this trend underscores the importance of identifying and protecting freight-critical corridors, intermodal connectors, and assets that support continuity of goods movement.

- **Growth of E-Commerce and Last-Mile Deliveries**
  The continued growth of e-commerce is reshaping freight patterns, particularly through increased last-mile and regional delivery activity. This trend results in denser delivery networks, higher truck volumes, more frequent deliveries, and increased interaction between freight vehicles and local streets. Considerations include first- and last-mile connectivity, curb management, land use compatibility, and impacts on suburban and urban communities.

- **Advances in Freight Technologies**
  Rapid advancements in freight-related technologies – including automation, artificial intelligence, connected vehicle systems, warehouse operations, and data analytics – are influencing how freight is moved and managed. While many innovations are private sector driven, public agencies must anticipate infrastructure readiness, policy implications, and data integration needs. This includes intelligent transportation systems (ITS), connected freight corridors, and digital permitting and monitoring tools.

- **Truck Parking and Safety**
  Truck parking availability remains a persistent operational and safety challenge. Insufficient parking can lead to unsafe practices such as shoulder or ramp parking and can affect driver fatigue and compliance with hours-of-service requirements. Truck parking is a cross-cutting issue involving safety, land use, operations, and coordination with private-sector partners and local governments. PennDOT is currently engaged in an initiative to develop new parking capacity at safe locations within highway rights-of-way across the Commonwealth.

- **Environmental Sustainability and Emissions Reduction**
  Freight transportation faces growing pressure to reduce environmental impacts, including greenhouse gas emissions and air quality effects. While vehicle electrification and alternative fuels are long-term strategies, near-term opportunities exist through operational improvements that reduce congestion, idling, and delay. Sustainability considerations increasingly influence funding, project prioritization, and public expectations.

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- **Data-Driven Freight Planning**
  Freight planning is becoming increasingly data-driven, with greater reliance on national and state freight datasets, performance measures, and visualization tools. The use of Freight Analysis Framework (FAF) data, employment data for freight-intensive industries to identify concentrations of freight activity, and other emerging datasets support improved understanding of freight flows, trends, and future conditions. This trend highlights the need for ongoing data collection, analysis, and monitoring rather than one-time plan updates.
- **Aging Infrastructure and Multimodal Bottlenecks**
  Aging infrastructure across highways, rail, ports, and intermodal facilities continues to constrain freight efficiency and reliability. Bottlenecks at bridges, interchanges, grade crossings, and terminals can have systemwide impacts. Maintaining a state of good repair and strategically addressing multimodal bottlenecks remains a foundational consideration for freight mobility.
- **Economic Competitiveness**
  Efficient goods movement is a key factor in supporting and growing a competitive economy. Both public and private sectors have a shared interest in Pennsylvania's economic health, and transportation is a vital support system for economic activity. The FMP recognizes the value in public and private freight stakeholders being jointly focused on what they must do separately, and together to support economic wellness.
- **Supply Chain Visibility**
  Rapid changes in freight transportation practices and markets, coupled with the increased exposure to natural and man-made disruptions in supply chains, have driven a growing interest in supply chain visibility for shippers, carriers and public sector planners. Real-time shipment monitoring and tracking across all transport modes will require the use of standardized data and interoperable platforms across supply chains.
- **Freight Railroad Industry Consolidation**
  In late 2025, a proposed acquisition of Norfolk Southern (NS) by Union Pacific (UP) was announced. This merger, if approved, would result in the first single-line transcontinental railroad, with a network of more than 50,000 route miles serving 43 states. The merger is subject to review and approval by the U.S. Surface Transportation Board; a final decision is expected in 2027. NS has a substantial presence in Pennsylvania, and this merger would have potentially transformational impacts on rail freight operations for shippers and shortline railroads in the state.

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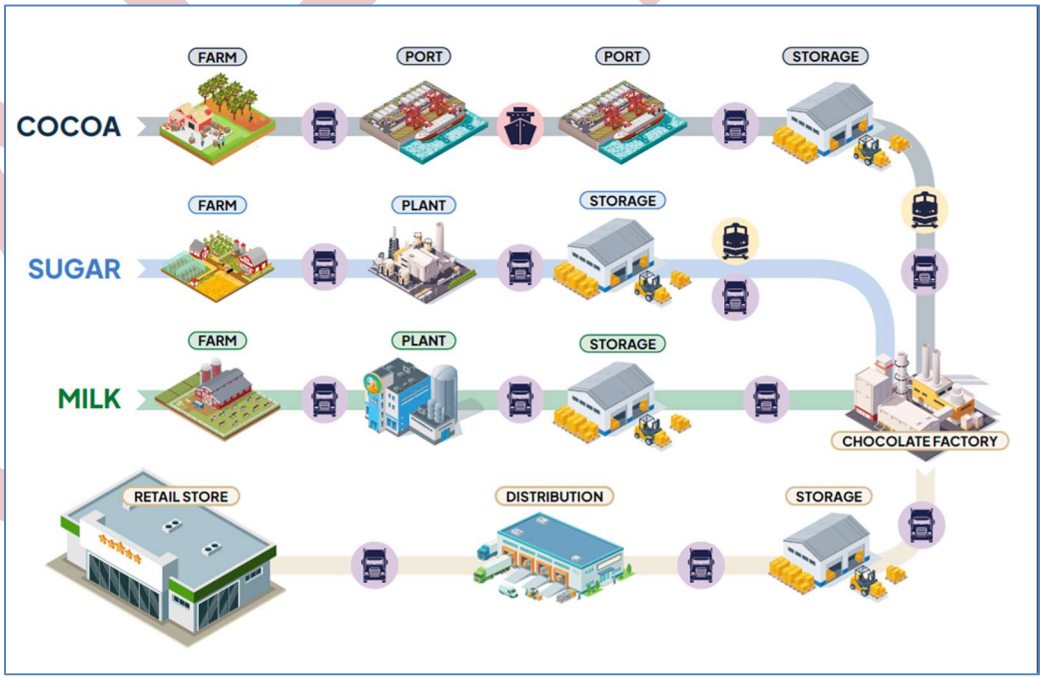
Supply Chain

A supply chain is a complex system that involves the extraction, production and transportation of raw materials and components to end users as finished products. Freight transportation is just one step in this process, but it often is the most difficult to measure and analyze because it takes place through a series of complex business arrangements involving shippers, receivers and transportation service providers that operate on public and private transportation infrastructure across multiple transport modes.

Pennsylvania is a dynamic environment for all steps of many supply chains, as a home to its own business and consumer base, as a center for industries engaged in manufacturing, mineral extraction and agriculture, and as a warehousing and distribution hub for major U.S. population centers in adjoining states. The public sector has a critical role in working with private industry to develop and maintain a freight transportation system that is both efficient and resilient in meeting the needs of Pennsylvania's citizens and business community.

Illustrative supply chains for Pennsylvania and modal options for the transport of raw materials and finished products shown on these pages include a chocolate candy bar (**Figure 1A**), a loaf of bread produced at a commercial bakery (**Figure 1B**), and nature gas extracted from the Marcellus/Utica shale regions of the state (**Figure 1C**).

Figure 1A: Illustrative Supply Chain – Chocolate Candy Bar



Supply Chain

Figure 1B: Illustrative Supply Chain – Bread

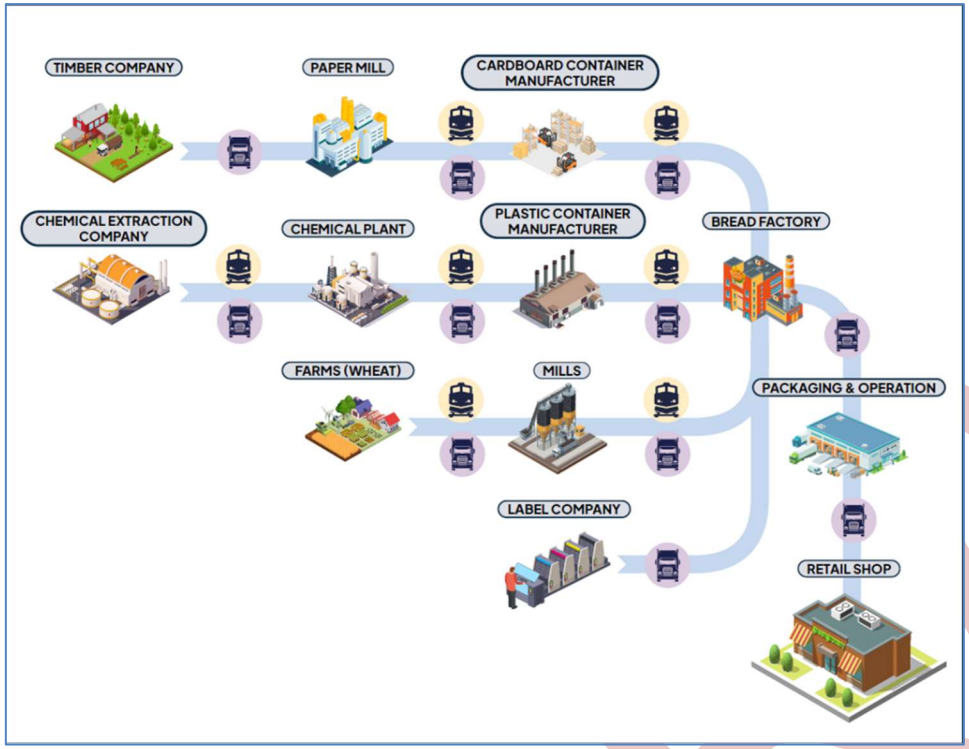
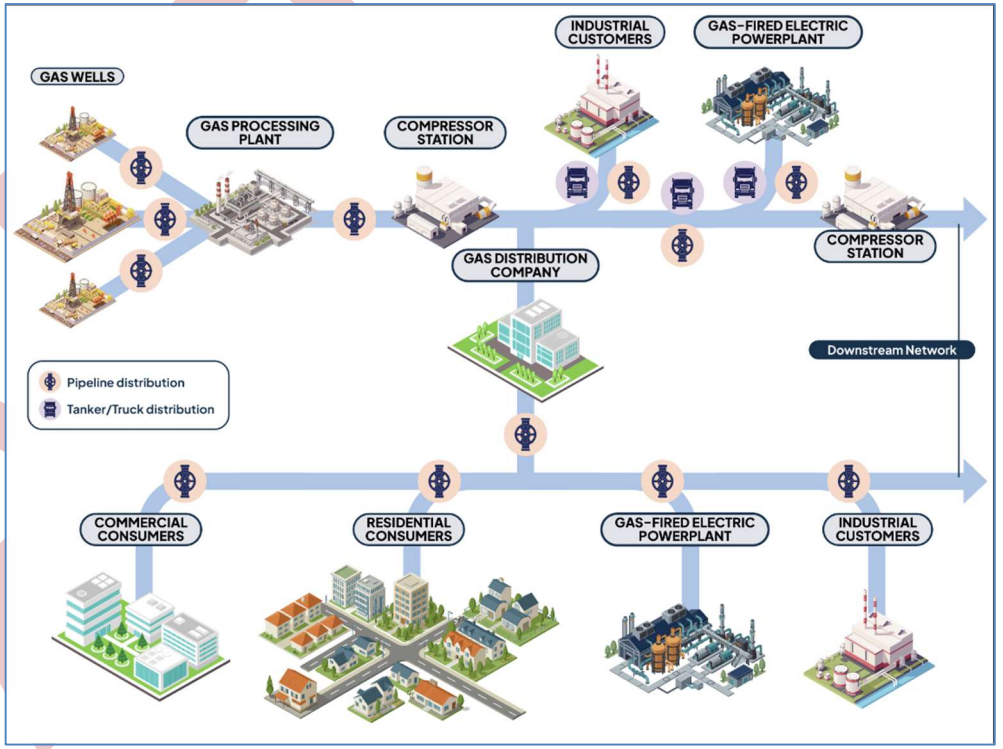
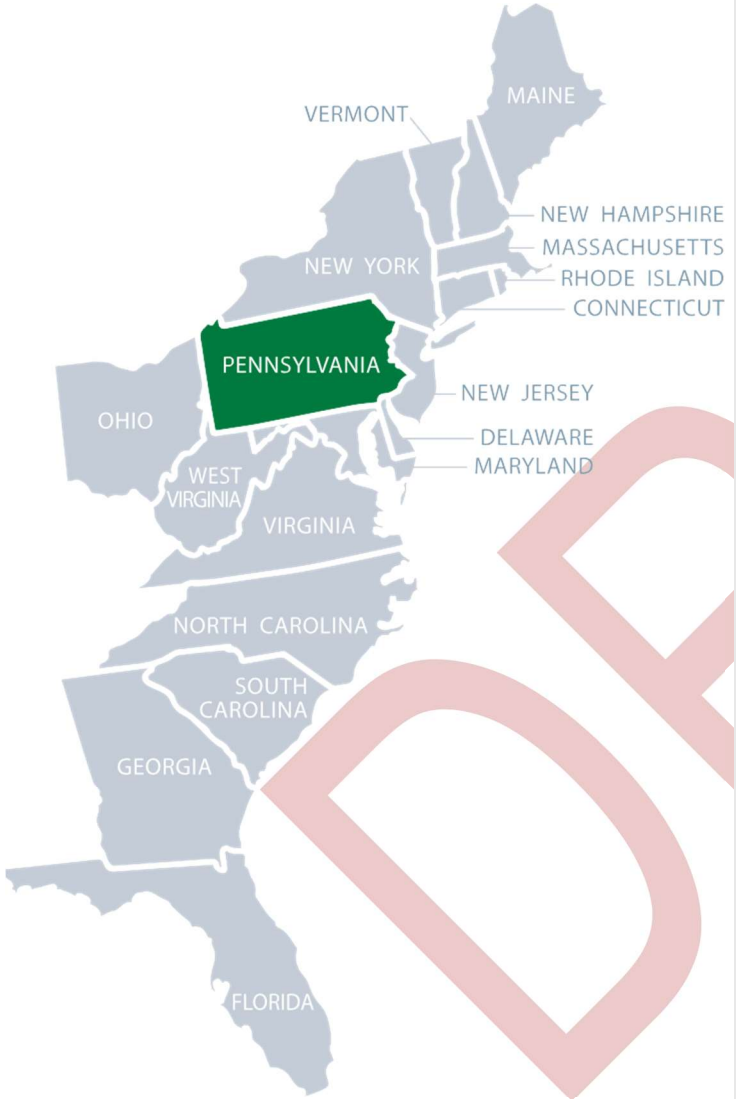


Figure 1C: Illustrative Supply Chain – Natural Gas



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Multi-State Freight Compacts



- In the United States, an interstate compact is a pact or agreement between two or more states, or between states and any foreign government. Congress recognizes the right of States, cities, regional planning organizations, federally recognized Indian Tribes, and local public authorities that are regionally linked with an interest in a specific nationally or regionally significant multi-State freight corridor to enter multi-State compacts to promote the improved mobility of goods. The States negotiate the compacts, and then each party enacts legislation establishing the compact in identical form. Congress must approve the compact unless it has no impact on Federal responsibilities.
- Some compacts create new multi-state governmental agencies which are responsible for administering or improving shared resources such as a seaport, bridge crossings, highway corridor, or public transportation infrastructure. PennDOT has worked diligently with neighboring States through agreements that address topics such as freight movement and interoperability.
- The Delaware Valley Regional Planning Commission (DVRPC) is the federally designated Metropolitan Planning Organization (MPO) for the Greater Philadelphia region, established by an interstate compact between the Commonwealth of Pennsylvania and the State of New Jersey. The DVRPC region is comprised of nine counties, each with a unique freight profile of facilities, employment, and trade patterns. DVRPC's freight advisory committee, the Delaware Valley Goods Movement Task Force, meets on a quarterly basis and advises the DVRPC Board on goods movement issues in the region.
- There are other multi-state organizations that are not formally interstate compacts but work together to address freight movement policy in Pennsylvania and neighboring states. These include:

THE EASTERN TRANSPORTATION COALITION
CONNECTING FOR SOLUTIONS

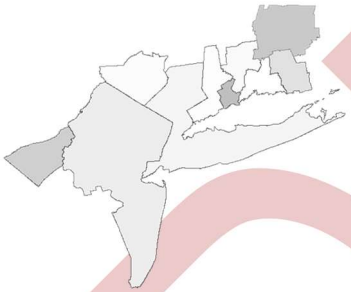
The Eastern Transportation Coalition (TETC)
https://tetcoalition.org/

The Eastern Transportation Coalition is a partnership of 20 states and D.C. focused on connecting public agencies across modes of travel to increase safety and efficiency. Formerly the I-95 Corridor Coalition, the organization started as an informal group of transportation professionals working together to manage highway incidents that impacted travel across state lines.

Multi-State Freight Compacts

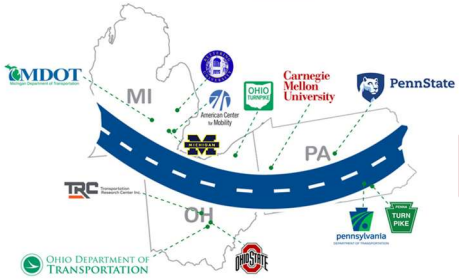
The Appalachian Regional Commission (ARC)
https://www.arc.gov/

The Appalachian Regional Commission (ARC) is a federal–state economic development partnership serving 423 counties across 13 Appalachian states, with a mission to build community capacity and strengthen economic growth across the region. While its work spans many sectors, transportation has been a core part of ARC's mission since 1965, particularly through its long-standing partnership with state DOTs to advance the Appalachian Development Highway System and local access road investments. ARC also supports transportation planning and research related to access, mobility, and infrastructure needs, recognizing that efficient highways, rail connections, ports, and local road links are essential to connecting Appalachian communities and businesses to labor, services, and markets. For Pennsylvania, ARC's transportation and freight-related work is especially relevant because it ties improved regional connectivity to broader economic development, helping freight-intensive industries and rural communities better reach regional and national markets.



The MAP Forum
https://map-forum-njtpa.hub.arcgis.com/

The Metropolitan Area Planning (MAP) Forum is a multi-state consortium of MPOs and councils of governments from Connecticut, New Jersey, New York, and Pennsylvania that was formed in 2008 to strengthen coordination on transportation planning across a highly interconnected megaregion. Created in response to FHWA and FTA recommendations, the forum helps member agencies align long-range plans, transportation improvement programs, modeling, performance measures, and air quality conformity activities where cross-border coordination is needed. Its freight-related work includes a Multi-State Freight Working Group that provides a regional perspective on goods movement issues, projects, and programs affecting the four-state metropolitan area.



Smart Belt Coalition

The Smart Belt Coalition is a multi-state transportation partnership centered on Pennsylvania, Ohio, and Michigan that brings together state transportation agencies, toll authorities, and university partners to advance connected, automated, and other emerging transportation technologies. Its work focuses on collaborative research, testing, data sharing, policy coordination, and deployment of technologies that can improve safety, mobility, and system performance across state lines.

