TRANSPORT OHIO

DRAFT Ohio State Freight Plan

Submitted to Office of Statewide Planning & Research

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cpcs

TRANSPORT OHIO

OHIO DEPARTMENT OF TRANSPORTATION

About Transport Ohio

Transport Ohio is the Ohio Department of Transportation (ODOT) state freight plan. It describes Ohio's multimodal freight system, how industries use the system, system needs, issues, and opportunities, and key system priorities. It will guide ODOT's policy and investment decisions through to fiscal year 2027.

Meeting Federal Requirements

Transport Ohio has been developed to meet both the existing freight plan requirements outlined in the Fixing America's Surface Transportation (FAST) Act, as well as requirements signed into law in November 2021 as part of the Bipartisan Infrastructure Law (BIL). A compliance crosswalk is provided in **Appendix A**.

Ohio Freight Advisory Committee

The Ohio Freight Advisory Committee (FAC) was instrumental in guiding the development of Transport Ohio. This group of stakeholders representing the modal, geographic, and industry components of Ohio's freight system met seven times during plan development. The listing of FAC members is provided in **Appendix B**.

For Further Information

Transport Ohio was informed by technical work that is documented in a series of Working Papers:

- Characteristics of Ohio's Multimodal Freight System
- Existing and Future Commodity Flow Profile
- Database of Truck Parking Locations
- Imbalances in Truck Parking Supply and Demand
- Ohio Truck Parking Study
- Existing Freight System Performance
- Synthesis of Freight System Needs, Future Trends, and Opportunities
- Infrastructure Investments
- Freight Advisory Committee Guidance

These Working Papers are available on ODOT's project website.[1]

An interactive tool that allows Transport Ohio data to be further queried and visualized is also available on the website

Cover image: Coal barge on the Ohio River near Cincinnati Source: ODOT

[1] https://www.transportation.ohio.gov/wps/portal/gov/odot/programs/transport-ohio/resources/03-transport-ohio-working-papers

Table of Contents

Executive Summary

Ohio's freight transportation system enables the state's economic competitiveness and growth. It plays a key, but often understated role, in the prosperity, safety, and quality of life of Ohioans.

This state freight plan, Transport Ohio, will guide the Ohio Department of Transportation (ODOT) in making policy and investment decisions to further these ends and related statewide goals, including the Access Ohio 2045 goals: safety, preservation, efficiency and reliability, economic competitiveness, mobility and accessibility, quality of life, and environmental stewardship.

Ohio's Freight Transportation System and Economic Linkage

Ohio's freight transportation system, comprised of multiple transport modes, makes the state a trade hub for the Midwest and an anchor for global and domestic supply chains, including Ohio's key industries of advanced and automotive manufacturing, energy and chemicals, food and agriculture, and others.

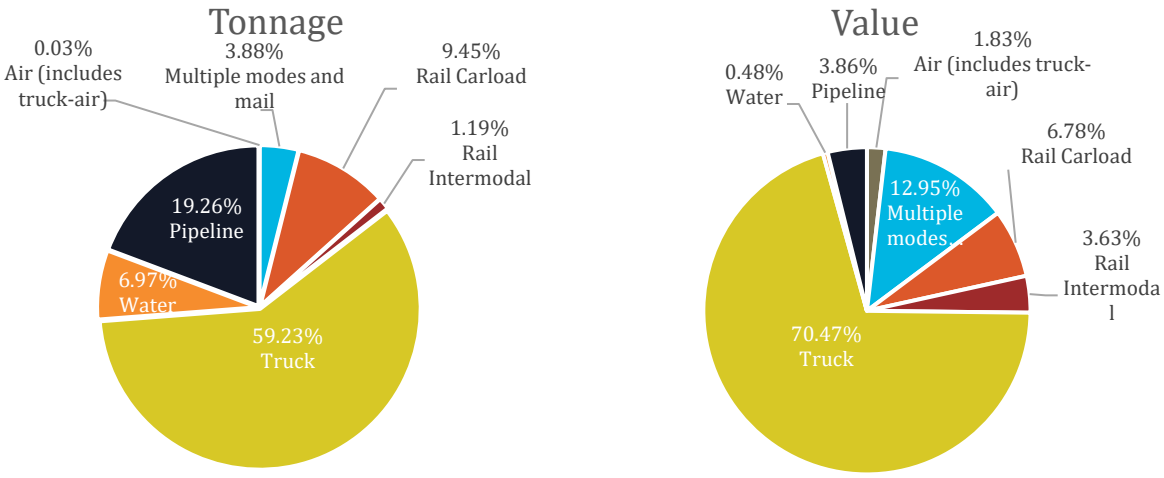
1,330	5,081	736	8	110,000+
Interstate Miles*	**Active Rail Miles**	**Maritime System Miles**	**Airports with regular cargo service**	**Miles of Gathering and Transmission Pipeline**

*ODOT owned, operated, and maintained, only.

Ohio's freight system transported over 1 billion tons of goods worth over $1.2 trillion in 2018.

Ohio's economy depends on reliable delivery of raw materials and finished goods, which in turn requires access to multiple freight modes. The value of goods originating in Ohio (sum of outbound and within) topped $762 billion and a total of 719 million tons carried by all modes. Figure ES-1 shows the percentages of tonnage and value carried by mode in 2018.

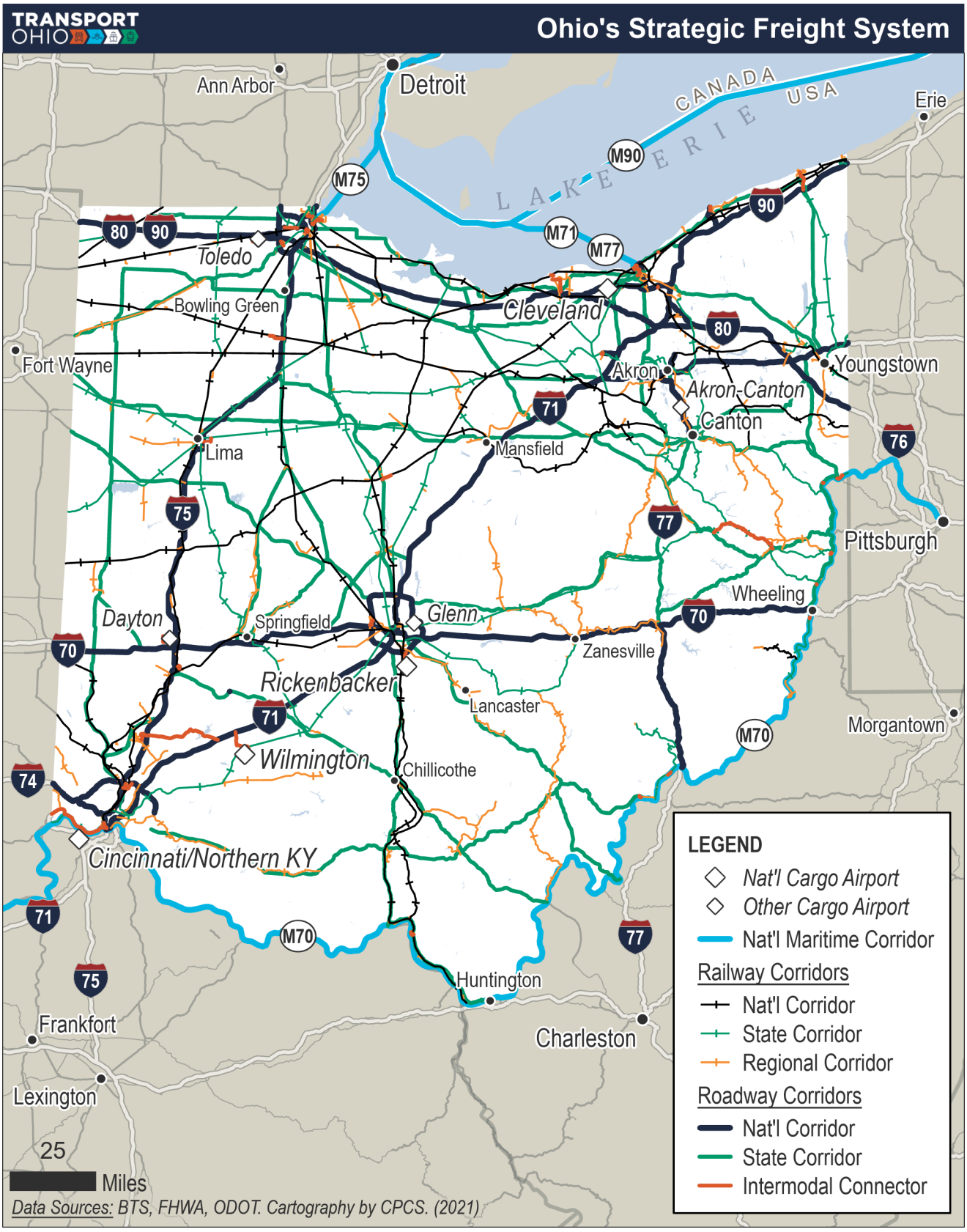
Figure ES-1: Total Tonnage and Value by Mode (2018)