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Economic Influences



Trends & Issues

- Pennsylvania's strategic location, bordering the Atlantic seaboard to the east and the Great Lakes to the west, makes it a critical hub of freight transportation. The Delaware River, which forms the boundary between Pennsylvania and New Jersey, serves as a key link for freight movement along a 103-mile stretch from Philadelphia south.
- Total Freight Flows into Pennsylvania from other states by all modes of transportation (Domestic) for 2024 were 590 million tons, with a combined value of $697 billion. In 2050, the projected flows into Pennsylvania are 832 million tons, with a value of $1.3 trillion. The top five commodities by total tonnage being imported into Pennsylvania include coal, food products, natural gas and other fossil products, waste/scrap, and gasoline.
- Total freight flows from Pennsylvania to other states for 2024 were 689 million tons, with a combined value of $756 billion. In 2050, the projected flows out of Pennsylvania to other states is 946 million tons, with a total value of $1.5 trillion. The top five commodities by total tonnage being exported out of Pennsylvania to other states include natural gas and other fossil products, coal, base metals, nonmetal mining products, and food products.
- Total freight flows within Pennsylvania for 2024 were 376 million tons, with a combined value of $283 billion. In 2050, the total tonnage within Pennsylvania is projected at 529 million tons, with a value of $528 billion. The top five commodities by total tonnage being transported within Pennsylvania by all modes include gravel, natural gas and other fossil products, nonmetal mining products, waste/scrap, and coal.

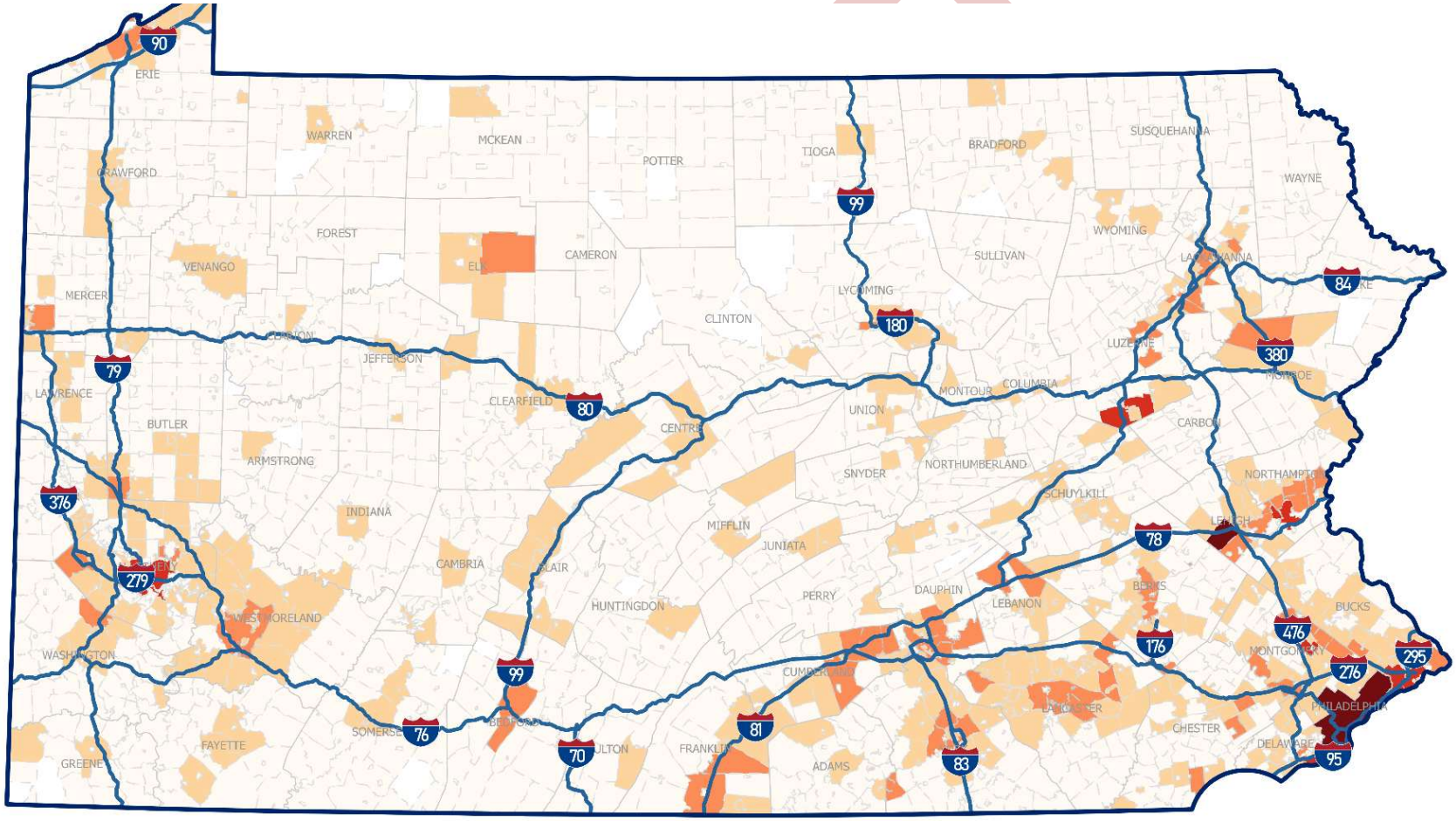
A full set of commodity flow tables for 2024 and intermediate-term (2032) and long term (2050) horizon years is contained in **Appendix 2: Commodity Flow Tables**.

Planning Implications

- Freight-intensive industries employed nearly 1.2 million workers in Pennsylvania as of 2022, based on statistics from the Pennsylvania Department of Labor & Industry. These include the following industry groups:
  - Manufacturing 590,000
  - Transportation & Warehousing 361,000
  - Wholesale Trade 185,000
  - Mining, Oil & Gas 21,900
  - Agriculture 27,200
- Among Pennsylvania's 67 counties, those with the greatest concentrations of employment in freight-intensive industries include the following:
  - Allegheny 81,600
  - Montgomery 81,000
  - Lancaster 75,300
  - Philadelphia 72,900
  - York 57,100
  - Berks 53,400
  - Bucks 53,100
  - Lehigh 50,000
  - Luzerne 45,800
  - Chester 42,300
- The freight-related employment figures by county, municipality, and industry group for Pennsylvania are contained in **Appendix 3: Freight-Related Employment**. Freight related employment by municipality is shown in **Figure 2**.

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Figure 2: Freight Related Employment by Municipality (2022)



Employment Count, 2022

- < 500
- 500 - 3,000
- 3,001 - 8,000
- 8,001 - 20,000
- >20,000

0 25 50 Miles

N

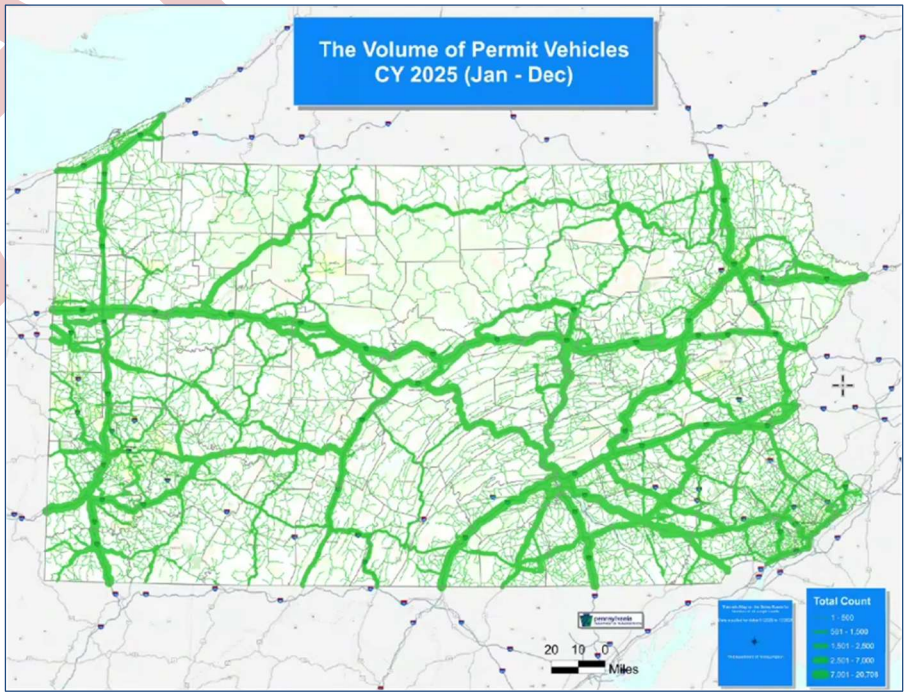
Source: Pennsylvania Department of Labor & Industry

Trucking



Background and System Information

- Pennsylvania's highway network includes a total of 121,435 linear miles, with 28,800 linear miles being on the Federal Aid System.
- The U.S. National Highway Freight Network (NHFN) was established under the FAST Act in 2015 and includes the following roadway subsystems (see **Figure 3,** with networks defined in detail in the **Glossary** of this document):
  - 1,408.1 miles of Primary Highway Freight System (PHFS) roadways
  - 459.2 miles of non-PHFS Interstate Highway
  - 299.9 miles of Critical Rural Freight Corridors (CRFC)
  - 149.4 miles of Critical Urban Freight Corridors (CUFC)
  - 25 designated PHFS Intermodal Connectors (including 5 airport connectors)
- The NHFN is the primary network of importance for freight nationally. In Pennsylvania, it is one element of the highway system that serves the trucking industry. It is a subset of the National Highway System (NHS), a network of significant highways for all users that was established by Congress under the National Highway Designation Act of 1995. The roadways in the NHS network include the following, as shown in **Figure 4**:
  - The Interstate Highway System
  - The Strategic Highway Network (STRAHNET)
  - Connectors to Intermodal Facilities
- PennDOT maintains its Automated Permit Request and Approval System, an online platform that allows users to submit applications for special permits for oversized and overweight trucks. This system was implemented to streamline the permit application and review process and provide analytical capability to assess the viability of roads and bridges to accommodate oversize and overweight loads.
- PennDOT issued 349,185 of these special hauling permits in 2025. These include single-trip permits as well as seasonal and annual permits for shippers that make many separate truck trips over those periods of time. Trucks hauling indivisible loads in excess of an 80,000-lb. gross vehicle weight (GVW) are generally prohibited on the Interstate Highway System, so trucks hauling these loads mainly use state routes under Pennsylvania's legislated weight exemptions and permit system.



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Figure 3: National Highway Freight Network

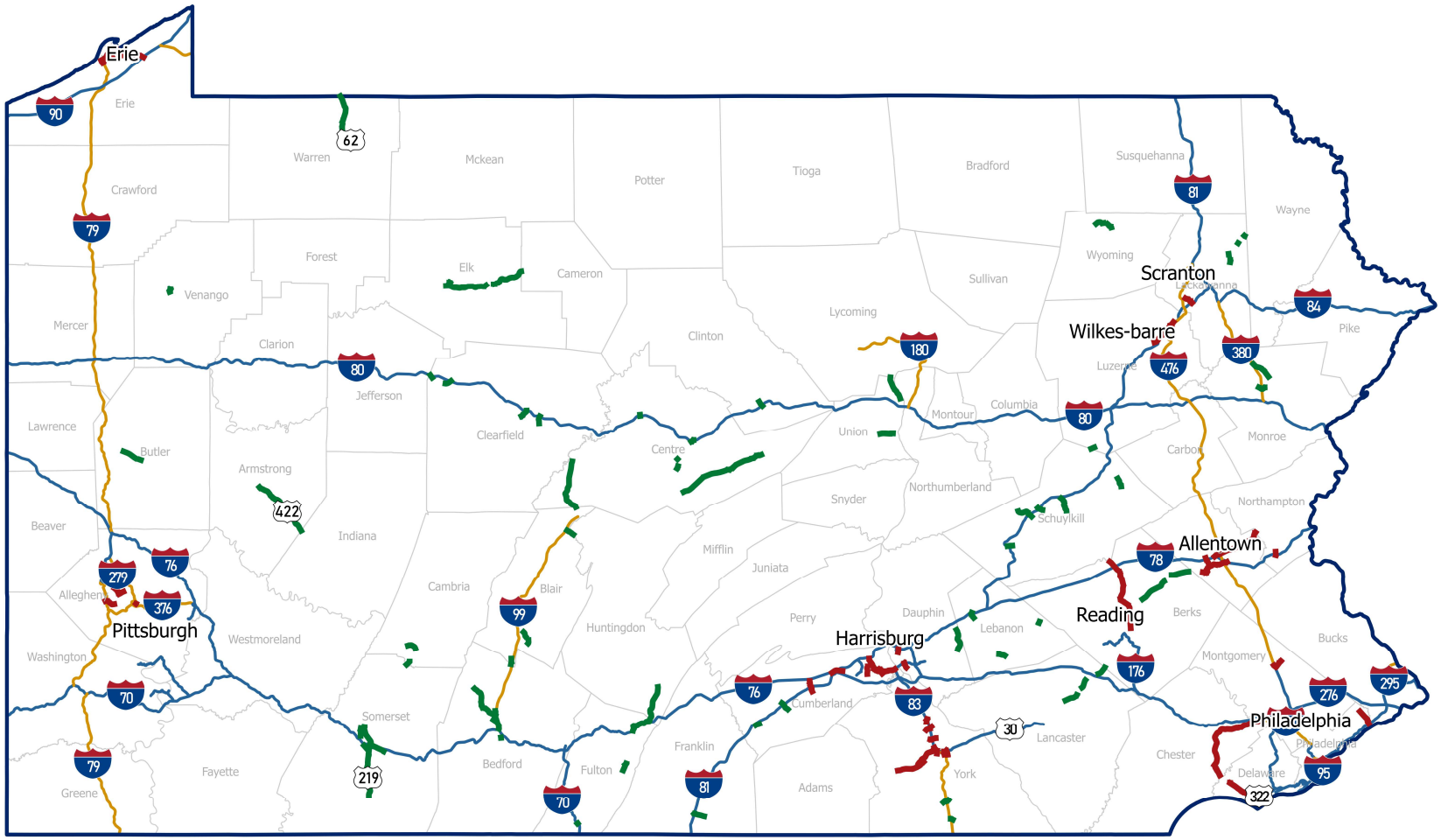
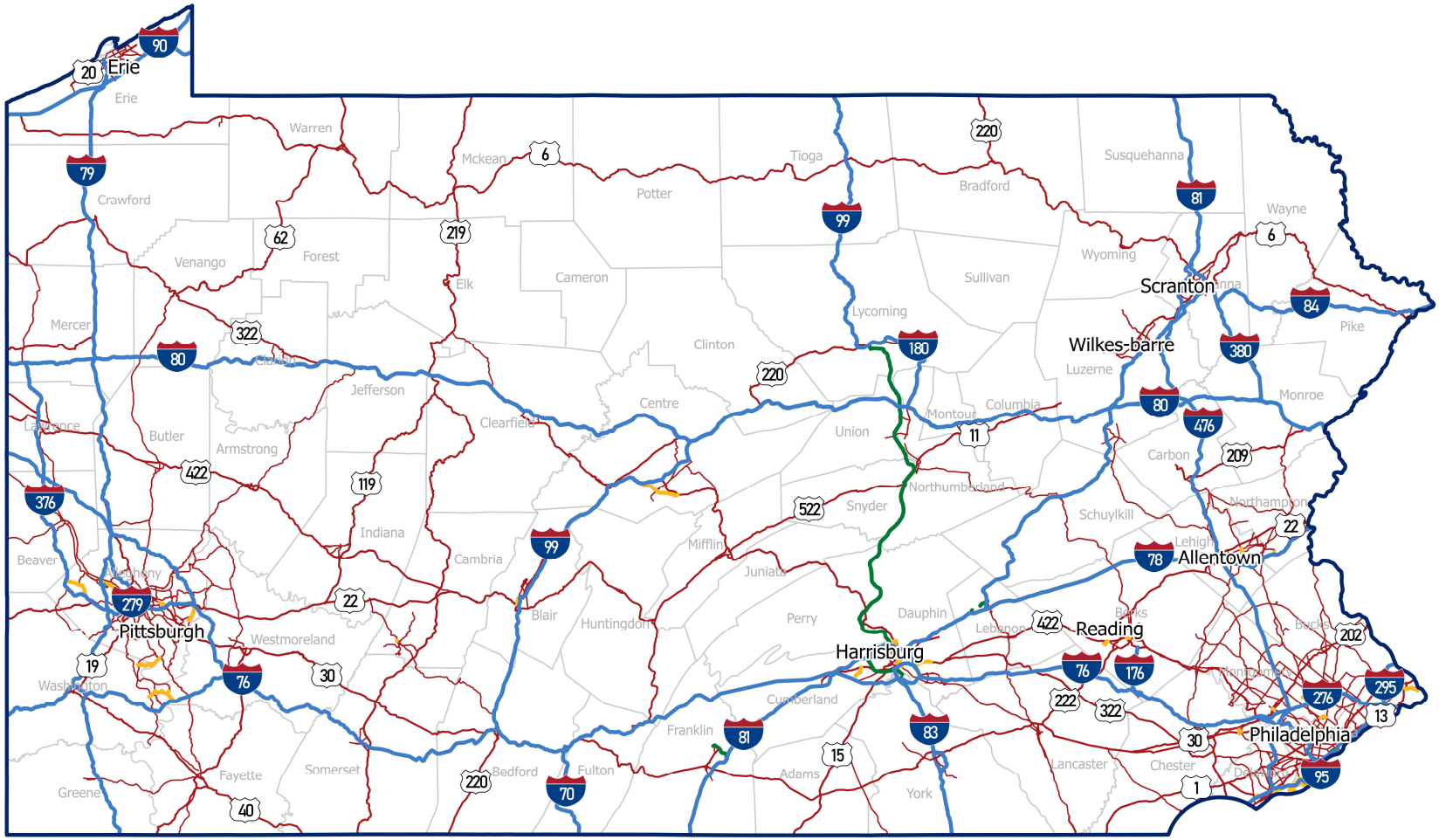


Figure 4: National Highway System



Truck Commodity Flows

- Measured in tonnage, the top commodities transported by truck to destinations in Pennsylvania (not including internal deliveries within Pennsylvania) include gravel, waste/scrap, other foodstuffs, non-metallic mineral products, and natural gas and other fossil products. Measured by value, the top commodities destined for Pennsylvania include pharmaceuticals, mixed-freight, other foodstuffs, electronics, and motorized vehicles.
- Measured in tonnage, the top commodities transported by truck from origins in Pennsylvania to destinations outside the state include gravel, nonmetallic mineral products, other foodstuffs, waste/scrap, and coal. Measured by value, the most common commodities originating in Pennsylvania include mixed freight, pharmaceuticals, electronics, base metals, and other foodstuffs. A full set of commodity tables is shown in **Appendix 4: PA Truck Commodity Tables**.
- As measured by tonnage, the top external trading partners among U.S. states for truck freight originating in Pennsylvania are New Jersey, New York, Maryland, Ohio, and Virginia.
- These states are also the top external trading partners among U.S. states for truck freight destined for Pennsylvania, ranked as follows: New Jersey, New York, Ohio, Maryland and Virginia.
- Freight forecasts from the Freight Analysis Framework published and maintained by the USDOT Bureau of Transportation Statistics, indicate long-term growth in truck freight activity for the 2024 to 2050 planning horizon. By tonnage, truck freight moving to, from, and withing Pennsylvania is projected to grow by 64%, 64%, 49%, respectively, over that period. These figures indicate an ongoing pattern of strong growth in truck traffic on the Commonwealth's highway system, primarily in additional truck trips between Pennsylvania and its neighboring states.

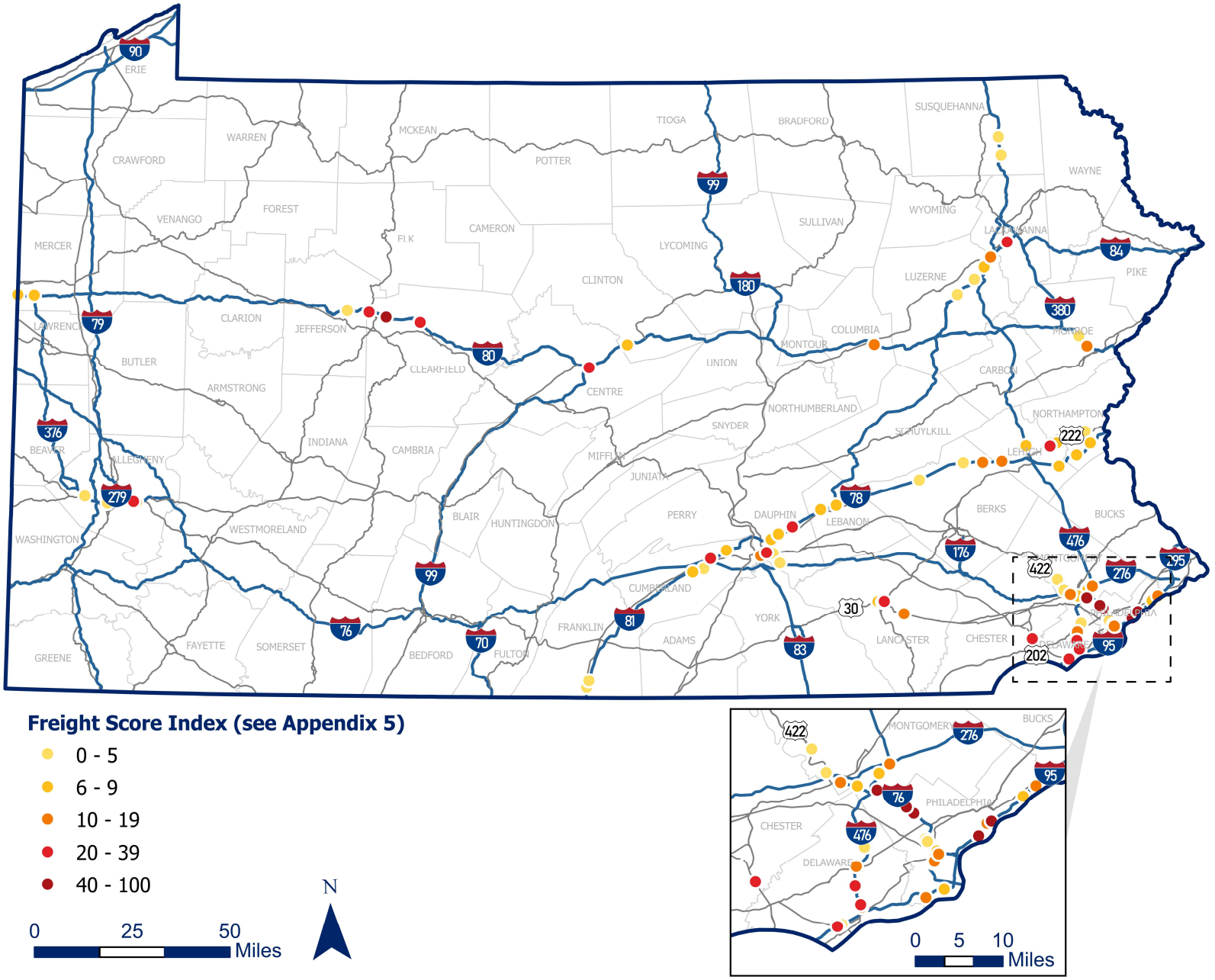
Truck Bottlenecks

- Highway congestion remains a significant concern for the trucking industry nationwide and throughout Pennsylvania. Delays caused by recurring congestion, traffic incidents, work zones, weather events, and geometric constraints can affect business productivity, consumer costs, economic competitiveness, and overall transportation system efficiency. Identifying freight bottlenecks is therefore an important component of freight planning and transportation investment decision-making.
- The Pennsylvania 2050 Freight Movement Plan Truck Bottleneck Assessment completed for this study was included in PennDOT's most recent PM3 performance measure report. This report, incorporated by reference into the FMP as **Appendix 5**, identifies the Top 100 truck bottlenecks on the Interstate and major State roadway network in Pennsylvania.
- The top truck freight bottlenecks in Pennsylvania for 2025 are shown on **Figure 5**. The bottlenecks with the highest (worst) Freight Bottleneck Scores include:
  - I-95 in the Philadelphia area – ◆
  - I-76 in Montgomery County
  - I-80 in Clearfield County
  - I-376 in the Pittsburgh area
  - I-476 in Delaware County
  - US-22 in Lehigh County
  - I-81 in Cumberland County
  - I-83 in Dauphin County – ◆

◆ – *Indicates a location corresponding to an ongoing or future improvement project with National Highway Freight Program (NHFP) funds programmed in the 2027 Twelve Year Program (TYP) and listed in the Freight Investment Plan described in Appendix 15.*

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Figure 5: Pennsylvania Freight Bottlenecks



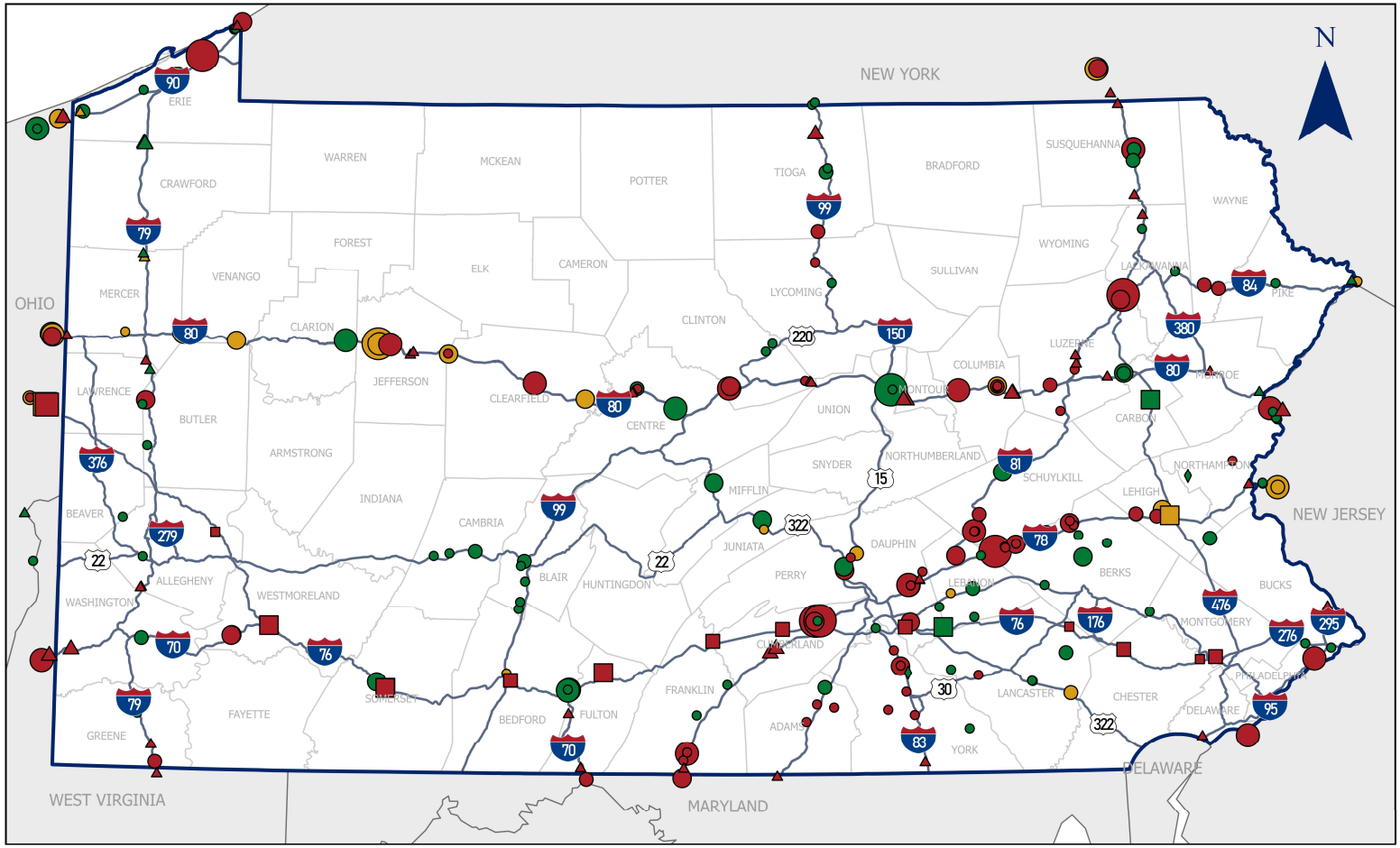
Source: PennDOT, 2026

Commercial Motor Vehicle Parking Facilities Assessment

- Meeting the needs of the trucking industry for rest and staging is an important consideration for supply chains and freight-related economic activity. This has been an important issue on a national level and the subject of extensive study by Congress and the USDOT since the late 1990s.
- PennDOT and its partners have been working to measure truck parking issues and related safety concerns since the initial statewide assessment of truck parking, *Truck Parking in Pennsylvania* (Pennsylvania State TAC) was completed in 2007.
- A subsequent study completed for the TAC, *Expanding Truck Parking in Pennsylvania* (2023), is attached by reference as **Appendix 6**. This study includes a methodology for prioritizing highway corridors for truck parking demand based on a set of metrics that include truck volumes, capacity and peak utilization at existing facilities, freight-related employment, truck crash data, and others. The study's 19 recommendations are aimed at implementing new parking capacity in the priority corridors identified using this methodology.
- PennDOT regularly completes updates of truck parking data across the Commonwealth, identifying new parking locations, closed facilities, and peak overnight utilization as warranted. Since the final publication of the 2045 FMP in May 2023, this information had been updated in 2023 for the aforementioned TAC study and supplemented with a set of peak utilization counts and observations at a broad set of sample truck parking facilities across Pennsylvania in the spring of 2026. The 2023 and 2026 data were submitted to the FHWA as part of the 2026 Jason's Law Truck Parking Survey Update.
- In 2025, PennDOT embarked on an initiative to implement one of the recommendations of the 2023 TAC study, involving the development of new low-cost truck parking capacity within PennDOT rights-of-way. When completed by early 2027, the initiative will add 1,200 new parking spaces at locations that include weigh stations, underutilized park & ride lots, construction laydown areas, and highway entrance ramps with sufficient lateral clearance and sight distance to accommodate safe parking spaces. Nearly 600 of these spaces were open as of July 2026. These parking spaces are also listed on PennDOT's 511PA system as they are opened.
- The truck parking facility utilization by facility type and size is illustrated in **Figure 6**. The data includes 272 parking facilities across the state and in a 10-mile buffer region in adjoining states. These facilities had a combined capacity of approximately 12,330 truck parking spaces. During the peak overnight data collection period in 2026 they accommodated about 13,357 trucks parked, for an overall peak utilization of 108%.
- The trucks observed parked in undesignated areas on highway shoulders and interchange ramps are aggregated by roadway segment and measured in terms of parked trucks per linear mile of roadway. This parking activity is shown in **Figure 7**, with locations identified by the Pennsylvania State Police for frequent illegal parking activity highlighted.
- General observations about truck parking in Pennsylvania include the following:
  - Peak overnight parking activity has grown across Pennsylvania between 2020 and 2026. By facility type, total growth rates ranged from 2.1% for PA Turnpike Service Plazas to 27.8% for rest areas and welcome centers. Geographically, growth rates ranged from 4.4% in western Pennsylvania to 9.2% in the southeastern part of the state.
  - About 90.5% of the vehicles parked in truck spaces at the facilities where sample data were collected in 2026 were tractor-trailer combination trucks. The remaining 9.5% included single-unit trucks, RVs (not a sizable number due to the time of year when this data was collected) and "bobtail" trucks (tractors without trailers). This second group is noteworthy because most vehicles of this type would not fully occupy a parking space delineated for a tractor-trailer combination vehicle and could potentially be accommodated outside conventional truck parking spaces in the future.
  - Private fee-based companies offering truck parking spaces such as Truck Parking Club and FleetPark have a growing presence in Pennsylvania. This is an emerging and rapidly changing business model that offers potential solutions to truck parking needs in corridors of high demand such as I-78, I-81 and I-95.

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Figure 6: Truck Parking Utilization and Capacity



Facility Utilization

% of Truck Parking Spaces Utilized

- < 85%
- 85% - 100%
- > 100%

Facility Shape

Facility Type

- Rest Area
- PA Turnpike Service Plaza
- Truck Stop, Gas Station, Other
- Terminal

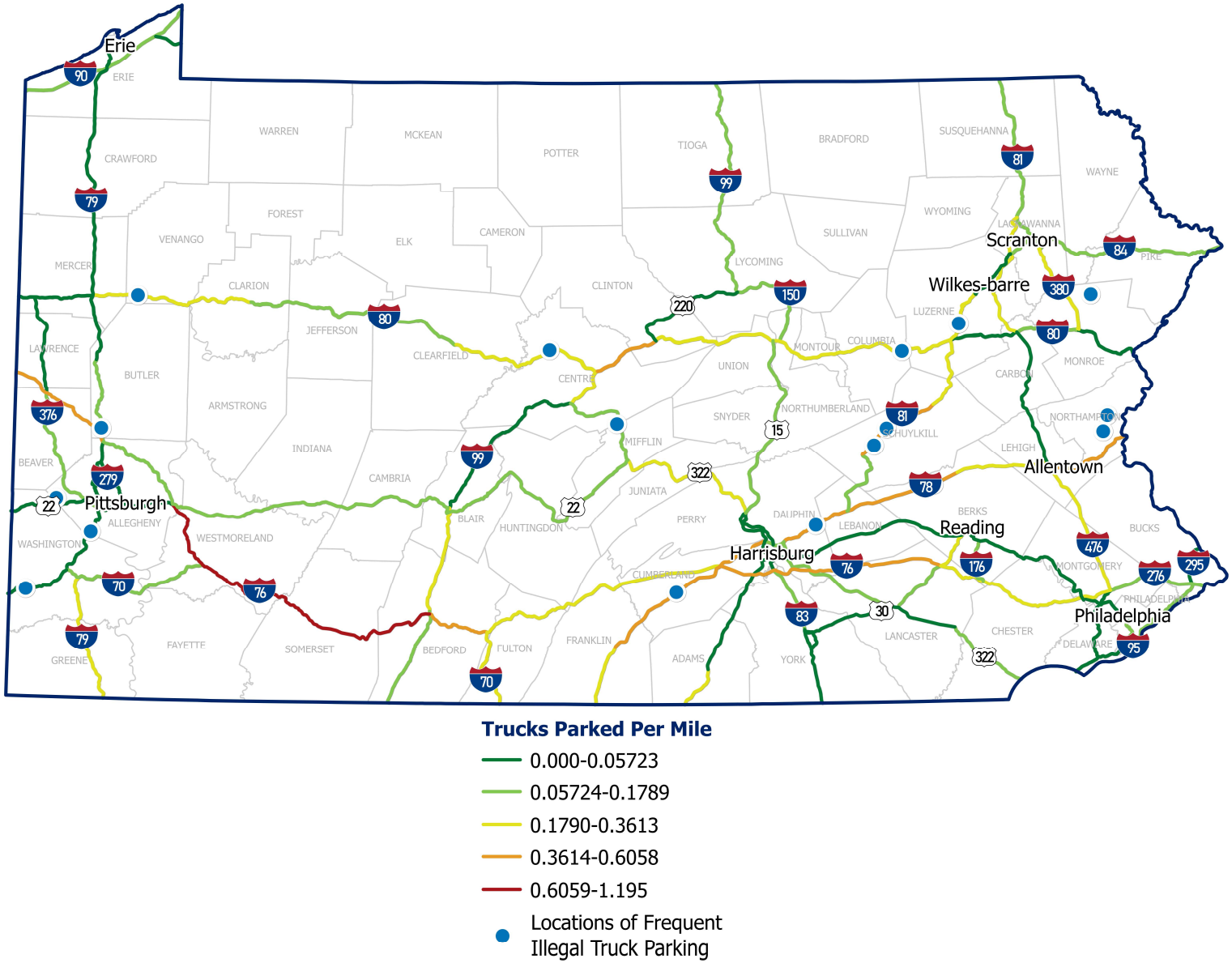
Facility Size

# of Truck Parking Spaces

- 0 - 20
- 21 - 50
- 51 - 100
- 101 - 200
- 201+

Source: PennDOT (2026)

Figure 7: Truck Parking on Shoulders and Ramps



Source: PennDOT (2026)

Planning Implications

- Trucks are the predominant mode of freight transportation in Pennsylvania and will continue to be for the foreseeable future. Planning and programming for sufficient roadway capacity is one of the biggest challenges facing PennDOT, with trucks being one of many contributors to highway congestion while also serving as a critical transport mode for the Commonwealth.
- A number of the truck bottlenecks identified in Pennsylvania are being addressed through ongoing projects that are being implemented through the 12-Year Program (TYP). Two major Interstate Highway System initiatives being undertaken in the current TYP that related to these bottlenecks include I-95 in the Philadelphia area and the I-83 corridor through the Harrisburg area, including the South Bridge replacement across the Susquehanna River. A more detailed discussion of the truck bottlenecks and the TYP projects is included in the Implementation section of this plan and **Appendix 5**.
- The growth of e-commerce has resulted in changes in truck operations that will likely accelerate over time, with more frequent trips in smaller trucks and vans, and more "last-mile" deliveries to homes and business establishments that will place a growing burden on local streets.
- Oversize and overweight trucks play an important role in the transport needs of many Pennsylvania industries, particularly in agriculture, manufacturing, and energy. Measuring the impacts of these movements on the Commonwealth's pavement and bridges will be critical to help ensure that PennDOT can plan for the potential acceleration of infrastructure deterioration and secure funding through its permit system to cover the true cost of these unconventional freight movements on the highway system.
- Advances in truck technology are an opportunity to improve efficiency in the industry, but there are challenges. Truck platooning, automation, and zero-emission vehicles (ZEVs) are areas of rapid technology development that have implications for the trucking industry. The primary implication for the public sector is to understand how to adapt to these changes in a timely manner when planning for infrastructure investments.
- Automation of warehousing/logistics facilities drives an acceleration of freight movement in the supply chain. This results in an increase in truck traffic generated by warehousing and distribution facilities even without changes to the physical size of the building. An integrated approach to transportation planning/programming and local planning for freight-intensive land use is essential to ensuring the viability and sustainability of Pennsylvania's highway system, and the strength of the state's industries and overall economy.
- Further, transportation costs are sometimes driven higher by reactively trying to keep pace with warehousing and distribution growth. Coordinated transportation and land use could lessen this problem.
- PennDOT can work collaboratively with MPOs/RPOs, municipal officials, and industrial real estate developers to identify tools to measure impacts of additional truck traffic and freight-related emissions—not only on the local road network but also on the regional highway system.
- Modeling and forecasting tools available through the American Association of State Highway and Transportation Officials (AASHTO) and the Institute of Transportation Engineers (ITE) should be refined and improved to establish more realistic forecasts of truck traffic for industrial sites. Data sources such as weigh-in-motion data and vehicle probe data can be used to more accurately estimate trip rates, vehicle weights, and origin/destination patterns.
- The lack of sufficient truck parking availability across much of the nation is a major operational issue for the trucking industry as well as a safety issue for the trucking industry and the traveling public in general. Truck parking and the associated challenges of federal hours-of-service rules and staging needs at shippers and receivers are issues nationwide. Insufficient capacity in rest areas and truck stops leads to serious safety implications when truck drivers are forced to park on highway on-ramps or shoulders.
- Providing truck parking is not the sole responsibility of a State DOT, but state government does have a stake in being a part of the problem-solving with the private sector, given its core mission of transportation safety.