Source: WSP Analysis of FHWA FAF5, 2021

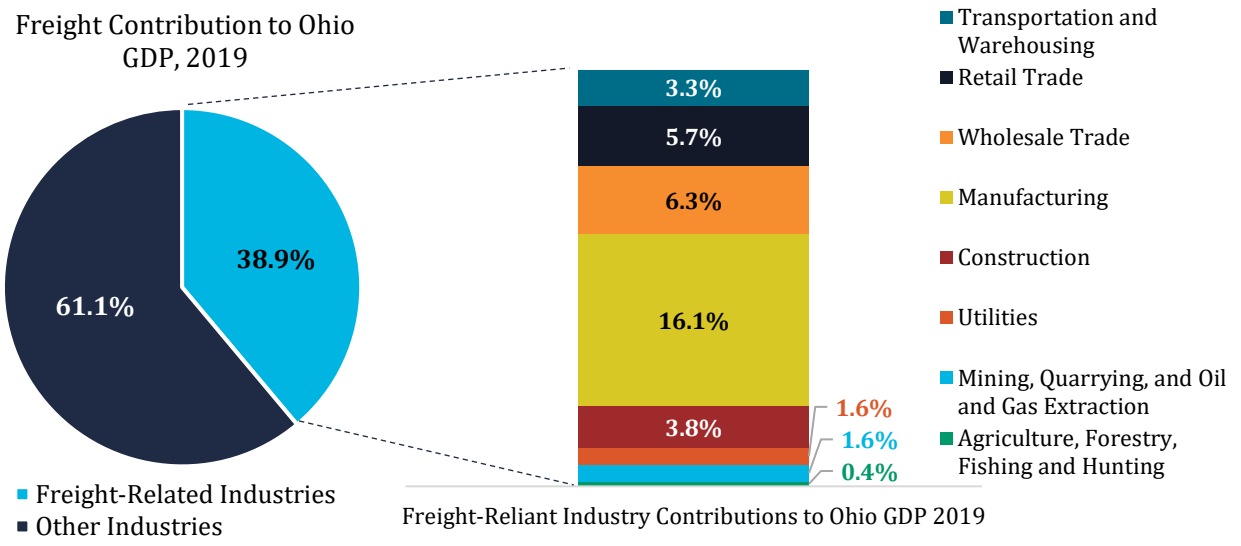
Figure ES-2 highlights Ohio's strategic freight system, designated as part of Transport Ohio. This multimodal system handles the majority of freight in the state.

Figure ES-2: Ohio's Strategic Freight System



Ohio's freight-reliant industries contributed nearly 39% of Ohio's $695 billion GDP in 2019, with the manufacturing sector (the largest contributing sector) responsible for over 16% of Ohio's total GDP.

Figure ES-3: Freight Contributions to the Ohio Economy



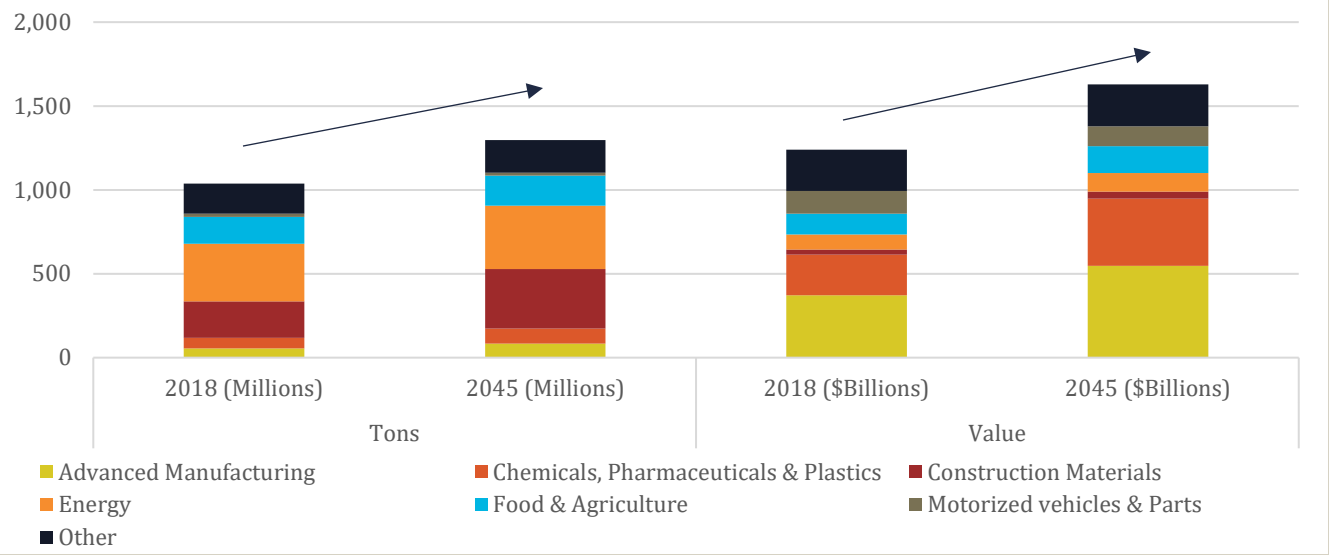
Source: CPCS Analysis of Bureau of Economic Analysis, 2019 data

Ohio's Freight Transportation System Needs

Ohio's freight transportation system has served Ohio well, but it must continue to adapt to evolving demands and pressures, structural trends, and unmet needs and emerging opportunities.

Certainly, to maintain a high level of performance and to continue to meet other statewide goals, Ohio's freight system must accommodate and prepare for continued growth: more capacity in the right places.

Figure ES-4: Expected Ohio- Traffic Growth to 2045 (All modes, including pipeline)



Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021

Other key needs for Ohio's strategic freight system include:

Roadway Network Needs

Safety: Using the truck fatality rate as a measure, safety has improved on national corridors within Ohio, but has worsened on state corridors and intermodal connectors. Since the bulk of vehicle miles traveled occur on national corridors, average safety has improved on all roads. More frequent and severe crashes occur near urban areas. Intermodal connectors also tend to see more severe crashes.