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Freight Rail



Trends & Issues

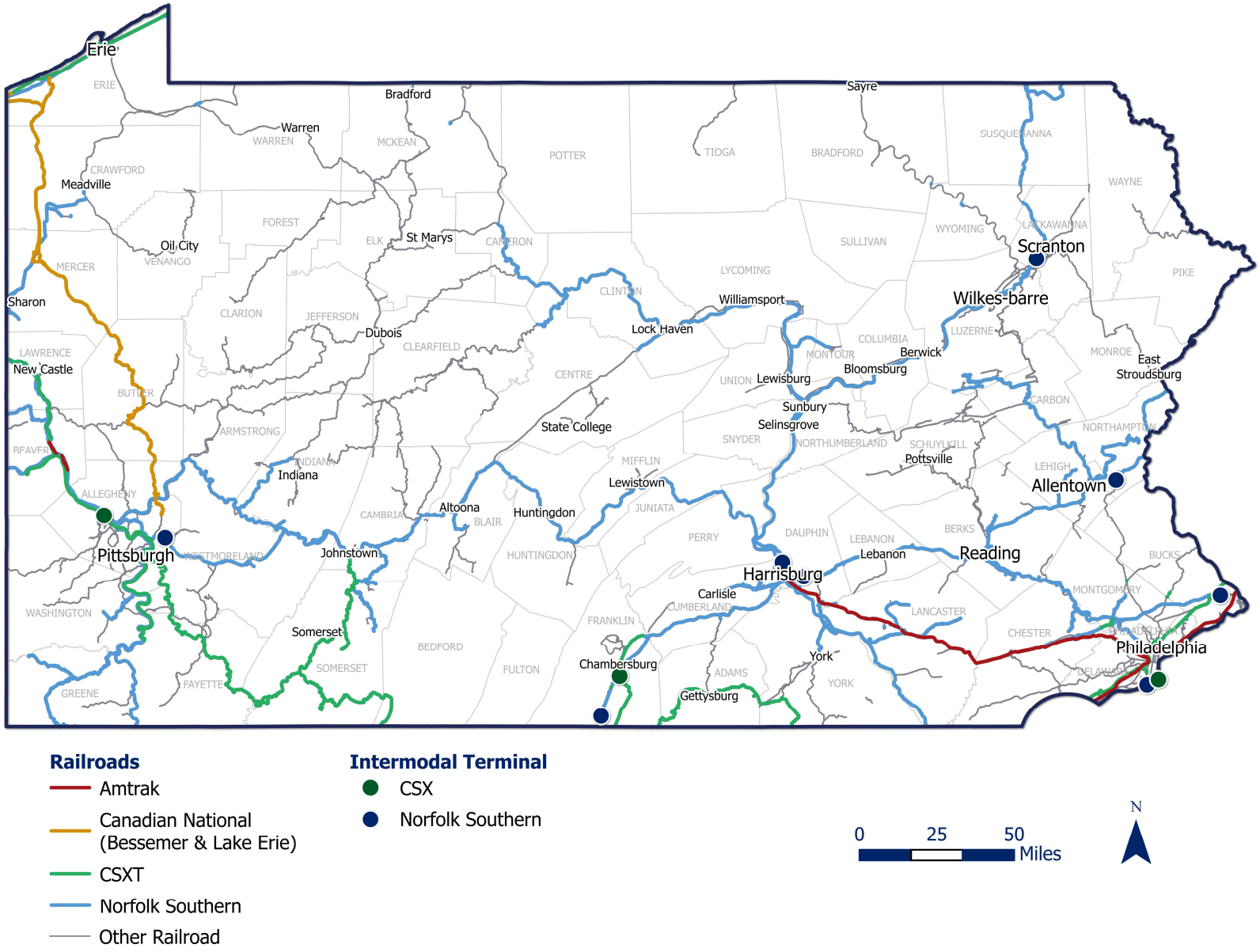
- Pennsylvania's railroad infrastructure and economy prominently ranks among the top states across the U.S. over several key statistics. Pennsylvania ranks first in the total number of freight railroads and third in total miles of rail. Pennsylvania ranks eighth in carloads originating and sixth in carloads terminated, which speaks to the volume of rail freight moving through and within the state. As related to tonnage, Pennsylvania's railroads rank ninth in originated rail tons and twelfth in terminated rail tons. These statistics are supported by a strong employment economy which sees Pennsylvania ranking ninth across the U.S. in rail employment.
- The Pennsylvania freight rail network provides the state's industries access to customers and suppliers across North America. The busiest corridors are those east-west links that historically connected Pennsylvania to origins/destinations in the Midwest and Great Plains. The previous two decades have seen strong growth on north-south routes in the eastern U.S. that have emerged since the acquisition of Conrail by Norfolk Southern and CSX in the late 1990s.
- The Pennsylvania freight rail system comprises three general categories established by the Federal Railroad Administration (FRA):
    - Three Class I railroads, comprising 3,615 route-miles in Pennsylvania (53% of the total)
    - Three regional (Class II) railroads, with 984 route-miles
    - 56 short-line (Class III) railroads, including local and terminal/switching railroads, comprising 2,243 route-miles
- The Pennsylvania railroad networks for each of the three major FRA categories are shown in **Figures 8**, **9**, and **10**.
- One of the unique elements of the Pennsylvania freight rail network is the Conrail Shared Assets system. The railroad is jointly owned by CSX and NS, and in Pennsylvania it operates on more than 65 miles of right-of-way in the Philadelphia area
- One of the transformational issues for the national railroad industry is the proposed merger of Union Pacific and Norfolk Southern to form the largest Class I railroad in the U.S. and the first railroad that would provide single-carrier coast-to-coast rail service in the nation. This is an emerging issue that is in the midst of a U.S. Surface Transportation Board (STB) review process, and will have potentially substantial implications for the state's rail system and operations if approved.
- Measured in tonnage, the top commodities transported by rail in Pennsylvania include coal, natural gas/fossil products, metallic ores, plastics/rubber, base metals, other foodstuffs, newspaper/print and crude petroleum. In addition to the products above, when considering rail ton-miles, agricultural products rank in the top six, which stands to reason given the strength and size of Pennsylvania's agricultural economy. Coal and natural gas continue to be top export materials by rail from Pennsylvania while crude petroleum and nonmetal mineral products top the products imported into Pennsylvania. A full set of commodity tables is shown in **Appendix 7: PA Rail Commodity Tables**.
- As measured by tonnage, the top state trading partners among U.S. states for rail freight originating in Pennsylvania are Pennsylvania itself, Maryland, North Carolina, South Carolina, New York and Virginia.
- The top trading partners among states for freight transported by rail to Pennsylvania (by tonnage) include Pennsylvania itself, West Virginia, North Dakota, New York, Texas, and Iowa.
- Freight Analysis Framework forecasts indicate that, except for coal, Pennsylvania's leading rail commodities are projected to increase in tonnage through 2035 and 2050. Coal tonnage is forecast to increase through 2035 before returning to approximately 2022 levels by 2050, while other leading commodities are generally expected to experience continued growth.

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- While freight rail is primarily operated and financed by the private sector, it provides significant public benefits that have long justified public investment in rail infrastructure and related freight facilities. Rail transportation helps reduce highway congestion, pavement and bridge wear, fuel consumption, and transportation-related emissions by shifting freight movements from trucks to rail. Pennsylvania's extensive freight rail network also connects industries, distribution centers, ports, and transload facilities to national and international markets, supporting economic competitiveness throughout the Commonwealth.
- The 2025 Pennsylvania State Rail Plan identifies connectivity and coordination among transportation modes as a key priority, recognizing that efficient rail-truck, rail-marine, and rail-airport connections are increasingly important to modern supply chains. Pennsylvania's rail network includes critical interchange locations, intermodal terminals, port connections, and shared freight-passenger corridors that support the movement of goods throughout the eastern United States. As freight demand evolves, maintaining adequate system capacity, improving multimodal connections, and preserving a state of good repair across both major freight corridors and shorter connecting rail lines will remain important challenges. The continued growth of distribution, logistics, manufacturing, and energy-related industries further underscores the need for investments that strengthen freight mobility while balancing community, environmental, and operational considerations. The 2025 State Rail Plan is incorporated by reference as **Appendix 8**.
- Intermodal terminals and transload facilities are the primary ties between the freight modes of trucking, water ports and rail within Pennsylvania. These facilities play an integral role in the movement of freight and goods across the state and while they are privately operated, they have direct ties to land use and transportation decisions.

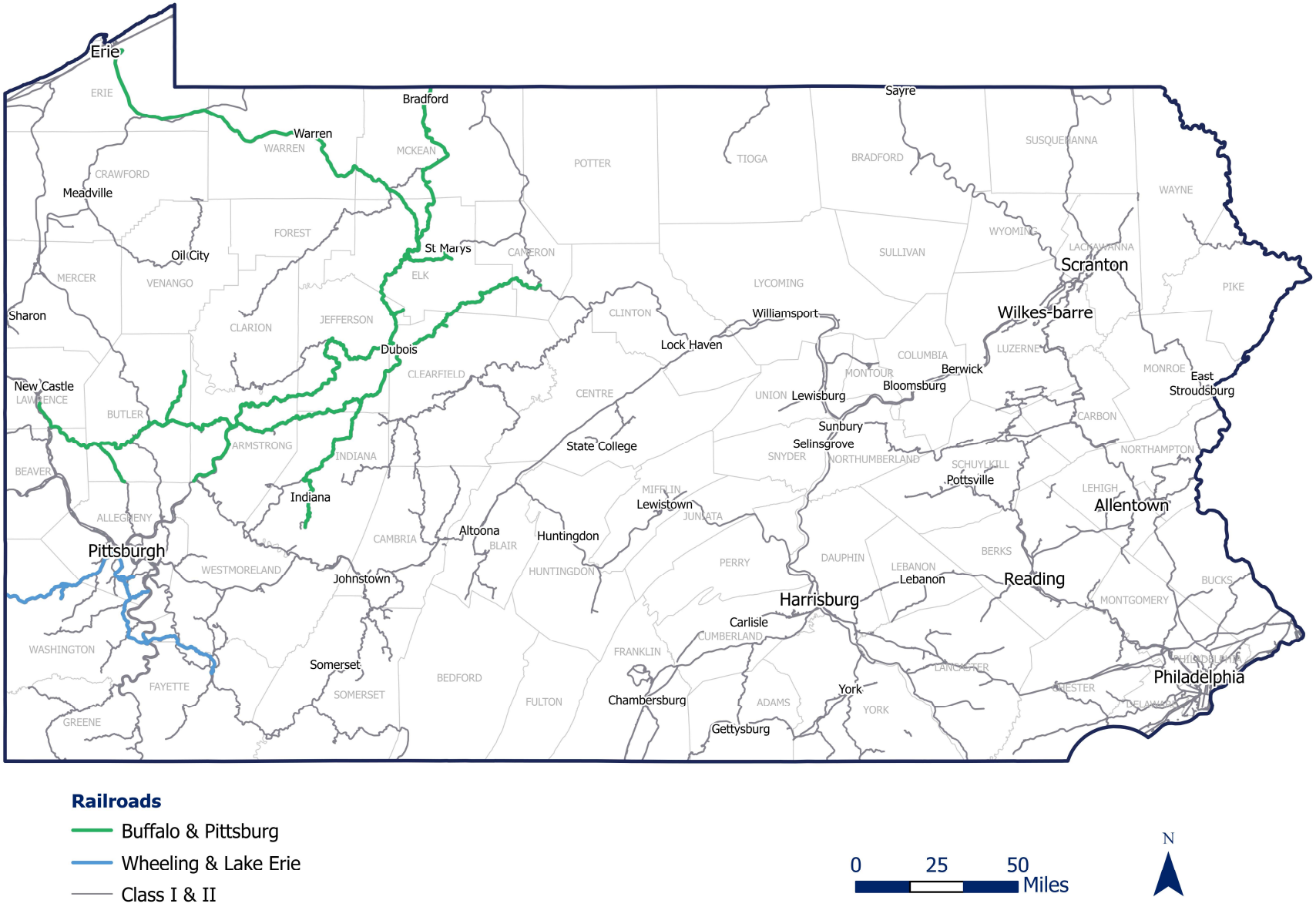
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Figure 8: Class I Railroad System



Source: Pennsylvania State Rail Plan, 2025

Figure 9: Class II Railroad System



Railroads

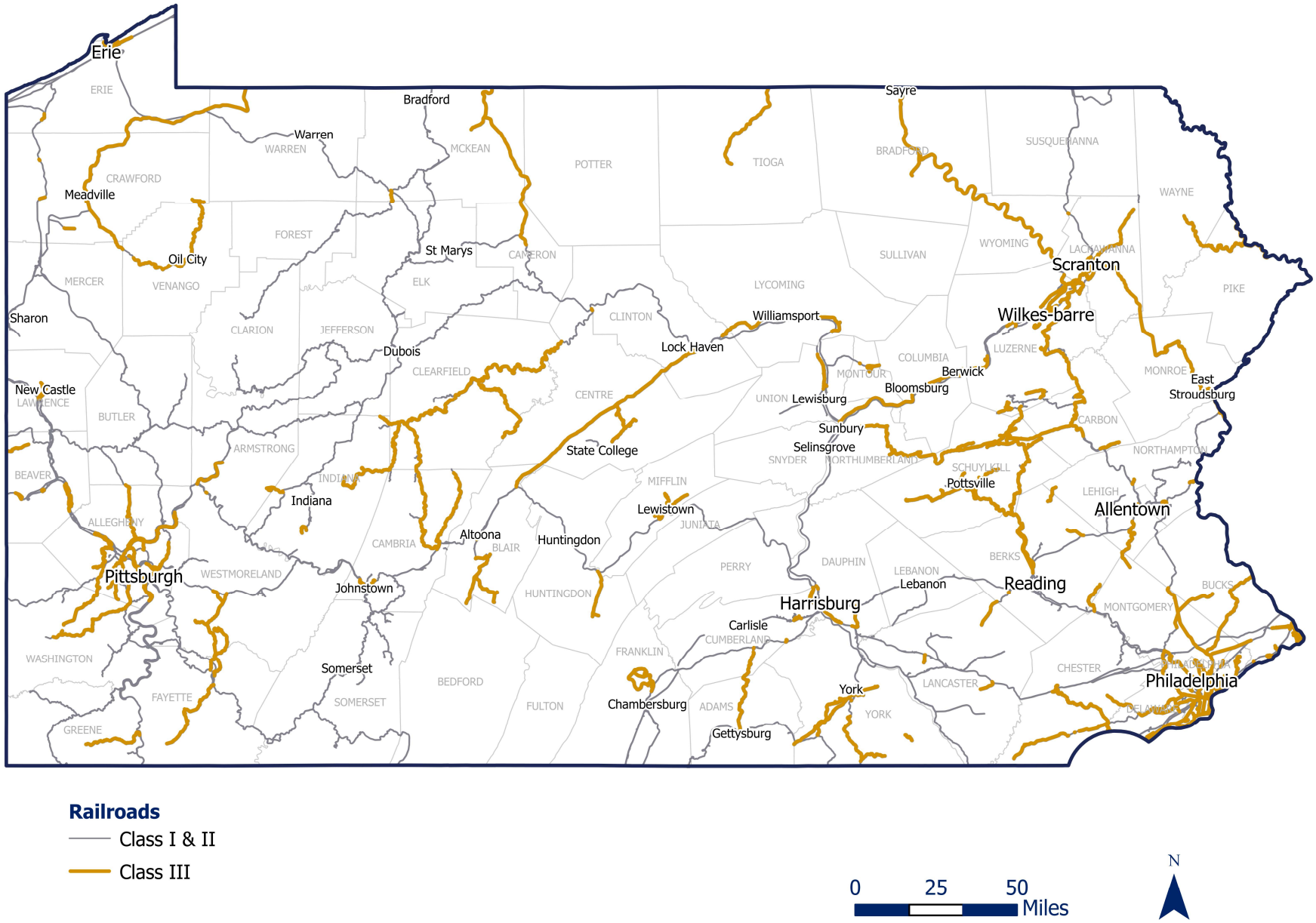
- Buffalo & Pittsburg
- Wheeling & Lake Erie
- Class I & II

0 25 50 Miles

N

Source: Pennsylvania State Rail Plan, 2025

Figure 10: Class III Railroad System



Source: Pennsylvania State Rail Plan, 2025

Planning Implications

- Pennsylvania's rail freight system is an essential component of the Commonwealth's multimodal transportation network. Efficient connections among railroads, highways, ports, waterways, airports, and freight terminals allow shippers to use the advantages of multiple modes within a single supply chain. Roadway access to marine terminals, rail yards, transload facilities, and intermodal terminals is especially important because disruptions or capacity constraints at these connections can affect freight movement beyond the individual facility.
- The different operating roles and infrastructure needs of Class I, regional, and short-line railroads are also important considerations for freight planning. Pennsylvania's smaller railroads provide connections between industries and the broader national rail network, often serving customers that depend on specialized rail equipment, industrial sidings, transload facilities, and connections with larger carriers. Maintaining these connections, improving interchange efficiency, preserving rail-served industrial locations, and bringing aging infrastructure to a state of good repair can help Pennsylvania industries retain access to competitive transportation options. These considerations also underscore the importance of public-private investment programs that address documented infrastructure needs while producing broader economic, safety, mobility, and community benefits.
- Implications of potential developments with the proposed UP-NS merger should be examined closely in 2027, particularly with regard to Pennsylvania railroad yards and operations, rail customer access, and Class III (shortline) railroad connectivity.
- The 2025 Pennsylvania State Rail Plan establishes the following updated vision:

  Pennsylvania's integrated rail system will provide safe, convenient, reliable, and cost-effective connections for people and goods. Rail is a core transportation mode that supports economic vitality and sustainable growth throughout the Commonwealth.

The Freight Movement Plan supports this vision by aligning freight rail planning and investment with the following goals of the 2025 State Rail Plan:

1. Enhance the safety and security of Pennsylvania's rail system while minimizing risks to the communities in which railroads operate.
2. Bring the rail system to a state of good repair and ensure its continued maintenance.
3. Enhance connectivity and coordination within Pennsylvania's rail network and between rail and other transportation modes.
4. Enhance quality of life in Pennsylvania.
5. Support energy efficiency, environmental sustainability, and resiliency.
6. Identify stable and predictable funding alternatives.

Together, these goals provide a framework for freight rail decisions that considers infrastructure condition, system safety, multimodal connectivity, operational capacity, economic competitiveness, community impacts, environmental sustainability, and long-term investment needs. Alignment between the Freight Movement Plan and State Rail Plan will help PennDOT and its public- and private-sector partners coordinate policies, programs, and projects affecting Pennsylvania's freight rail network.

The 2025 State Rail Plan (**Appendix 8**) is linked here: https://advancingparail.com/pennsylvania-state-rail-plan/

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Ports and Waterways

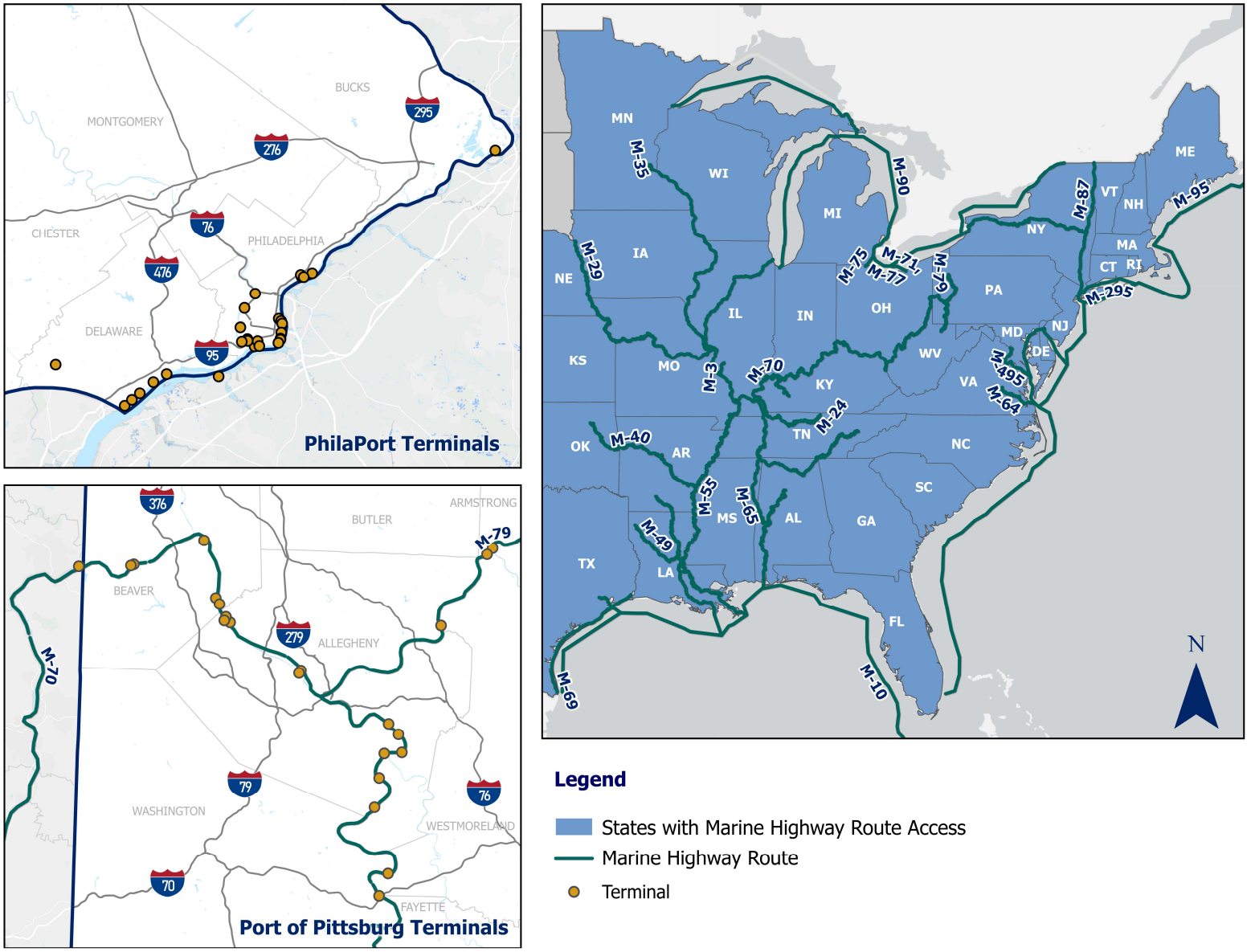


Trends & Issues

- Pennsylvania is the only U.S. state with direct access to the Atlantic Ocean, inland waterways, and the Great Lakes, positioning it as a strategic hub for maritime commerce.
- Maritime transportation continues to be the most cost-effective long-distance freight mode, with water ports serving as critical intermodal connectors between marine and landside systems.
- Pennsylvania's three water ports each function uniquely to move domestic and international commerce across deep-water, inland, and Great Lakes waterways. The Port of Philadelphia serves Atlantic Ocean vessels and transfers raw materials in bulk, as well as containerized cargoes. The Port of Pittsburgh serves predominantly river barge traffic carrying dry bulk materials for the metal, chemical, and energy industries. The Port of Erie connects the interior of North America to international waters along the St. Lawrence Seaway. Its top freight includes aggregates used in construction and specialized equipment for a growing wind power generation market.
- Each port is associated with one or more federally designated Marine Highway segments. The Marine Highway system serves as an extension of the surface transportation system. Each all-water route is designated to offer relief to landside corridors suffering from traffic congestion, excessive air emissions, or other environmental challenges.
- The U.S. Army Corps of Engineers (USACE) is responsible for maintaining waterway access and its associated infrastructure. The U.S. Marine Highway system and terminal maps for Philadelphia and Pittsburgh are illustrated in **Figure 11**.
- One of the major maritime developments in Pennsylvania since the completion of the 2045 FMP was the establishment of a new Marine Highway, M-79, which functions as an extension of M-70 and extends eastward from Pittsburgh up the Allegheny and Monongahela Rivers.
- The navigable inland waterways require significant capital investment and maintenance. Locks and dams enable vessels to traverse inland waterways. Dredging is necessary to maintain inland and coastal channel widths and depths for commercial navigation.
- The Port of Philadelphia (PhilaPort) is Pennsylvania's primary international seaport, specializing in containerized and refrigerated cargo, with major infrastructure investments and strong economic impact. In 2024, PhilaPort handled a record-breaking 841,751 TEUs (twenty-foot equivalent units), marking a 13% increase over 2023 and nearly double the volume since 2015. The port processed 6.9 million metric tons of cargo in 2023, with over 1,100 vessel calls, generating an estimated $1.5 billion in economic impact.
- PhilaPort is strategically located on the Delaware River with direct access to I-95, I-76, and the Pennsylvania Turnpike, enabling efficient truck transport. It's also served by CSX and Norfolk Southern, providing strong rail links to Northeast and Midwest markets.
- Port performance in Pennsylvania is evaluated using operational and economic indicators such as cargo throughput, vessel traffic, turnaround times, berth utilization, and job creation. These metrics help determine how effectively ports like Philadelphia, Pittsburgh, and Erie support freight movement and contribute to regional development.
- The multimodal connectivity of PhilaPort supports the movement of containerized goods, refrigerated cargo, automobiles, breakbulk, and liquid bulk, and places PhilaPort within a day's reach of over 100 million consumers, making it a vital hub in both domestic and international supply chains. PhilaPort is also a strategic military port and depends on the intermodal connections to be ready and effective should the need arise.
- A geographic breakdown of trade partners for each of the three Pennsylvania ports is shown in **Figure 12**.

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Figure 11: U.S. Marine Highway Routes and Port Terminals

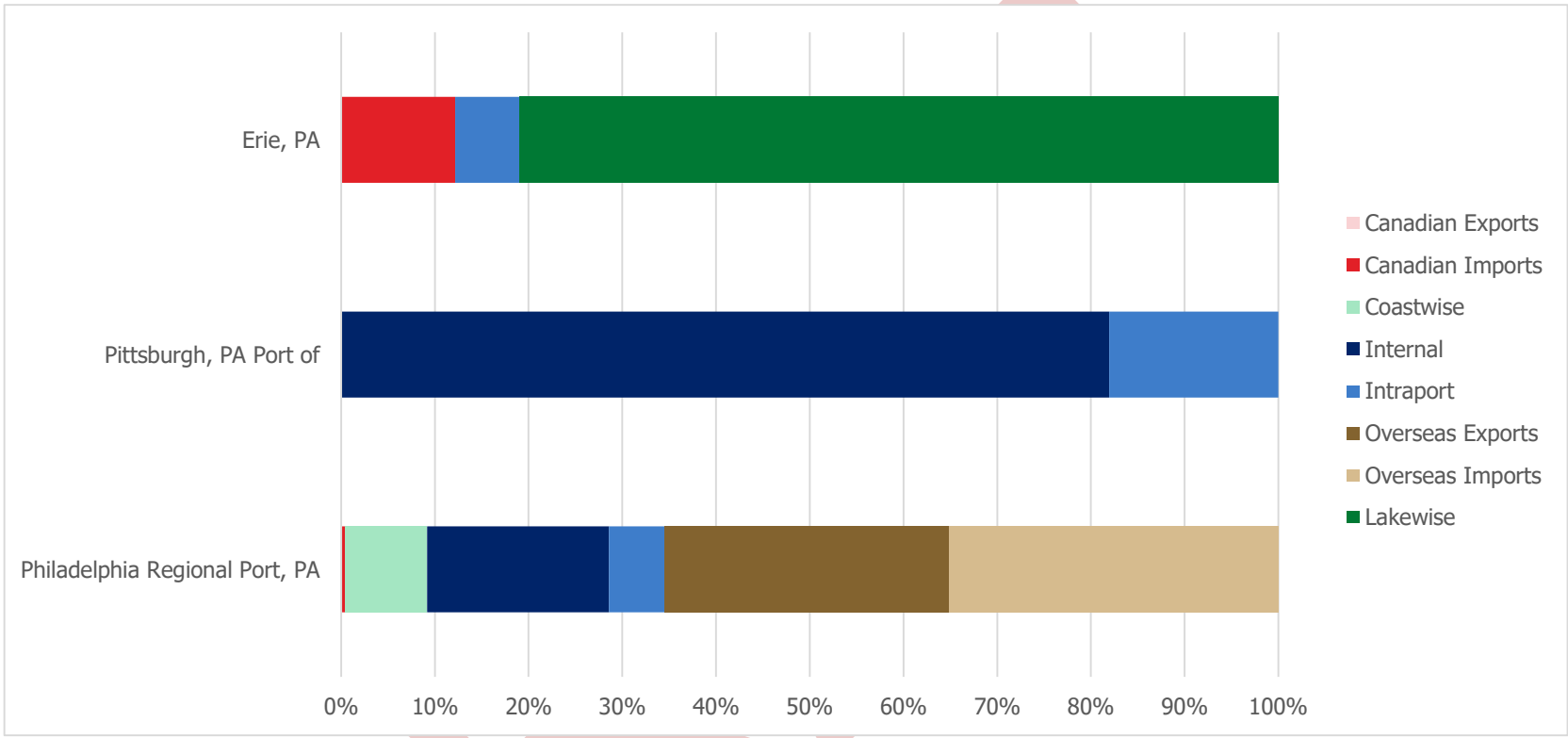


Source: USDOT; PennDOT Multimodal Transportation Bureau; PhilaPort; and Southwestern Pennsylvania Commission

- The Pennsylvania Intermodal Cargo Growth Incentive Program (PICGIP) is a state-run initiative designed to boost containerized cargo movement through Pennsylvania's ports by offering financial incentives to ocean carriers. The PICGIP offers $25 per twenty-foot equivalent unit (TEU) to ocean carriers that exceed cargo benchmarks or launch new services at PA ports. The program has moved over 3 million TEUs and awarded more than $7 million since 2015. Extended through July 2027, PICGIP includes enhanced incentives up to $500,000 annually for carriers adding a new service with cargo originating from Southeast or Far East Asia.
- The Port of Pittsburgh is a leading inland river port focused on bulk commodities like coal and chemicals, vital to energy and manufacturing. It is the 33rd busiest port among all U.S. coastal and inland ports as a group. Over the last 10 years, an average of 30 million tons of freight passed through the Port of Pittsburgh annually, 70 percent of which was coal.
- There are numerous waterfront industrial sites along the Monongahela, Ohio and Allegheny rivers that represent potential freight-oriented redevelopment opportunities. On the Monongahela River, these sites extend south into West Virginia.
- The Port of Pittsburgh is well-positioned at the easternmost end of the M-70 Marine Highway and the junction of M-70 with the recently established M-79 Marine Highway, and provides access to many industrial properties along the Ohio, Allegheny, and Monongahela rivers. However, the Port of Pittsburgh faces challenges including a decline in coal traffic and a system of aging locks and dams along the entire Mississippi-Ohio River System.
- The Lower Mon Dredging Project is a U.S. Army Corps of Engineers project to reconstruct a navigation channel in the Monongahela River between mile 23.8 and mile 41.5 of the river (measured upstream of the confluence of the Monongahela with the Ohio River). Phase 1 of this effort is aimed at assessing dredging requirements to maintain a 9-foot maintenance depth beneath the waterline to support maritime commerce on the river.
- The Port of Erie is located on the southeast shore of Lake Erie in a natural bay sheltered by the Presque Isle peninsula. The port provides industries in northwestern Pennsylvania with intermodal access to Mid-Atlantic, Mid-West, and Canadian markets across the Great Lakes region, as well as to international markets via Lake Ontario and the St. Lawrence Seaway. A port-owned rail spur connects the dock face and shipyard to the CSX mainline about a half-mile from shore. The Bayfront Parkway provides roadway connections to I-79 and I-90.
- The Port of Erie, Pennsylvania's only Great Lakes port, handles over 600,000 tons of inbound and outbound cargo annually, playing a vital role in regional logistics and economic development. Bulk materials such as limestone are delivered for use in local construction projects, while lake freighters transport salt to the port for distribution to state and local highway departments. In addition to bulk goods, the port also accommodates large project cargo, including power generation equipment.
- The Port of Erie has strong multimodal transportation access that supports the specialized needs of Great Lakes cargo movement. It has direct highway connections to Interstate 90, Interstate 79, and U.S. Route 20, enabling efficient truck transport across the tri-state region. The port is also connected to major rail networks, facilitating cargo movement to inland destinations. Additionally, its proximity to Erie International Airport supports airfreight logistics and crew transfers. This combination of road, rail, air, and maritime access positions the Port of Erie to serve both domestic and international markets effectively within a 500-mile radius of over 85 million people.
- USDOT commodity flow data for Pennsylvania, including domestic and international import and export tonnage, is shown in **Appendix 9: PA Waterborne Commodity Tables**.

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Figure 12: PA Ports Maritime Trade Breakdown



Source: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center (10/23/2025)

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Planning Implications

- Maritime transportation continues to be the most cost-effective long-distance freight mode, with water ports serving as critical intermodal connectors between marine and landside systems. Planning is essential in all aspects of maritime freight transportation, as outlined below.
- Environmental: The redevelopment of legacy industrial sites with waterfront access for freight-intensive industries is a prime economic development opportunity for Pennsylvania. However, this is constrained at many prime sites by environmental considerations such as legacy pollution caused by mining and industry, nutrient runoff, and water quality degradation. This particularly affects inland waterways such as the Ohio, Allegheny, and Monongahela Rivers, and for sites downstream along the Susquehanna River outside of Pennsylvania.
- Sustainability: Cold ironing, alternative fuels, and minimizing carbon emissions are the focus of key initiatives in the maritime sector to reduce environmental impacts and promote sustainability.
- Growth and Maintenance: Due to its location at the eastern reaches of the Mississippi River system, port district operations at the Port of Pittsburgh area are heavily impacted by lock and dam closures and drought conditions downstream to address maintenance and repairs. The downstream locks and dams outside Pennsylvania represent the bottlenecks in the inland waterway system. Automated locks in Pittsburgh will be tested to increase goods movement while decreasing the cost of operations.
- Funding: State and federal funding directly influences port performance outcomes by enabling infrastructure upgrades, dredging, and terminal expansions such as the $217 million MEGA grant awarded to PhilaPort in 2024 for its SouthPort terminal facilities expansion.
- Funding also supports modernization of aging lock and dam systems in inland waterways, particularly in Pittsburgh, and helps agencies like PennDOT and the U.S. Maritime Administration collect performance data to guide strategic planning and investment.
- Market Reach and Customer Connectivity: Multimodal transportation access and intermodal connections to port facilities are critical elements of an efficient, environmentally sound freight transportation system. Improvements to first-mile/last-mile truck access to waterfront properties and on-dock rail capabilities should be encouraged, and promoted where feasible.
- Technology presents opportunities for port and waterway efficiency and reliability that can reduce risk in the supply chain from source to consumer. From an operations perspective, automated/semi-automated, robotic, and electrified vessels, terminals, as well as landside facilities can improve overall throughput and efficiency.
- Information technology can enable automated appointment scheduling at terminals to expedite truck movements/turn-around times, thus updating changes in schedule to reduce downstream impacts. Technology can also monitor infrastructure conditions, with results anticipating and informing capital project needs.
- Artificial Intelligence (AI) usage can enhance operations, security, asset management in marine transportation and terminal operations.