Preservation: Preservation refers to the condition of pavement and bridges on different corridor types. A review of the top road segments with preservation needs shows that national corridors constitute the largest number of segments that demonstrate urgent needs for infrastructure repair and improvement.

Efficiency and reliability: Efficiency and reliability refer to how quickly and reliably vehicles can maneuver on Ohio's road network. Four segments on the Ohio road network – three of which are located in the Greater Cincinnati area (I-71 at I-75, I-75/I-71 at I-275, I-71 at I-70, and I-75 at I-74) are among the top 100 truck bottlenecks in the US. Other efficiency and reliability needs include roadway capacity increases to accommodate growth, increasing height clearances of certain rail overpasses, and other site-specific bottlenecks.

First-/Last-Mile Roadway Connector Needs

The condition and performance of intermodal connectors – the access roads connecting freight facilities to the broader transportation system – are indicators of the ease of mobility and accessibility of the system. Identifies improvement priories include improved first/last mile connectors to new e-commerce distribution centers, intermodal connectors that serve as linkages between non-highway modes, such as logistic centers at Cincinnati/Northern Kentucky International Airport (CVG) and Rickenbacker International Airport (LCK), and inadequate connectors compromise safety.

Mobility and accessibility. The intermodal connectors with the greatest needs are located in areas with multiple key freight assets and Ohio's key economic centers: The Greater Cincinnati – Dayton Region, the Greater Columbus Region, the Greater Cleveland area, Toledo, Ashtabula. Specific needs are outlined in this plan. Issues on intermodal connectors may add additional air pollution and impact the health and wellbeing of surrounding communities negatively.

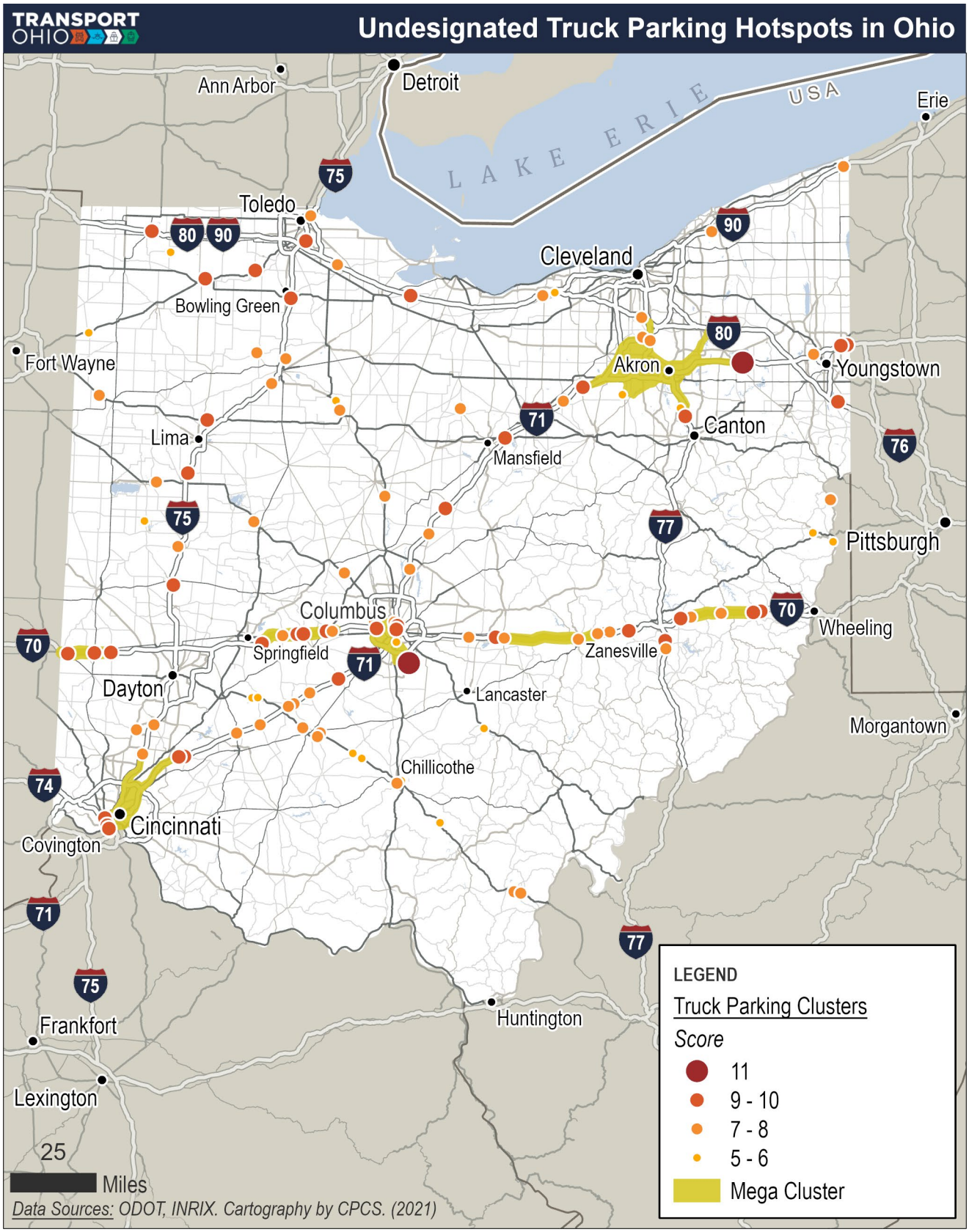
Truck Parking Needs

Truck drivers count on truck parking locations to get the rest they need, as required by Federal Hours of Service (HOS) regulations. Truck parking is also important as drivers wait for pick-up and delivery appointments (known as staging). Currently, there are inadequate truck parking facilities in Ohio, leading to negative economic and social costs for both truck drivers and the public.

To locate the greatest truck parking needs in Ohio, the Ohio Truck Parking Study identified and evaluated locations of undesignated truck parking throughout the state. Undesignated truck parking refers to unmarked locations where trucks park. The prevalence of these locations constitutes the most noticeable indicator of truck parking issues, providing insight into both the locations and magnitude of unmet truck parking demand.

In total, seven undesignated truck parking mega-clusters were identified (Figure ES-5). Together, the combination of the four mega-clusters along I-70 and the Columbus and Cincinnati mega-clusters suggests significant truck parking needs in Southwest Ohio and through Central Ohio, an area with high e-commerce activity. Additionally, the final mega-cluster is around Akron and between Akron and Youngstown, which has many priority truck parking clusters scattered along several major corridors including I-71, I-76, I-77, I-80, I-271, and SR 21.

Figure ES-5: Undesignated Truck Parking Hotspots in Ohio



Rail Network Needs

Safety: Average safety has improved on all railroads. Nevertheless, the majority of the rail safety needs are located on the national corridors. The segments with the most safety concerns are located in the northern part of the state. Many of the top safety hot spots form two clusters in the Toledo and the Cleveland areas, with most unsafe segments within urban areas. This may be due to a higher possibility of collision occurrence with heavier traffic and denser population. Some of the needs include the occurrence of blocked crossings.

Preservation: National rail corridors in Ohio have the highest percentage of high weight capacity (286,000-pound capable track) at 60 percent. Regional corridors have the lowest at 14 percent. The average for all rail lines in Ohio is 53 percent. Some lightly used branch and local rail lines cannot handle these heavier cars, which limits their ability to accommodate certain trains.

Efficiency and reliability: The majority of rail bottlenecks in Ohio are on national corridors. Causes of bottlenecks include lack of onsite track capacity, rail congestion, lack of rail car availability, and service and switching delays. Other issues include poor rail access to certain industrial locations, inadequate rail-to-rail connections, and bridge and track maintenance needs.