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Air Cargo



Trends & Issues

- Pennsylvania continues to serve as a vital hub for aviation, with nearly 700 aviation facilities statewide. This includes 229 privately owned and 121 public-use airports. Beyond airports, the Commonwealth hosts 313 heliports, 9 seaplane bases, 3 gliderports, 13 ultralight flight parks, and 1 balloon port.
- Fourteen airports in the state are designated as commercial service airports under 49 U.S.C. 47102(7), meaning they offer scheduled passenger service and handle at least 2,500 enplanements annually. These airports also manage the majority of Pennsylvania's air cargo operations. Pennsylvania's commercial service airports are mapped in **Figure 13**.
- Air transportation is the fastest mode for moving freight, but is also the most costly. Therefore, it is generally used to transport lower-weight, time-sensitive, and high-value cargoes over long distances.
- Key industries that rely on air transportation for goods movement include technology/biotechnology, pharmaceuticals, and overnight parcel delivery.
- One of the growing trends in the air cargo industry is the increased volume of freight moved in the cargo holds of passenger aircraft instead of dedicated air freighters.
- Airports are vital transportation hubs, connecting local communities to global networks for moving people and goods, while also supporting critical services like air cargo, law enforcement, emergency medical care, firefighting, and disaster response. They drive economic and social benefits, creating jobs on-site and attracting visitors who contribute to local, regional, and state economies through spending and commerce.
- In 2024 Philadelphia International Airport was the busiest airport in Pennsylvania, ranking 21st nationally in enplanements. Pittsburgh International Airport follows, ranking 48th nationally. Both airports have experienced about a 10% increase in total enplanements since 2023.
- As of 2023, PHL generated $18.7 billion in spending annually and supports more than 102,600 full-time jobs for the 11-county Philadelphia MSA while serving 28 million passengers. 2024 rankings among U.S. airports for PHL were #21 for total passengers, #20 for total cargo (freight and mail), and #25 for total movements. PHL offers 449,761 sq. ft. of cargo space across six active cargo facilities and an American Airlines maintenance hangar. Freight carriers include: UPS, FedEx, Amerijet, and ABX Air. PHL has undergone more than $2.4 billion in capital improvements since 2000.
- Lehigh Valley International Airport (ABE) received $40,798,046 of funding from the U.S. Department of Transportation (USDOT) INFRA program to construct the Northside Logistics and Cargo Complex. The funding will be used to create a new cargo facility, parallel taxiway, an aircraft parking apron, and new roadways. Air cargo activity at ABE has grown 800 percent from 2014 to 2024 and recorded a fourth consecutive year of record annual volume in 2023, processing 275,000,000 pounds of air cargo. Air service at ABE is provided by Allegiant, American Airlines, Delta, and United.
- With its strategic location between New York City and Chicago, Pittsburgh International Airport (PIT) enables efficient distribution both east and west. PIT is located within 500 miles of 50% of the U.S. population. The airport has no congestion and easy access to ground transportation, and the 8.8 million people living within a 2-hour drive provides an ample customer base and labor force. It has lower costs compared to other key gateways in the region, and a robust local supply chain network. Cargo 4 at PIT opened in 2025, enabling Boeing 747 freighter operations. Its modern design, prime location, and foreign trade benefits attract major cargo airlines, enhancing regional logistics, creating jobs, and supporting economic growth through increased air freight capacity and efficiency.
- Harrisburg International Airport (MDT) is positioning itself as a growing cargo hub. In 2025, the Susquehanna Area Regional Airport Authority issued a Request for Proposals to develop new air cargo facilities, aiming to expand capacity, attract freight operators, and leverage its strategic location near major highways and distribution centers. MDT carriers include American Airlines, UPS, and FedEx.

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Figure 13: Commercial Public-Use Airports in Pennsylvania



Planning Implications

- Intermodal connectivity, particularly highway/truck access, is essential for air cargo. Air cargo facilities rarely handle freight that is moved to or from an origin or destination in the immediate vicinity of an airport; most of this cargo travels longer distances by a different mode.
- Public- and private-sector stakeholders involved in the FMP outreach process indicated that a lack of uniform data across different types of airports is a potential problem, particularly for small airports that do not have their data reported in national resources. This makes it difficult for airport managers and public officials to identify and respond to changing trends.
- Overnight carriers such as FedEx and UPS are the main form of air cargo activity at small airports, but there may be great potential at these airports for economic development related to specialized cargoes in the technology, pharmaceutical, and biomedical industries.
- Links between air cargo and economic development are critical. Tying infrastructure improvements and enhanced air cargo amenities to industrial recruitment is a sound approach to collaborative land use and transportation planning. Air transport of specialized, time-sensitive cargo such as medical supplies and pharmaceutical products for rural hospitals was identified by industry stakeholders as a major economic development opportunity for small commercial airports throughout the Commonwealth.
- At the state level, PennDOT's Unmanned Aircraft System (UAS) Policy supports drone deployment for both public and contracted operations, emphasizing safety, privacy, and compliance with federal and state laws. As regulatory frameworks mature, Pennsylvania is well-positioned to expand drone-enabled freight services across healthcare, infrastructure, and logistics sectors.
- Drones are being utilized for surveying, inspecting bridges, and managing incidents. They provide faster data collection, improved safety, and reduced costs. The integration of drones into freight-related infrastructure projects, such as monitoring construction zones and assessing disaster sites, has significantly enhanced operational efficiency across Pennsylvania's transportation network.
- Cargo drones are becoming increasingly popular for last-mile and inter-facility freight delivery. For instance, companies like Zipline are collaborating with Pennsylvania-based organizations such as WellSpan Health to deliver medical supplies and prescriptions up to seven times faster than traditional automotive methods. These autonomous systems can reduce emissions by up to 97 percent, and their scalable logistics model is creating opportunities for broader freight applications in both rural and urban areas.
- In December 2022, the Pennsylvania State TAC released the *Pennsylvania Aviation System Strategic Investment Plan*. This study covered both passenger and freight issues in the Commonwealth, and included a set of strategic actions to address air cargo needs. These include:
    - Assess the local and regional business needs for air cargo services to align businesses with future air cargo opportunities.
    - Develop a guide for air cargo analysis and integration with planning application at the state and regional levels.
    - Engage aviation stakeholders in the updates of state and regional freight plans and studies to encourage new, collaborative approaches to intermodal connectivity and to foster stronger linkages among cargo, land use, and economic development.

  These strategic actions all have linkages to the 2050 FMP, and reflect the input received from air cargo stakeholders in the FMP outreach process. The TAC *Pennsylvania Aviation System Strategic Investment Plan* is included in the FMP by reference as **Appendix 10**.

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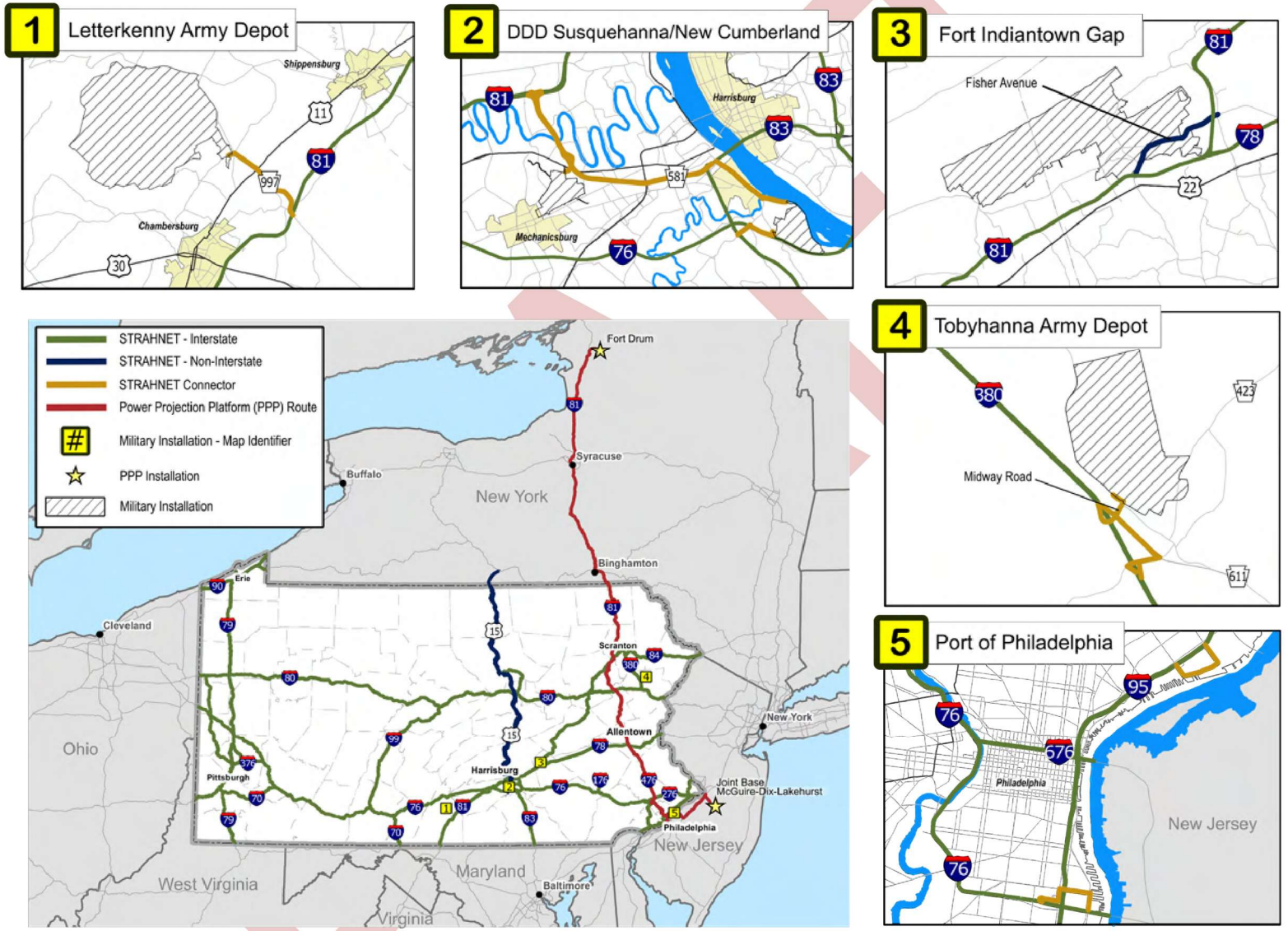
Consideration of Military Freight



- U.S. military needs on the civilian transportation network are established through the United States Transportation Command (USTRANSCOM), a unified combatant command which provides support to other U.S. combatant commands, the military services, defense agencies and other government organizations.
- USTRANSCOM has established two primary national transportation route networks that serve as strategic assets for the U.S. Department of Defense. These include the Strategic Highway Network (STRAHNET) and the Strategic Rail Corridor Network (STRACNET).
- The STRAHNET, originally established in 1956, is a nationwide system of about 62,400 miles of highways, including the Interstate System, plus an additional 1,800 miles of STRAHNET Connectors that link military installations, marine ports, and airports.
- The STRACNET is a network of civil railroad lines and connectors that are designated to meet minimum U.S. Department of Defense requirements for defense readiness. The STRACNET was established in 1993 and has undergone review and revisions at five-year intervals since then.
- The U.S. Department of Defense has identified five military installations in Pennsylvania as key facilities. These include:
    1. Defense Distribution Depot (DDD) New Cumberland (includes DDD Susquehanna in Mechanicsburg) in Cumberland and York Counties
    2. Tobyhanna Army Depot in Monroe County
    3. Fort Indiantown Gap in Dauphin and Lebanon County
    4. Letterkenny Army Depot in Franklin County
    5. Port of Philadelphia
- In Pennsylvania, the sole non-Interstate STRAHNET route is US-15 from I-81 in Cumberland County to the junction of I-180 and the newly designated section of I-99 in Williamsport. The STRAHNET and Connectors in Pennsylvania are shown in **Figure 14**.
- Pennsylvania's STRACNET routes include railroad mainlines and designated connector routes (**Figure 15**).
- U.S. Military Power Projection Platforms (PPPs) are facilities that serve a strategic purpose in deploying one or more active or high-priority reserve units. Roadways between PPP installations and designated airfields and marine ports of embarkation are designated as PPP Routes. These routes are a subset of the STRAHNET system.
- U.S. Department of Defense mission requirements call for "ensuring PPP Routes are maintained at a capable design, performance, and condition standard to support national emergency deployments." (U.S. Military Surface Deployment and Distribution Command, Transportation Engineering Agency, PPP Route Designations (5/11/2022)
- The PPP routes within Pennsylvania provide access to the Port of Philadelphia from two military installations in the Northeastern U.S.: Fort Drum in upstate New York and Joint Base McGuire-Dix-Lakehurst in central New Jersey (Figure 15).

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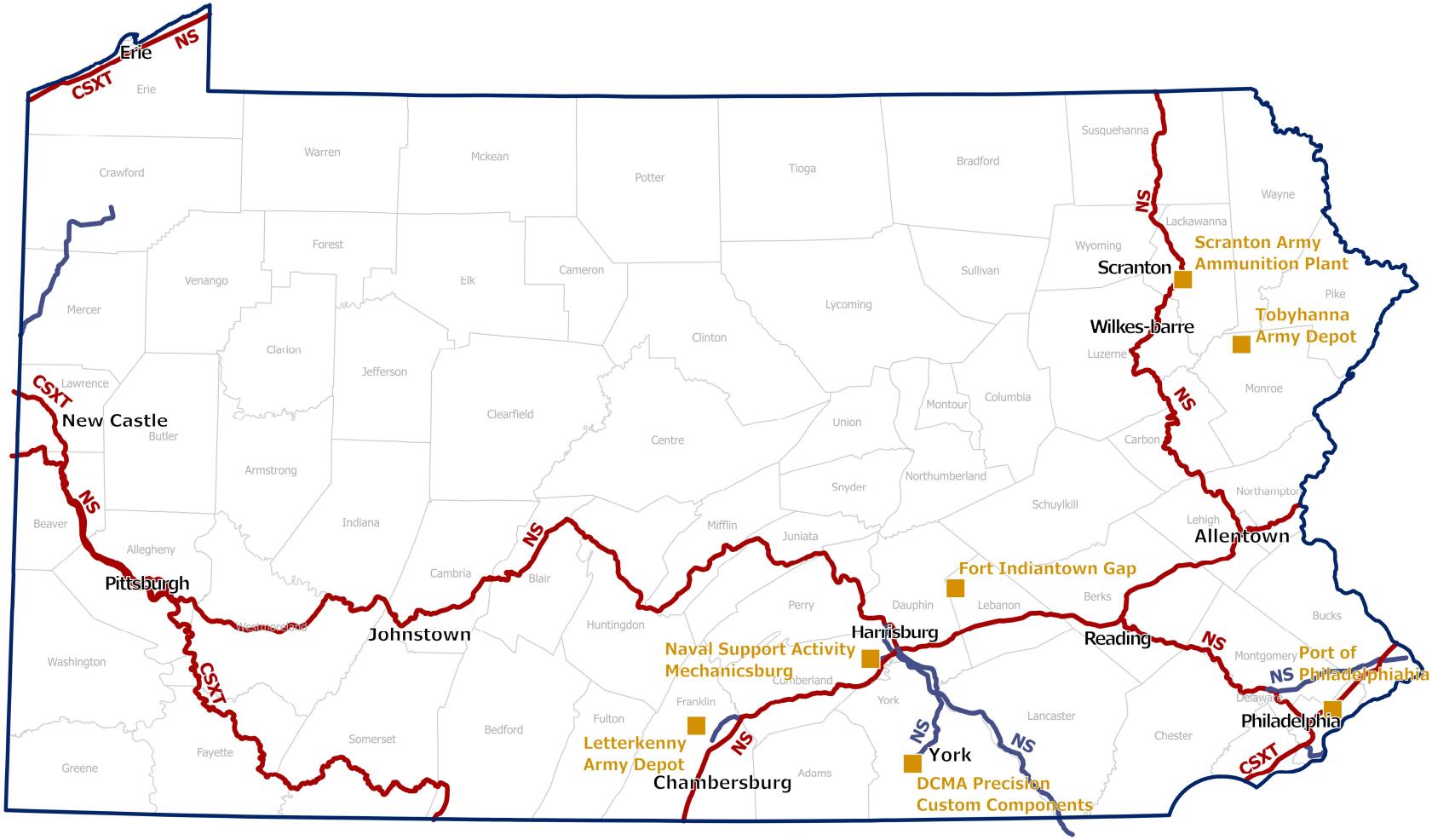
Figure 14: Pennsylvania Strategic Highway Network (STRAHNET) and Power Projection Platform Routes



NOTE: U.S. Department of Defense information not yet updated to reflect recent upgrade of US-15 to I-99 north of Williamsport

Source: Military Surface Deployment and Distribution Command – Transportation Engineering Agency

Figure 15: Pennsylvania Strategic Rail Corridor Network (STRACNET)



Source: Federal Railroad Administration

Critical Urban & Rural Freight Corridors

Trends & Issues

- The federal requirements and parameters for designating critical urban freight corridors (CUFCs) and critical rural freight corridors (CRFCs) in each state were formally established under the FAST Act of 2015 and amended in 2021 under the IIJA. Pennsylvania's current limits are 150 miles for CUFCs and 300 miles for CRFCs.
- PennDOT developed a detailed methodology for evaluating roadway segments across the state and prioritizing them for potential certification as CUFCs and CRFCs. This evaluation process included a wide range of criteria, such as freight tonnage, truck volumes, truck vehicle-miles traveled, proximity to major freight generators and intermodal facilities, weight restrictions, truck bottleneck locations, and others.
- PennDOT designated a listing of proposed CUFCs and CRFCs, which FHWA certified in February 2019. These were updated in 2025-26 to reflect revised urban boundaries under the 2020 U.S. Census. The lists of the critical urban and rural freight corridors are included as **Appendix 11** and mapped in Figure 3.

Planning Implications

- The PennDOT evaluation criteria used to develop the current list of CUFCs and CRFCs was a cohesive approach to identifying freight transportation infrastructure needs in the context of freight-related land use characteristics.
- This evaluation process can be refined and expanded to incorporate a larger freight network in Pennsylvania that goes beyond the critical freight corridors identified in the FAST Act and IIJA requirements. Variations of it have been used in some MPO regions in their planning efforts to guide the process of identifying core regional freight networks in their respective regions.
- The aggregate lengths of the CUFC and CRFC segments listed in **Appendix 11** are established under the IIJA and its accompanying USDOT guidance, and may be revised over time as statutory limits change, urban boundaries change, and the data used to evaluate and prioritize these corridors is updated in the future. PennDOT should be prepared to implement its refined methodology to meet future changes in federal requirements for freight corridors with special designations such as these CUFCs and CRFCs.

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Pipelines



Trends & Issues

- Pipelines are a critical component of Pennsylvania's freight infrastructure, forming part of a vast national network that supports the movement of energy commodities essential to both the state and the nation. According to the U.S. Energy Information Administration (EIA), Pennsylvania was the nation's second-largest natural gas producer after Texas in 2023. Its extensive pipeline mileage, and its strategic location in the Northeast underscore the importance of thoughtful pipeline planning in the statewide freight context.
- Pennsylvania has an extensive network of more than 96,000 miles of gas pipelines organized under the following categories:
  - 49,800 miles of distribution main lines
  - 31,400 miles of distribution service lines
  - 10,500 miles of transmission pipelines
  - 4,700 miles of gas gathering lines
  - 750 miles of gas gathering lines
- The state is also served by more than 4,200 miles of liquid pipelines for the following commodities:
  - 2,600 miles for refined petroleum products
  - 1,600 miles for highly volatile, flammable and toxic liquids (2 tanks)
  - 45 miles for crude oil

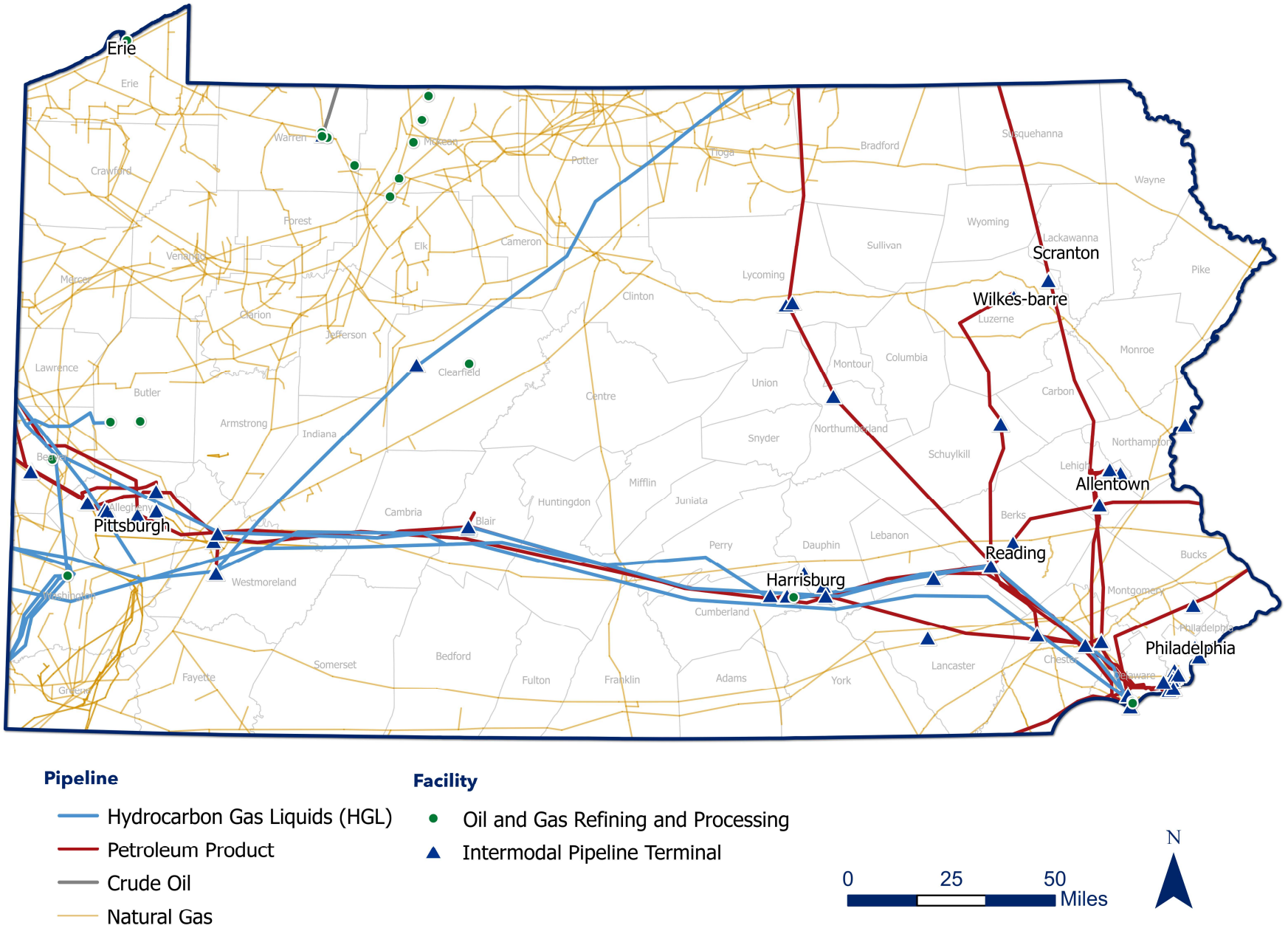
  Pennsylvania's pipeline network is shown in **Figure 15**.
- Natural gas has grown significantly in the state's electricity generation mix, rising from less than 5% in 2005 to more than 36% today. The electric utility sector now accounts for roughly half of all natural gas consumed in the state.
- As measured by tonnage, the top originating states for commodities transported by pipeline to Pennsylvania are West Virginia, New York, Delaware, New Jersey, and Louisiana.
- The top destination states for commodities transported by pipeline from Pennsylvania are New Jersey, New York, Maryland, Ohio, and West Virginia. A full set of commodity flow tables for pipeline transport is included in **Appendix 12**.

Planning Implications

- Pipelines are generally considered the safest and most cost-effective means of transporting bulk liquid and gas commodities over long distances.
- Natural gas extraction and processing will continue to play a major role in Pennsylvania's economy, driven by natural gas development from the Marcellus and Utica Shale deposits.
- The Marcellus Shale boom has driven rapid pipeline expansion, supporting both upstream production and downstream manufacturing, including new facilities such as ethylene crackers and chemical plants. By providing a local outlet for ethane, Marcellus Shale enables downstream industries, chemical plants, plastics manufacturers, and related businesses to thrive in Pennsylvania. This reduces reliance on Gulf Coast facilities, attracts billions in investment, and creates thousands of construction and permanent jobs.
- Future surface transportation needs for freight movement should incorporate consideration of manufacturing sites and transload terminals that handle materials transported by pipeline, as these facilities play a critical role in shaping freight demand and infrastructure requirements.

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Figure 16: Pennsylvania Pipeline Network



Source: U.S. Bureau of Transportation Statistics, National Transportation Atlas Database (NTAD)

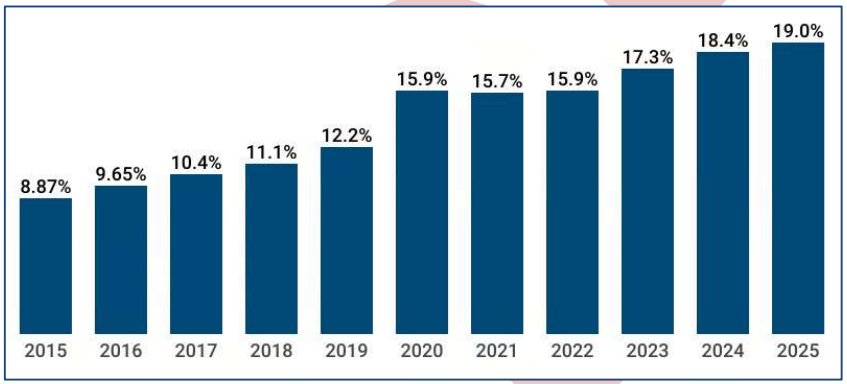
Impacts of E-Commerce on Freight Infrastructure



Trends & Issues

- E-commerce has steadily grown as a share of all retail sales in the U.S. (see **Figure 17**). National e-commerce sales now comprise nearly 20% of total U.S. retail sales.
- In 2025, the Pennsylvania Transportation Advisory Committee published a study of e-commerce in the Commonwealth. The study report is attached by reference as **Appendix 13: *Transportation and Land Use Implications of E-Commerce***.
- The study included a series of findings in six categories: Transportation Demand & Operations, Employment and Economic Development, Land Use, Technology, Data Needs, and Revenue.
- A total of 14 recommendations were included, in the areas of Transportation Planning, Infrastructure & Support, Land Use and Local Government Support, Public-Private Sector Collaboration, and Data Collection & Analysis.

Figure 17: E-Commerce as a Share of Total, US Retail Sales



Source: US Census Bureau

Planning Implications

- E-commerce as a portion of overall retail activity is likely to grow in the future. At the same time, the distinction between e-commerce and traditional retail and warehousing/distribution is blurring as more major U.S. retail chains operate retail sales, e-commerce fulfillment and conventional distribution to retail stores out of the same facilities.
- The impacts of e-commerce growth occur primarily at the local level at both ends of the delivery process. A typical fulfillment center employs more workers than a traditional warehouse, and deliveries are made in larger numbers of smaller delivery trucks and vans. And street-level impacts are observed in urban areas where delivery vehicles compete for curb space with motorists, cyclists, and public transit vehicles.
- Transportation and land use planners should examine the need for off-street loading areas or dedicated on-street loading zones in urban areas to address the growing demands of e-commerce.
- E-commerce growth and innovations in delivery processes often outpace land use regulations.
- E-commerce has had a transformational impact on traditional retail centers, particularly in small towns. This presents both a challenge from declining use of commercial space as well as an opportunity for new business establishments that can be well positioned to take advantage of broader customer access through e-commerce.
- Workforce access and public transportation needs are more acute for e-commerce facilities, due to the higher number of employees compared to conventional warehousing and distribution facilities.
- A review of “complete streets” design guidelines may be warranted in areas with heavy concentrations of e-commerce delivery activity.

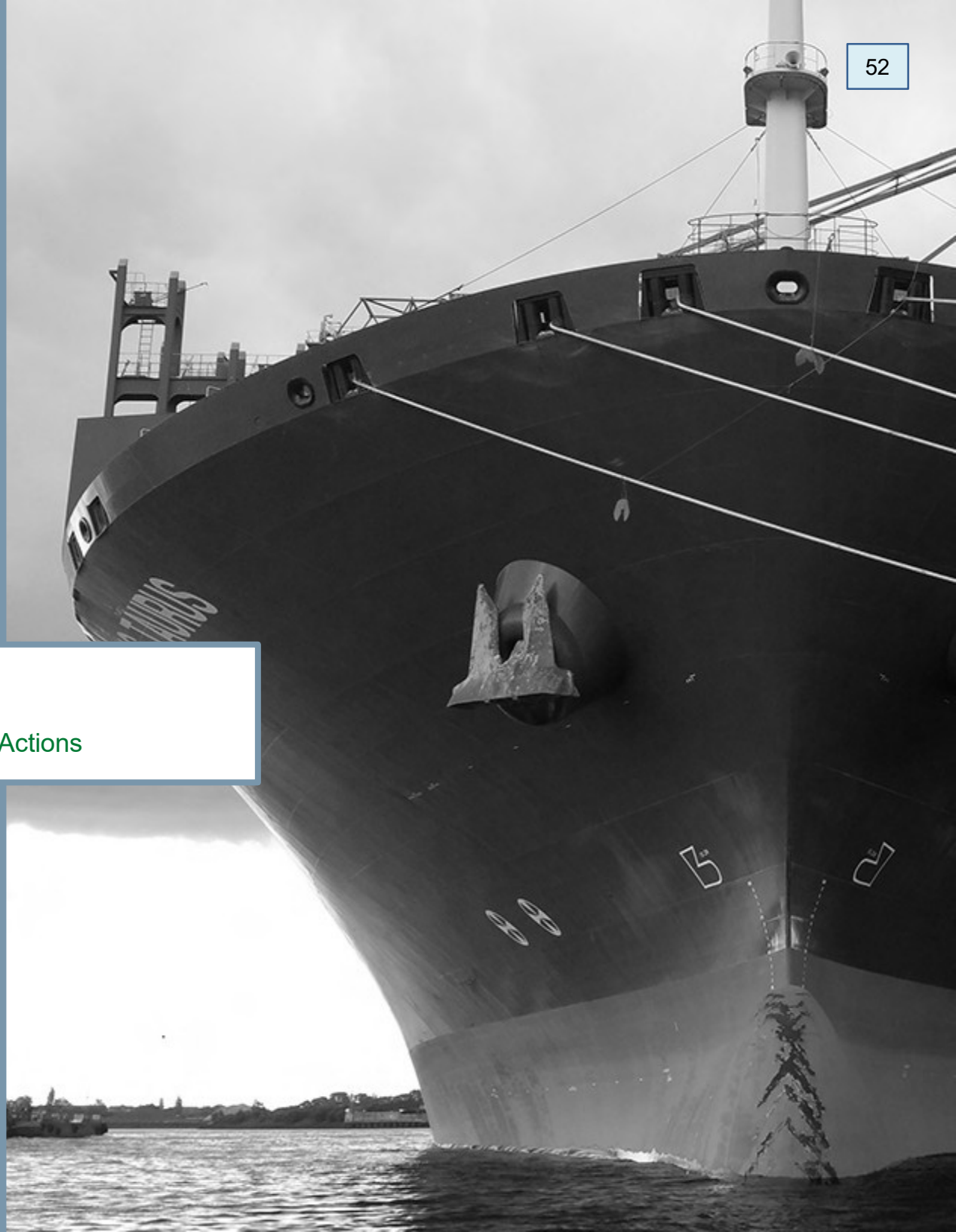
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Strategic Directions: Where We Need to Be

SECTION CONTENTS

Introduction

Goals, Objectives and Actions



Introduction

Establishing strategic directions in a planning process is about defining a desired future and determining how to achieve that future. What are the characteristics of the transportation system Pennsylvania needs now and in 20 years? How can limited resources best be directed to achieve that future system?

Goals, Objectives & Actions

The 2050 FMP builds on the Goals and Objectives of the 2045 FMP. A sixth goal has been added to the five in the 2045 FMP to establish a framework for building and enhancing organizational capacity for freight planning efforts at PennDOT.

Goal statements, described on the following pages, convey various facets of that envisioned future. They are developed to align with national planning priorities and requirements, while also reflecting top concerns expressed by regional planning partners, local governments, and the general public.

Objectives are more specific, defining what needs to be done to make progress under each goal area. They consider the starting point (existing conditions) as well as current trends and opportunities.

Lastly, strategic **Actions** are specific steps to be taken by PennDOT, MPO and RPO partners, other Commonwealth agencies, and other freight stakeholders to advance the safe, efficient and sustainable transportation of freight in Pennsylvania. These Actions are detailed in **Appendix 14**.

Together, these three elements of the FMP set a course for PennDOT and its partner agencies over the four-year implementation horizon for this 2050 Freight Movement Plan.

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GOAL A: LAND USE & ECONOMIC DEVELOPMENT

Align freight mobility initiatives, programs and projects with economic development and land use.	**Land Use Objectives**
Freight-intensive land uses are directly linked to the growing demands on Pennsylvania's transportation infrastructure. Major generators of freight transportation demand include manufacturing facilities, warehousing/ distribution centers, ports, intermodal terminals, and air cargo facilities. In addition, resource-related industry sectors such as energy, mining, and agriculture are an integral part of the state's economy, and support a global customer base. Aligning transportation infrastructure investment with freight-oriented economic development and land use planning is an effective way to ensure that infrastructure costs correlate closely with the economic benefits of these investments. This goal is intended to establish and enhance a process in which economic benefits of various industries are measured, and industries that provide substantial benefits in terms of employment, contributions to gross regional product (GRP), tax revenues, supply chain relationships to other Pennsylvania industries, and links to national and global transportation assets become an integral part of decision-making for transportation infrastructure investments. Further, there is the need to coordinate transportation and land use in the best interest of communities, PennDOT, and others. This more proactive approach has great potential for more orderly development and cost savings, and presents an opportunity to coordinate with other federal and state agencies to promote brownfield redevelopment opportunities in Pennsylvania's legacy industrial areas.	A-1: Manage and refine a core Pennsylvania highway freight network and improve mapping of the network. A-2: Develop industrial land use and transportation planning guidance for MPOs/RPOs and municipalities. A-3: Collaborate with other organizations to assemble recommended industrial site development standards and ordinances.

GOAL B: FREIGHT MOBILITY

Advance project investments that enhance freight mobility.	**Freight Mobility Objectives**
Long-term forecasts indicate that freight transportation demand will grow substantially in Pennsylvania in the future, driven by population changes (primarily growth in the state's urbanized areas), employment growth, and associated consumer and business demand for products and services. According to Freight Analysis Framework (FAF) forecasts developed by the USDOT, truck and rail freight (measured in tonnage) in Pennsylvania is projected to grow by 56% and 5%, respectively, between 2024 and 2050. In addition, the Port of Philadelphia has proposed an ambitious set of initiatives to grow in the future through improvements in efficiency, market penetration, and commodity diversification as it positions itself competitively against other East Coast ports. This freight transportation activity will take place on an aging transportation system in a mature region where opportunities to expand capacity are limited. Key highway links on the regional roadway network are subject to recurring congestion that add time and cost to truck movements. It will be essential that project investments in transportation infrastructure be focused on assets that provide the most value in terms of capacity utilization and allow the state to meet its freight transportation needs in a manner that is as cost-effective as possible while minimizing environmental impacts. The overarching goal for the future is for improved freight mobility across multiple transportation modes, with a focus on non-truck transport for long-haul shipments that can be made using more energy-efficient modes such as railroads and waterways. This will require ongoing investment not only in highway, railroad, and marine infrastructure, but in protecting and enhancing access to terminals that are critical to the overall operation of the freight transportation system. A Freight Investment Plan (FIP) outlining a fiscally constrained program of highway mobility improvements under the National Highway Freight Program (NHFP) is included as **Appendix 15**. A representative set of potential freight rail infrastructure improvements outlined in the 2025 State Rail Plan is included in **Appendix 8**.	B-1: Continue to identify, measure, and improve truck bottlenecks. B-2: Preserve and enhance major freight transportation assets, including waterways, railroads, major truck corridors, intermodal terminals, and air cargo facilities. B-3: Pursue opportunities to expand truck parking capacity and safety infrastructure.

GOAL C: ANALYTICAL TOOLS & PROCESSES

Provide planning, data, and analytical tools for improved decision-making and collaboration with freight stakeholders. Reaffirm State Freight Data Repository components and solicitation efforts.	**Analytical Tools & Processes Objectives**
Freight activity has been growing faster than passenger travel for many modes of transportation in Pennsylvania and across the U.S. as a whole. It is incumbent upon transportation agencies to expand and enhance their capabilities in understanding freight flows and forecasting future freight demand. Planning for future system needs dictates the need for these capabilities. This goal is aimed at improving upon the traditional methods of forecasting freight demand, linking freight generation and employment characteristics for freight-intensive land uses to the transportation planning process, and analyzing freight transport needs in the context of full supply chains instead of discrete commodity movements. The next five years present the Commonwealth with an opportunity to improve on its freight planning capabilities by building on its existing platform of transportation data and tools. These refined and enhanced capabilities build on some of the key advances that have grown from national research efforts and best practices in modeling, forecasting and planning for freight, including: (1) the compilation of industry-level freight data at a more granular geographic level than the regional and county-level data typically used in freight planning; (2) incorporating local land use policies and controls in the freight forecasting process; and (3) linking freight planning to broader economic trends and supply chain dynamics	C-1: Develop and expand analytical tools, data, and forecasting techniques to measure costs and benefits of freight-related transportation initiatives, programs, and projects. C-2: Identify data resources for air cargo volumes and industrial development at airports across Pennsylvania. C-3: Examine key topic areas related to oversized/overweight truck operations. C-4: Develop expanded freight performance measures for Pennsylvania's future biennial TPR publications. C-5: Refine existing PennDOT freight bottleneck and corridor analyses to improve granularity and measure freight mobility constraints on secondary roads for local planning needs.