Maritime Network Needs

Ohio's maritime system includes two distinct sub-systems – Lake Erie and the Ohio River. The maritime system faces institutional constraints, with the need for increased recognition and integration of the maritime system in transportation and economic development planning. Since Ohio does not govern the maritime system or assets, the state must collaborate with federal and other stakeholders, including the private sector, to address issues on the maritime system.

Preservation: The condition of Ohio's maritime system and assets remain below average, with a risk of failure. Notably, the condition of Ohio's ports scored below the national average. Perhaps more pressing, two-thirds of Ohio's locks and dams are over 50 years old and in need of rehabilitation. Aging and damaged maritime assets further affect the efficiency and reliability, as well as the economic competitiveness, of the state's maritime system, by leading to unplanned delays or outages that affect maritime system users.

Efficiency and reliability: Delays at locks are the greatest barrier to efficiency and reliability of Ohio's maritime system. While most locks in Ohio have not seen increases in monthly average delay between 2012 and 2019, most locks have seen an increasing percentage of vessels delayed during this time.

Economic competitiveness: Certain ports and terminals in Ohio have physical and operating constraints that restrict cargo movements, including the inability to handle oversized/dimensional cargo at specific facilities and a lack of access to existing maritime infrastructure from certain locations. An additional economic consideration includes Great Lakes and other maritime system fee charges (e.g., pilotage, Harbor Maintenance tax, etc.) that increase costs for maritime system users.

Environmental stewardship: Seasonality during winter months (e.g., ice conditions from late December to late March) and fluctuating water levels restrict navigation on and access to certain waterways. Environmental factors like these require yet further maintenance and funding. Marine ports in Ohio also have opportunities to reduce air emissions and modernize through shore power systems, wind, solar and renewable energies and investments in electric or alternative energy equipment.

Air Cargo Network Needs

There are eight airports in Ohio with regularly scheduled air cargo service, enabling international freight service for high-value manufactured and perishable goods, integrated/express carriers for same-, next-, and two-day deliveries, and belly freight for smaller manufactured items and perishable goods handled by passenger carriers. Four of these airports handle 99 percent of the state's air cargo volumes.

Preservation: All of Ohio's cargo airports have runway pavement conditions that are fair or better. However, there are opportunities to improve runway pavement conditions at Ohio's largest cargo airports,

each of which has at least one runway rated as fair, indicating mid-surface cracking, unsealed joints, and slab edge spalling. Stakeholders also note that infrastructure close to and at airports need continued attention and maintenance, especially as aviation assets and facilities handle increasing volumes.

Economic competitiveness: A pressing need identified by Ohio's top cargo airports is for new and improved facilities. This includes improvements to capacity, modernized facilities, improved ramps space. Across all cargo airports, lack of adequate and efficient access to facilities may also inhibit air cargo operations. Adequate road infrastructure is needed to link airport and cargo facilities to the highway system. This includes the need to designate air facility connectors to the national highway system, as well as expand and/or enhance efficiency on these last-mile connectors.

Pipeline Network Needs

Ohio is home to over 110,000 miles of gathering and transmission pipeline, 57 terminals and refineries, and over 50,000 oil and gas wells, leading to 2.8 million barrels of oil and 2.9 billion cubic feet of gas produced annually. Pipeline development in Ohio has increased significantly to support growing economic needs. To ensure continued and efficient operation of the pipeline system, there is a need for the state to engage in resiliency planning. If a pipeline shuts down for any reason (e.g., the unexpected Colonial Pipeline shutdown), impacts may include commodity shortage, higher commodity prices, and transportation security vulnerability. Additionally, lost commodity flows due to pipeline shutdowns must be accommodated by other transport modes on the rail, road, and maritime systems. As a result, there is a need for the state to prepare and plan for potential pipeline disruptions. Stakeholders also note the importance of statewide pipeline access, particularly to get natural gas resources to all parts of the state. In particular, there is a need for better access to natural gas in Southwest Ohio.

Strategies for ODOT Action

Eighteen strategies across five focus areas are recommended to respond to Ohio's freight transportation needs and to enable continued progress towards statewide goals. These strategies and actions were informed by stakeholder consultations, analysis of the system, and the strengths, weaknesses, opportunities, and threats of Ohio's freight system revealed during scenario planning. These strategies reflect discussion and vetting with ODOT, Ohio's Freight Advisory Council (FAC), and other freight stakeholders, including metropolitan planning organizations (MPOs) and regional transportation planning organizations (RTPOs).

Figure ES-6: Recommended Freight System Strategies aligned with Plan Goals

Focus Area / Strategy	Safety	Preservation	Efficiency & Reliability	Economic Competitiveness	Environment	Quality of Life	Mobility & Accessibility
Planning							
Develop/conduct freight specific plans and studies	✓	✓	✓	✓	✓	✓	✓
Monitor and track progress to Transport Ohio goals/performance	✓	✓	✓	✓	✓	✓	✓
Expand access to freight related data and information	✓	✓	✓	✓	✓	✓	✓
Encourage Ohio's regions to develop multimodal freight transportation plans and assessments	✓	✓	✓	✓	✓	✓	✓
Operations & Maintenance							

Focus Area / Strategy	Safety	Preservation	Efficiency & Reliability	Economic Competitiveness	Environment	Quality of Life	Mobility & Accessibility
Maintain transportation assets (including enabling technologies) in a state of good repair		✓		✓			
Employ Transportation System Management and Operations (TSMO) strategies to address congestion and improve reliability along key Strategic Freight System corridors	✓		✓		✓		
Identify and mitigate extreme weather and other risks to freight transportation	✓		✓		✓	✓	
Reduce the number of freight traffic-related fatalities and serious injuries	✓						
Expand access to truck parking within Ohio	✓	✓	✓	✓			
Innovation & Technology							
Continue to position Ohio as a national leader and support the adoption of connected and automated vehicle technologies for freight	✓		✓	✓			✓
Study and support the expanded use of drones/Advanced Air Mobility (AAM) for last-mile freight deliveries			✓	✓			
Encourage adoption of alternative fuel vehicles for goods movement, including trucks, locomotives, and vessels		✓	✓		✓		
Coordination & Partnerships							
Facilitate and strengthen ongoing dialogue between ODOT and freight stakeholders	✓	✓	✓	✓	✓	✓	✓
Partner with public agencies on project delivery and strategic initiatives	✓	✓	✓	✓	✓	✓	✓
System Investment							
Prioritize transportation system investments that grow the economy and improve access to jobs	✓	✓	✓	✓	✓	✓	✓
Support multimodal freight transportation investments that align with community values, public health, environment, and equity		✓			✓	✓	
Manage and distribute pass-through freight funding to modal agencies	✓	✓	✓	✓	✓	✓	✓
Engage the private sector in Public-Private Partnership opportunities	✓	✓	✓	✓	✓	✓	✓

ODOT will lead the implementation of these strategies with a variety of partners, including the FAC, other State of Ohio agencies including JobsOhio, the Public Utilities Commission of Ohio, DriveOhio, the Ohio Rail Development Commission, and the Ohio State Highway Patrol (see **Appendix C** for more details). Others will also be critical to advancing industry- and modal-focused strategies, local government agencies including cities, MPOs, RTPOs, airport and port authorities, and private sector stakeholders.

Freight Transportation System Investments

Transport Ohio investments will build on existing Ohio funding programs that benefit freight and are defined in Ohio's Freight System Investment Plan for fiscal years 2022-2026.

Decisions for projects anticipated for construction between 2022 and 2026 (investments in the next 5 years) for many of ODOT's funding programs are still in process. However, as part of freight system investment planning ODOT has identified the projects that will receive National Highway Freight Program (NHFP) funding.

In November 2021, President Biden signed the $1.2 trillion Bipartisan Infrastructure Law (BIL). The legislation adds an additional $550 billion in federal funds over five years to invest in the country's infrastructure. Included is the updated apportionment for NHFP funds to states; Ohio is expected to receive just over $290 million as shown in Figure ES-6.

Figure ES-6: National Highway Freight Program Funding by Fiscal Year (Ohio) ($millions)

2022	2023	2024	2025	2026	2027
$ 46.5	$ 47.4	$ 48.3	$ 49.3	$ 50.3	$ 50.3

Source: IIJA-Highway-Apportionment-Estimates-August-2021, https://policy.transportation.org/wp-content/uploads/sites/59/2021/11/IIJA-Highway-Apportionment-Estimates-August-2021.pdf. Accessed December 16, 2021

The NHFP funded projects are shown in Figure ES-7. These projects are expected to provide safety, condition, and efficiency benefits to the freight system.

Figure ES-7: Ohio's National Highway Freight Program Projects (2022-2027) ($millions)

Mode	Year	Project	Project Description	NHFP Funding	ODOT Matching Funds	Total Funding
Highway	2022	I-70/I-71 Downtown Ramp Up: Phase 4R/6R	The project includes the reconstruction and widening of I-70/71 in Franklin County. Works include but not limited to adding an extra lane through the 70/71 overlap area, constructing a new ramp onto Fulton St from 70 E and 71 N, and closing the existing ramps from 70 E to Front and 70 E to Livingston.	$45.5	$197.5	$243.0
Highway	2023	I-70/I-71 Downtown Ramp Up: Phase 4B	This project is the part 4 of the Big Build Pavement replacement of 70 WB & EB from Front to Grant. It also includes pavement replacement of 3rd & 4th St from Livingston to Fulton, 3rd & 4th St bridge replacements and 5 retaining walls.	$46.4	$182.6	$229.0
Highway	2024	Cleveland Innerbelt Modernization	Projects will improve I-90 east and westbound in the Central Interchange area between E. 9th St. and Carnegie Avenue and replace the E 22nd Street and Carnegie Avenue bridges over I-90.	$47.4	$112.6	$160.0

Mode	Year	Project	Project Description	NHFP Funding	ODOT Matching Funds	Total Funding
Highway	2025	Brent Spence Bridge Corridor Project	The project will reconstruct and widen I-75 from just north of the Linn St. overpass to the northern limits of the bridge over Findlay St. It will also replace the Linn St. overpass with 1-75 and reconstruct Gest Street from Freeman Avenue to US 50.	$48.3	$49.7	$98.0
Highway	2026	Akron Beltway Improvements	The project will improve the west side within the Akron "Beltway" freeway system to increase capacity and improve safety including structure rehabilitation and noise walls within the City of Akron, Summit County, Ohio.	$49.3	$35.7	$85.0
Highway	2027	Brent Spence Bridge Corridor Project	The project work contains the reconstruction of I-75 from Findlay St. to just south of Marshall Ave. This is the northern end of the Brent Spence Bridge Corridor Project. The project includes the construction of a new interchange on I-75 to connect to the new Western Hills Viaduct (WHV).	$49.3	$108.7	$158.0
Rail	2022-2027	Freight Rail Development	TBD	$1 per year	-	TBD
		Total Funding		**$291.2**		**at least $979.0**

Source: ODOT

1. Importance of Freight and Statewide Goals

Why is Freight Transportation Important?

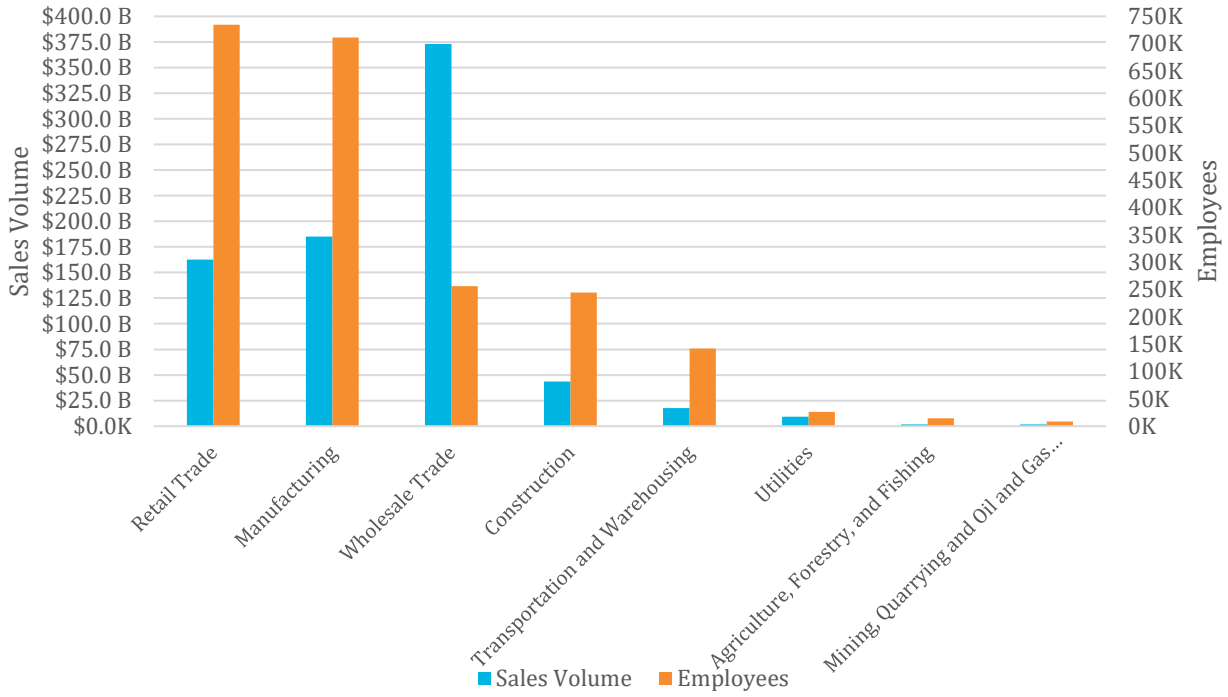
Freight transportation is critical to the lives just about everyone on the planet. Yet for most, its importance is not well understood. Consequently, the role of freight transportation in the prosperity, safety, and quality of life of Ohioans is generally understated.

The reality is that just about everything that is produced or consumed in Ohio touches or is otherwise dependent on some part of the state's freight transportation system. The food at the grocery store. The intermediary input needed to manufacture a product in Ohio. The e-commerce package that arrives within days of ordering.

Most jobs in Ohio are also directly or indirectly enabled by the freight transportation system. Manufacturing, for example, requires inputs, machinery and a way to move products to market. Retailers need warehousing, distribution activities, and transportation to manage inventories and sales.

Figure 1 illustrates the sales volume and employment by freight-reliant industries. Within the state's freight-reliant industry workforce, manufacturing and retail trade employ the majority of Ohio's over 11 million residents. Both sectors employ approximately 700,000 people.