GOAL D: OPERATIONS and SAFETY

Improve and enhance multimodal freight transportation operations and safety.	**Operations & Safety Objectives**
Motor vehicle crashes are one of the leading causes of death in Pennsylvania, and the management of a safe highway system is one of PennDOT's primary roles. This overall goal is to improve the safety and efficiency of freight transportation through operational improvements, technology applications, and safety enhancements across all modes of freight transportation. Safety, with the overall goal of reducing crashes, fatalities and injuries, is one of the key sets of metrics that is reported in the Commonwealth's biennial TPR. PennDOT's Strategic Highway Safety Plan (SHSP) serves as a blueprint to reduce fatalities and serious injuries on Pennsylvania roadways by identifying Priority Emphasis Areas (Lane Departure Crashes, Impaired Driving, and Pedestrian Safety) and additional Safety Focus Areas that have the most influence on improving highway safety for all public roads throughout the commonwealth. Using data-driven methods and implementing strategies pertaining to the emphasis and safety focus areas discussed throughout this document will help reduce fatalities and serious injuries. Each successive update of Pennsylvania's Freight Movement Plan has included ambitious actions to support an overarching goal of improving freight transportation and safety across all transport modes. Many of these are tied to general initiatives aimed at improving overall transportation operations and safety, with the added benefit of enhancing freight transportation. Much of the freight transportation activity in Pennsylvania takes place on public roads and on other infrastructure used for passenger transportation. Privately owned railroads with no passenger rail activity but with numerous grade crossings with train/vehicle interactions also represent a major safety exposure on the transportation network. These are another area of focus for PennDOT and its partners in the railroad industry.	D-1: Continue working to measure and reduce truck-related crashes, injuries, and fatalities statewide. D-2: Continue to document reportable incidents, injuries, and fatalities statewide from Federal Railroad Administration (FRA) resources, with the aim of reducing the frequency and severity of these incidents. D-3: Measure and reduce non-recurring delays on Pennsylvania's highway system. D-4: Enhance interoperability of the transportation network with neighboring states.

GOAL E: ENVIRONMENTAL STEWARDSHIP and SYSTEM RESILIENCY

Mitigate adverse environmental impacts of freight transportation and enhance resiliency of the freight system.	**Stewardship & Resiliency Objectives**
Environmental stewardship is the responsible use and protection of the natural environment through conservation and sustainable practices to enhance ecosystem resilience and human well-being. As a public policy issue of increasing importance, it represents a timely and meaningful framework for ensuring that freight transportation does not adversely affect the environment. Conversely, there is also an intent to ensure that freight movement itself is not adversely affected by environmental events. PennDOT historically has sought to minimize transportation's impact on the natural environment, whether it be in reference to air quality, stormwater runoff, or loss of wildlife and habitat. PennDOT and its network of MPOs and RPOs regularly consult with representatives from environmental resource agencies through the Agency Coordination Meeting (ACM) framework on a wide range of planning initiatives – including complex project Environmental Impact Statements and regional long-range transportation plans. Pennsylvania has regularly experienced severe weather events such as heavy flooding that have damaged roadways and bridges, triggered mudslides, and closed down commercial corridors, affecting freight mobility. Disruptions like these to Pennsylvania's transportation and distribution networks negatively affect supply chains and the cost of doing business. Pennsylvania can mitigate the impacts of extreme weather events on the transportation system by investing in system resiliency. FHWA defines resilience as "the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions." In Pennsylvania, the top transportation system resilience concerns are flooding, rockslides, and the results of other severe weather events such as winter storms. Accidents such as hazardous materials releases and bridge strikes can also cause sudden and serious disruptions.	E-1: Adapt to advances in truck electrification, alternative fuels, and other technologies. E-2: Mitigate the severity of impacts of extreme weather and natural disasters on freight mobility. E-3: Reduce freight movement-related emissions and its impact on local air quality. E-4: Reduce the impact of freight movement on flooding and stormwater runoff. E-5: Reduce impacts on wildlife loss and habitat related to freight transportation. E-6: Promote growth in non-truck mode share for ground-based freight transportation.

GOAL F: INSTITUTIONAL & ORGANIZATIONAL CAPACITY

Enhance PennDOT's professional capabilities and stakeholder collaboration in freight transportation.	**Institutional Capacity Objectives**
Building and enhancing professional capabilities in the world of freight transportation is an essential element of a state transportation agency's role in planning a safe, efficient and resilient freight transportation system. This goal builds on the success PennDOT has already shown in developing staff resources and strengthening ties to the private sector that operates at different stages in the state's critical supply chains. PennDOT's Freight Work Group (FWG) was established nearly a decade ago to serve as a mechanism for exchanging information and building relationships among the agencies various bureaus and its MPO and RPO partners. The FWG has been successfully deployed to serve in an advisory role in the development of both the 2045 FMP and this 2050 FMP. The FWG members were also instrumental in helping to plan and execute the freight focus group meetings that were essential elements of the freight stakeholder outreach process for both Plans. Coupled with the enhancements in freight data, analytics and tools in Goal C, these professional capacity building efforts offer an exciting and dynamic opportunity to move PennDOT to the forefront of freight planning capabilities on a national level.	F-1: Identify new initiatives for PennDOT's Freight Work Group (FWG). F-2: Conduct regular engagement with MPO and RPO representatives to provide updates on FMP implementation progress. F-3: Expand and enhance training and education of PennDOT staff on freight issues.

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Implementation: How We Will Get There



SECTION CONTENTS

Overview

Actions and Accountability

Implementation Partners and Projects

Transportation Performance Management

Overview

Implementation is about putting the FMP to work—translating Pennsylvania's desired big-picture, long-range transportation direction for freight into real, tangible progress over the next four years. At that point the FMP will be updated to adjust to changing conditions.

The overarching principles for plan implementation are:

- Accountability
- Flexibility and adaptation
- Information-sharing, especially in support of stakeholder collaboration
- Strengthening the Planning–Programming–Performance linkage

Actions and Accountability

The Goals, Objectives and Actions documented in **Appendix 14** establish the initial activities for advancing each plan objective. Actions are defined at a level to be assigned, scheduled, tracked, and collaborated on with other organizations. Implementation leads and partners are identified for each Action, and implementation progress will be measured over the four-year cycle before the next update of the Pennsylvania FMP.

For this 2050 FMP update, the Goal-Objective-Action matrix was presented at the August 2026 quarterly Freight Work Group (FWG) meeting and shared with each of PennDOT's bureaus for their review and input. Broad involvement in shaping the Actions ensures that they consider and appropriately reflect work that is already underway or planned. It also builds ownership of and commitment to the Actions by those on the front lines of implementation.

Many of the processes outlined in the Goal-Objective-Action matrix are already underway, as they flow from the 2045 FMP and were refined and enhanced from that starting point. These FMP actions sustain initiatives already ongoing at PennDOT, such as continuing efforts to enhance work zone safety. Other FMP actions double-down on initiatives that require more emphasis, such as expanding the freight metrics to be reported and tracked in the biennial TPR. Some FMP actions line up PennDOT to meet longer-range needs, such as training the next generation of the state's workforce in areas related to traffic operations, and connected and autonomous vehicles. Other actions are important first steps in understanding needs, such as efforts related to assessing transportation equity issues across the state.

The FMP and associated progress will be reviewed periodically by PennDOT's Freight Work Group and reported on annually to PennDOT leadership in conjunction with the Long Range Transportation Plan (LRTP) implementation progress. Basic summaries of plan implementation progress will be provided to PennDOT's Center for Program Development and Management, and PennDOT's Multimodal Deputate, as well as the STC, TAC, and the various stakeholder groups involved in shaping the plan as part of routine progress updates aimed at keeping the plan highly visible, and to maintain implementation momentum.

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Implementation Partners and Projects

The FMP represents Pennsylvania's official freight plan—setting the broad long-term directions as an overall compass for project investments, program and service delivery and other initiatives, and supporting compliance with federal planning requirements. PennDOT's Planning Deputate will oversee various efforts to ensure that there is a coordinated effort to integrate the FMP with:

- PennDOT's Strategic Plan
- 12-Year Program (TYP)
- Pennsylvania Long Range Transportation Plan (LRTP)
- Modal plans – aviation, rail freight, intercity rail, ports, etc.
- Functional plans – technology, asset management, etc.
- Regional LRTPs and freight plans
- Regional modal plans
- Ongoing changes in federal statutes and regulations related to freight planning



The FMP will be implemented in collaboration with PennDOT's various regional partners, particularly those that have freight task forces or committees. This promotes collaboration, joint problem-solving, and resource optimization. Specific projects such as a roadway widening or bridge replacement are identified, prioritized, and programmed (placed on a list of funded projects) at the regional level by MPOs and RPOs, mapped in **Figure 18**. They develop regional LRTPs with project lists and establish Transportation Improvement Programs (TIPs)—the list of funded projects expected to be undertaken within the next four years. These regional efforts should generally align with the statewide direction but not be prescribed by a centralized approach. This recognizes the necessity and practicality of customized solutions for each of Pennsylvania's unique regions.

Pennsylvania has a long history of working effectively with the Federal Aviation Administration and the Federal Railroad Administration. The multimodal emphasis of the LRTP and the Freight Movement Plan highlights the importance of this intergovernmental collaboration. The federal partner in the federal-state-local system will play a key role in implementing future federal infrastructure legislation and associated program changes and rule-making. Federal policy for 30 years has emphasized freight for public-sector transportation organizations. This emphasis has grown stronger over time, and will likely continue to grow in the future. The FMP has been developed with this policy priority in view.

The State Transportation Commission and the TYP that the commission approves are key to the implementation of the plan. The STC also oversees the issuance of the Transportation Performance Report, which will take on greater significance as this FMP supports greater integration of planning, programming, and performance monitoring.

Greater involvement of private-sector stakeholders will enhance freight plan implementation with the associated improvements and benefits. Historically, private-sector freight stakeholders have not always participated in the public-sector freight planning process.

As the federal government continues to elevate the importance of initiatives related to resiliency and sustainability, Pennsylvania can further enhance freight plan implementation by collaborating with experts in environmental sustainability such as the Pennsylvania Department of Environmental Protection and non-profit organizations with environmental expertise.

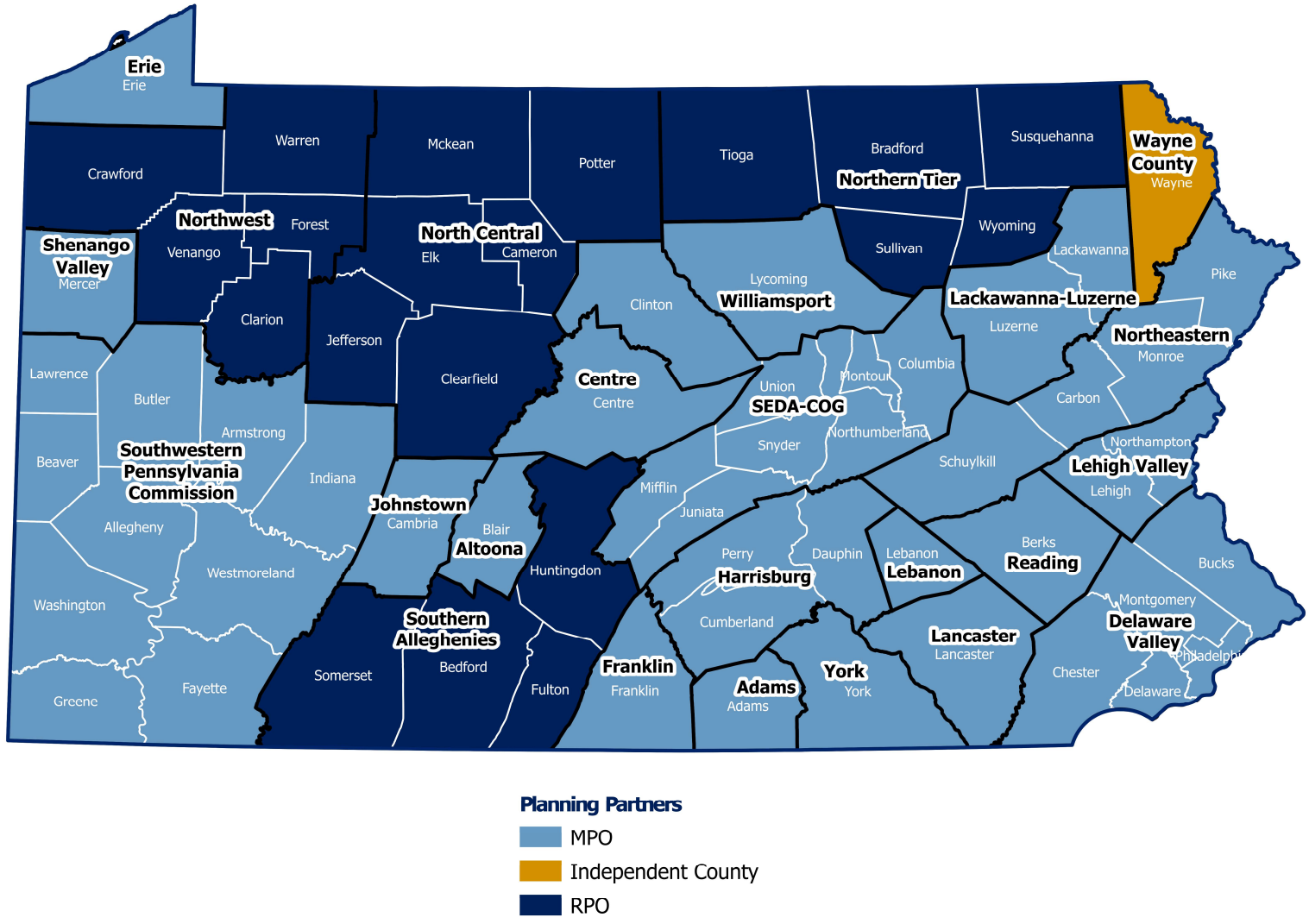
Broad state direction is provided through TYP development guidance to help guide program development by MPOs and RPOs. This helps to ensure a generally consistent procedural approach statewide—again without being project-prescriptive. It is anticipated that future guidance will incorporate the direction of the LRTP and the FMP as part of the overall framework. In a similar manner PennDOT uses the goals and objectives of the two plans to help frame its longer-term budgetary and financial horizon planning.

Project selection is also shaped by transportation performance management targets, described in the following section.

Finally, because freight transportation is ideally seamless at state lines, PennDOT will collaborate with neighboring states and others beyond Pennsylvania as beneficial in the implementation of the FMP.

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Figure 18: MPO and RPO Regions



Planning Partners

- MPO
- Independent County
- RPO

Transportation Performance Management

Ultimately, plan implementation success is measured by how well the transportation system works. Measures of various aspects of system performance in turn guide future planning and project investments to ensure Pennsylvania is making progress toward its goals.

Transportation performance management (TPM) is a federally required approach to prioritizing transportation investment that is focused on results—measurable, strategic improvements to the transportation system.

TPM involves setting measurable performance goals for the transportation system, tracking progress, and directing funds to projects that best achieve those goals. In a funding environment where needs consistently exceed available funding, a TPM approach is essential to maximize the benefits of every dollar spent.

The federal government established TPM requirements in its transportation funding legislation. Both the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act include performance management requirements to ensure that federal transportation funds are invested efficiently toward achieving national goals. The United States Congress established the following national performance goal areas:

- Safety
- Infrastructure condition
- Congestion reduction
- System reliability
- Freight mobility
- Environmental sustainability
- Reduced project delivery delay (getting roadway and other improvements built faster)

FHWA was responsible for determining a way of measuring current conditions and progress toward each of those goals. FHWA established the national transportation performance measures shown below in **Figure 19**.

Figure 19: National Transportation Performance Measures



Source: Federal Highway Administration

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The national TPM approach is implemented through the states and their regional and local partners. Pennsylvania has long utilized a comprehensive planning and programming process, with a focus on collaboration among PennDOT, FHWA, and Planning Partners at the county and regional levels. This foundation is used to implement TPM and Performance-Based Planning and Programming (PBPP). Performance-based planning aims to make the transportation investment decision-making process both informed and accountable. Key elements of TPM and PBPP include managing performance data, selecting performance targets, monitoring progress in meeting targets, and defining ways to integrate performance measures into the transportation decision-making process.

To support the integration and monitoring of the National Performance Measures, PennDOT produces biennial reports to FHWA documenting progress in meeting defined targets. Federal performance measures for freight and other metrics can be found in the following Pennsylvania Statewide Dashboard: State Performance Dashboard - Pennsylvania - State - Reporting - Transportation Performance Management - Federal Highway Administration

Through the STC, PennDOT produces its biennial TPR on progress made in safety, mobility, preservation, accountability, and funding. This report card provides an assessment of performance ratings and recent trends for each of the measures. Information and insights from these measures are used to inform the statewide FMP goals, objectives, and actions. They are also used to inform the development of PennDOT's 12-year and 4-year programs (TYP and STIP, respectively). PennDOT continues to enhance methods to track and share statewide transportation performance, and to expand on freight performance measures used in the TPR. Additional freight-related performance measure items for the 2027 update of the TPR could include:

- Expand the Mobility/Water Ports section of the TPR to include the Ports of Pittsburgh and Erie.
- Measure long-haul truck tonnage as a mode share relative to railroads and waterways, and measure positive trends based on a reduction in this mode share.
- Develop air cargo performance measures based on tonnage, market coverage for small airports, and air cargo facilities.
- Report truck-related crashes as a separate safety measure.
- Measure truck congestion and truck-miles traveled separately in the Mobility/Congestion and Mobility/Highway Capacity sections of the TPR, respectively. Tie the truck congestion to PennDOT's FHWA truck bottleneck reporting process.

PennDOT continues to work with regional and local partners to improve ways to integrate TPM. PennDOT has developed PBPP Procedures and Procedural Guidance for the development of the regional MPO/RPO TIPs. This includes formalizing methods to directly consider the performance measures in project identification and prioritization.

For long-range planning, PennDOT continues to support its regional planning organization with the integration of performance measures into each MPO/RPO LRTP. PennDOT works with MPOs/RPOs to ensure their LRTP:

- Describes the performance measures and performance targets used in assessing the performance of the transportation system.
- Includes a System Performance Report that (1) Evaluates the condition and performance of the transportation system with respect to performance targets, and (2) Documents the progress achieved by the MPO/RPO in meeting the targets in comparison to performance recorded in past reports.
- Integrates the goals, objectives, performance measures, and targets described in all the plans and processes required as part of a performance-based program.

PennDOT continues to develop and share information with the Commonwealth's planning regions, and the 2045 FMP laid the groundwork for some substantive improvements in resource sharing capabilities in matters related to freight. These have included ongoing collaboration between PennDOT and MPO/RPO partners for mapping, freight flows, freight-related industry employment, and analytical approaches for addressing common issues. This process has helped the Commonwealth maintain a high degree of consistency between its statewide and regional planning efforts in freight.

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