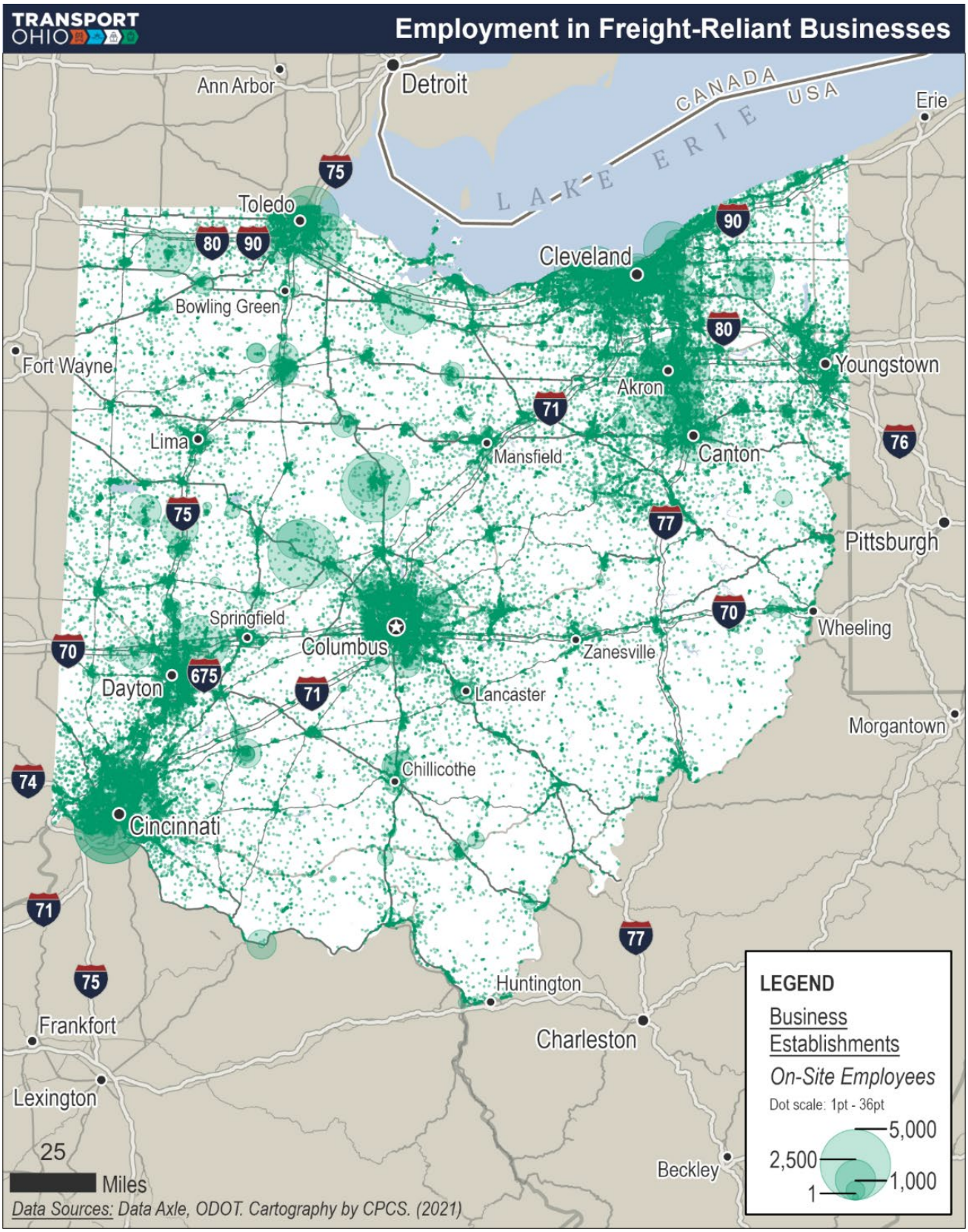
Figure 1: Sales Volume & Employment by Freight-Reliant Industry



Source: Data Axle 2019 Business Establishment Data

Figure 2 maps the employment in freight-reliant businesses. Not surprisingly, employment in freight-reliant sectors are clustered in and around Ohio's main economic centers including Columbus, Cleveland, Cincinnati, and Toledo, as well as areas that extend from these cities and follow major roadways. Establishments around Cleveland, Akron, Canton, and Youngstown also extend outside the city limits to create a triangle of activity in northeast Ohio.

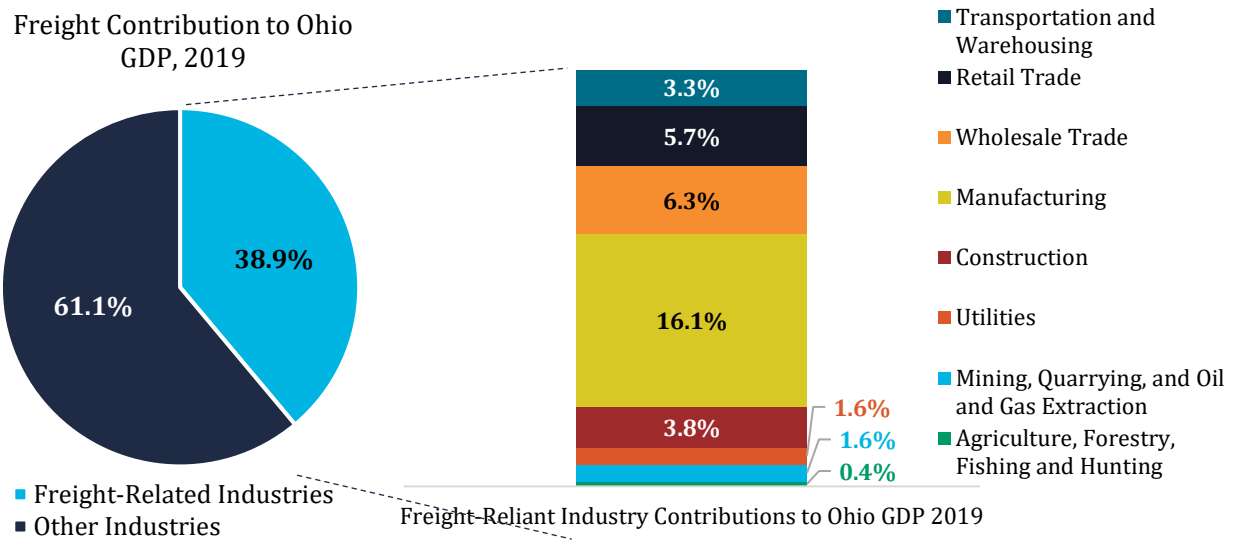
Figure 2: Employment at Ohio's Freight-Reliant Industry Establishments



Note: The map indicates the density of employment within freight-reliant industries across the state by symbolizing each freight-reliant business establishment with a transparent circle, sized to reflect the number of employees at the establishment location (total corporate employment is filtered out to focus only on employment reported or estimated at that location).

As shown in Figure 3, Ohio's freight-reliant industries contributed nearly 39 percent of Ohio's $695 billion GDP in 2019, with the manufacturing sector (the largest contributing sector) responsible for over 16 percent of Ohio's total GDP.

Figure 3: Freight Contributions to the Ohio Economy



Source: CPCS Analysis of Bureau of Economic Analysis, 2019 data

Even professional services jobs require a range of goods that are dependent on the freight system: paper, furniture, courier services, IT equipment, etc. In short, the freight transportation system is critically important to quality of life of just about everyone. Yet it is typically only when the freight transportation system does not work as it should that we notice.

The COVID-19 pandemic pushed e-commerce growth to new records, wildly driving up demand for freight. Containers began to arrive in droves at US ports unequipped to handle them. This, paired with unique economic circumstances, extreme weather events and other disasters, together with a market-wide worker shortage, produced a perfect storm for the freight transportation system. Freight transportation momentarily became dinnertime conversation, as did the package delays many experienced.

The recent supply chains disruptions underscore just how important freight transportation is to modern life. This is as true in Ohio as anywhere. Hence the importance of getting freight planning right.

Transport Ohio, seeks to ensure that Ohio's freight transportation system performs well, is resilient, and can enable all-important outcomes the freight transportation system supports, along with broader statewide goals.

Transport Ohio will guide the Ohio Department of Transportation (ODOT) in making policy and investment decisions to bolster the performance of Ohio's freight transportation system and achieve broader statewide goals.

Transport Ohio Goals

In 2020, ODOT completed an update to Ohio's long-range multimodal transportation plan, Access Ohio 2045 (AO45). AO45 provides a structure by which the state can make informed transportation investment and policy decisions over the next 25 years. As part of this, a new vision for transportation in the state was established.

AO45 Vision: All Ohio will be connected by a safe, smart and collaborative transportation system that moves people and freight efficiently and reliably and supports community visions.

This broad vision is inclusive of Ohio's freight transportation system – roads, rails, marine corridors and ports, cargo airports, and pipelines. Accordingly, Transport Ohio adopted this vision and the accompanying AO45 goals (Figure 4) but emphasizes those elements that are most critical to the multimodal freight system and can be quantified through data analysis.

Figure 4: Access Ohio 2045 Goal Areas

Transport Ohio goals have also been developed in alignment with USDOT National Freight Goals and the USDOT National Highway Freight Program Goals (i.e., the program that provides states sub-allocated funding to invest in their freight systems). These goals seek to identify and invest in infrastructure improvements, policies, and operational innovations that:

- Strengthen the contribution of the National Multimodal Freight Network (including the National Highway Freight Network) to the economic competitiveness of the US;
- Reduce congestion and eliminate bottlenecks on the National Multimodal Freight Network (including the National Highway Freight Network);
- Improve the year-around reliability of the National Highway Freight Network; and
- Increase productivity, particularly for domestic industries and businesses that create high-value jobs.

Lastly, Transport Ohio addresses and aligns with the goals in the Bipartisan Infrastructure Law (BIL), signed by President Biden on November 15, 2021, and which makes certain changes to freight planning guidance. This legislation identifies two broader priorities, one of which must be addressed by states conducting a freight plan, which are addressed by Transport Ohio

- Enhance reliability and redundancy of freight transportation, or
- Improve the ability to rapidly restore access to freight transportation.

The Transport Ohio plan should be in compliance with the updated freight plan guidance since it accomplishes the above requirements. A compliance crosswalk is provided in **Appendix A**.

Importance of Stakeholder Engagement

Freight stakeholder engagement was important to Transport Ohio development for several reasons. Engagement supplemented quantitative data on freight system use, including the type and volume of goods moved, key modes, routes, and their origins and destinations. This helped identify relevant needs and issues as well as possible stakeholder solutions. It also helped validate data analysis and explain patterns in the data, such as major interchange nodes or traffic flows.

Ohio has a broad range of public and private sector freight stakeholders that served an important role in informing the recommendations for Transport Ohio and advancing Ohio's freight system toward the plan's goals and outcomes.

The members of the Freight Advisory Committee are noted in **Appendix B**.

2. Existing Conditions

Drivers of Freight Transportation System Use

Shippers consider a range of modal options when moving freight, including trucks, railroads, air freight, and barge or ship service. However, the availability of access to each of these modes, as well as the characteristics of the cargo being moved, limits the true range of choices. In particular, the value per ton of the cargo plays an important role: shipping costs can make up a larger share of the overall cost of low-value cargoes, while higher-value cargos can "absorb" a greater transportation cost. Therefore, shippers of low-value, bulk cargoes may place a higher emphasis on transportation cost. In addition to shipping cost, shipping considerations that influence modal choices include shipping speed and reliability of shipping service.

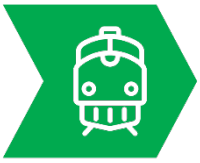
Businesses make transportation choices by considering the balance between shipment volume, shipment cost, and shipping distance.

Each mode of transportation has its own set of characteristics, and together, the modes that carry freight comprise a spectrum of services (Figure 5).

Figure 5: The Freight Modal Spectrum of Services

Pipelines are well suited to convey large quantities of select liquid or gas commodities over long distances. **Example industry that uses this part of the system: Energy and Chemicals.**

Maritime transportation is best suited for the long-distance movement of bulky low-volume goods such as grain, oil, chemicals, and aggregates. Maritime can also be suitable for long-distance movement of higher-value manufactured goods when fast service is not required. **Example industries that use this part of the system: Agriculture, Energy and Chemicals, Construction.**



Railroad shipping has a similar service profile to maritime shipping: it is capable of moving large volumes of lower-value goods effectively, and common loads include grain, aggregates, forest products, and oil. Additionally, higher-speed rail service (such as intermodal container service) for higher-value goods is available in select areas. **Example industries that use this part of the system: Logistics and Distribution, Advanced Manufacturing, Automotive.**

Trucking is important because road connections may be the only immediate modal connections that many establishments have. Therefore, trucking is often a key element in the first-/last-mile movement of goods. Trucking costs are higher and capacity is lower relative to rail, but is a common option for moving moderate- and higher-value goods longer distances in shorter periods of time. **Example industries that use this part of the system: Logistics and Distribution, Advanced Manufacturing, Automotive.**

Air freight is the most expensive modal choice, on a ton-per-mile basis, and is generally only used for high-value, low-volume, time-sensitive goods, such as pharmaceuticals, electronic components, and parcel service. **Example industries that use this part of the system: Logistics and Distribution, Aerospace and Aviation, Advanced Manufacturing.**

Ohio's Freight-Reliant Industries

Ohio's economy relies on an efficient transportation system, in which multiple modes connect and work with each other to meet businesses' needs. JobsOhio has designated 11 key industries that are driving the state's overall economy, of which seven are classified as freight-reliant industries. These industries are driving the demand on the state's multimodal freight system. The following section takes a systematic look at Ohio's freight transportation network and presents freight-reliant industry profiles that demonstrate the importance of a robust freight transportation system to the prosperity of those key industries.

JobsOhio Freight-Reliant Industries

Freight-Reliant Industries

- Advanced Manufacturing
- Aerospace and Aviation
- Automotive
- Autonomous Mobility
- Energy and Chemicals
- Food and Agribusiness
- Logistics and Distribution

Other Industries

- Financial Services
- Healthcare
- Military and Federal
- Technology

Advanced Manufacturing

For generations, Ohio has served as a hub for manufacturing. Ohio offers several advantages to manufacturing businesses including a pro-manufacturing tax structure and nine Foreign Trade Zones (FTZs) that offer duty/tax benefits to imports and exports (see Logistics and Distribution for more information on FTZs in Ohio). Today, Ohio is a national leader in advanced manufacturing, producing iron and steel, fabricated metal products, machinery, and electrical equipment.

The state's 54 technical centers, which graduate nearly 7,000 students annually in trade skills, support the state's manufacturing workforce.

Many companies, organizations, and academic institutions in Ohio specialize in the advancement of additive manufacturing, 3D printing, automation, advanced materials, and the industrial internet of things.

Many education and training programs in the state offer advanced manufacturing programs and partnerships, ranging from high school and higher education courses to apprenticeship and work.

The summary of top counties in terms of Advanced Manufacturing sales volume is included in Figure 6. Production activity in Advanced Manufacturing, though significant in clusters throughout the state, is highly concentrated in the Cleveland area.

Figure 6: Counties with the Top 5 Highest Sales Volume for the Advanced Manufacturing Key Industry (in billions of dollars)

County	Cuyahoga County	Hamilton County	Franklin County	Summit County	Stark County
Advanced Manufacturing	$7.71	$2.34	$2.29	$1.96	$1.87

Source: Data Axle 2019 Business Establishment Data

Aerospace and Aviation

As the birthplace of the Wright Brothers, Ohio's history with aviation, strong research and testing efforts, and skilled technical workforce make Ohio ideal for the Aerospace and Aviation industry. Today, Ohio is the top supplier state to Boeing and Airbus. It is also home to over 100 suppliers for the planned National Aeronautics and Space Administration (NASA) Orion missions.

The Aerospace and Aviation industry is located throughout the state, with clusters of activity in both the Cleveland and Cincinnati areas. There are also small clusters outside of city centers in the region surrounding Dayton along the I-75 corridor and in the area outside of Canton. The top 5 counties by sales volume reflect this suburban cluster trend for this industry, with top counties by sales volume including Stark County (includes Canton) and Lake County (in the outskirts of Cleveland), as well as Greene County and Miami County (both in the outskirts of Dayton), as detailed in Figure 7.

Figure 7: Counties with the Top 5 Highest Sales Volume for the Aerospace and Aviation Key Industry (in billions of dollars)

County	Cuyahoga County	Stark County	Lake County	Greene County	Miami County
Aerospace and Aviation	$0.81	$0.36	$0.29	$0.29	$0.25

Source: Data Axle 2019 Business Establishment Data

Automotive

The automotive industry contributes $12.7 billion in GDP, making up 8.2 percent of the nation's industry GDP (2016).[2] In Ohio, this industry employs over 103,000 individuals – a 31 percent growth over industry employment in 2012.[3] Ohio provides 10.9 percent of motor vehicle industry jobs in the nation, with particularly high concentrations in the sectors of stampings, transmissions and powertrain parts, and brake systems.[4] With a large number of automotive companies in the state, Ohio offers an in-state automotive supply chain – from designing to manufacturing to commercializing. The state is also centrally located, within a one-day's drive to over 72 percent of current North American auto assembly plants. These benefits maximize speed to market, while minimizing the risk of supply chain disruptions.

[2] US BEA from Ohio Development Services Agency, Office of Research, Ohio Industry Series: Automotive, January 2020, https://www.development.ohio.gov/files/research/B1015.pdf

[3] US Census Bureau, County Business Patterns 2012 and 2018

[4] US Census Bureau 2018 from Ohio Development Services Agency, Office of Research, Ohio Industry Series: Automotive, January 2020, https://www.development.ohio.gov/files/research/B1015.pdf

Ohio is a top producer and supplier of several key automotive materials and components (Figure 8). Cooper Tire and Rubber, Dana, Goodyear Tire and Rubber, and Parker-Hannifin are all headquartered in Ohio. The state also assembles millions of vehicles – in 2018, this included over 1.1 million light vehicles (by Honda, Fiat Chrysler Automobiles, General Motors, and Ford) and tens of thousands of medium- and heavy-duty trucks and buses (by Ford, Navistar, and Kenworth).[5] Ohio is also advancing automotive technologies, including electric vehicles (EV), and is also preparing for the future of the automotive industry as a national leader in connected and autonomous vehicles (CAV) technologies.

Figure 8: Ohio Automotive Components and Materials Production (North America)

No. 1	Producer of engines
	In plastics and rubber manufacturing
	In glass products manufacturing
No. 2	Manufacturer of transmissions
No. 3	Producer of iron and steel

Source: Adapted from JobsOhio, An Automotive Powerhouse (Automotive Brochure), 2018

In Ohio, the industry has a density of automotive employment along US-33 connecting Columbus to the I-75 corridor. Another cross-state corridor with a moderate level of density is the US-30 corridor between I-71 and I-75. The rings of activity around the urban centers of Toledo, Columbus, and Cleveland are also more sprawling and further from the city centers. The top five counties by sales volume reflect these suburban and rural parts of the state, as detailed in Figure 9.

Figure 9: Counties with the Top 5 Highest Sales Volume for the Automotive Manufacturing Key Industry (in billions of dollars)

County	Lorain County	Logan County	Montgomery County	Shelby County	Lucas County
Automotive	$3.67	$3.21	$2.71	$2.56	$1.31

Source: Data Axle 2019 Business Establishment Data

[5] Ohio Development Services Agency, "The Ohio Motor Vehicle Report," February 2019.

Autonomous Mobility

Autonomous Mobility is intertwined with the Advanced Manufacturing, Aerospace and Aviation, and Automotive industries. Ohio's physical, regulatory, and institutional infrastructure makes the ideal location for companies and organizations to design, test, and deploy autonomous mobility. Private and public organizations in Ohio are advancing the research, testing, and deployment of autonomous mobility for both ground and air transportation in the state, as shown in Figure 10 (ground) and Figure 11 (air).

Figure 10: Ohio Ground Autonomous Mobility Organizations (Sample)

DriveOhio was created under ODOT in January 2018 to develop statewide technology and data frameworks to advance smart mobility projects throughout the state. DriveOhio brings together private industry, government, and research to serve as a hub for smart mobility in the state.

Spanning 4,500 acres, the **Transportation Research Center (TRC)** is the largest independent automotive proving ground in America and is home to the only federal vehicle research and test lab. Its Smart Mobility Advanced Research and Test (SMART) Center provides 540 acres to test new technologies, including connected and autonomous vehicles (CAV) in a real-world environment.

The **Ohio State University (OSU) Center for Automotive Research (CAR)** is focused on research in sustainable and safe mobility in the US, with a concentration on preparing the next generation of automotive leaders. The CAR also aims to drive innovation in automotive technology, and its research focuses include Autonomous and Connected Vehicles. The CAR's Automated Driving Lab, Driving Dynamics Lab, Cybersecurity Lab, and Control and Intelligent Transportation Research Lab each focus on different components of advancing ACV technologies.

Figure 11: Ohio Air Autonomous Mobility Organizations (Sample)

Under ODOT'S DriveOhio Initiative, the **Ohio UAS Center** performs all unnamed aircraft operations for the DOT; serves as a resource for UAS flight operations and program development; and supports innovation in and integration of UAS technologies.

FlyOhio is an initiative under the Ohio UAS Center that coordinates research related to low-altitude UAS traffic management systems, to enable the Ohio airspace as one of the first in the nation ready to fly beyond visual line of sight UAVs.

The **NASA Glenn Research Center**, located in Cleveland, OH, designs and develops innovative technology to advance NASA aeronautics and space exploration. The **NASA Plum Brook Station**, a remote test facility located in Sandusky, OH, houses space simulation and spacecraft test facilities.

The **Air Force Research Laboratory (AFRL)** is headquartered at Ohio's Wright-Patterson Air Force Base. The AFRL leads discovery, development, and delivery of air, space, and cyberspace warfighting technologies – including autonomous aviation and unmanned vehicles technologies.

Energy and Chemicals

Energy

Ohio is a rising leader in energy, featuring low-cost feedstock, proximity to markets, and over $83 billion in upstream, midstream, and downstream private investment to date. Oil and gas extraction contributes $9.2 billion to Ohio's industry, making up 1.3 percent of the state's total GDP. Since 2010, GDP contributions from oil and gas extraction in Ohio have increased more than sevenfold.

The Utica and Marcellus shale formations lie beneath Ohio, West Virginia, and Pennsylvania. These shale formations contain natural gas, natural gas liquids, and crude oil. Since 2011, the Utica and Marcellus shale formations have made up 85 percent of the nation's shale production growth. Forecasters estimate Ohio Valley will supply nearly half of the nation's natural gas production by 2040.[6]

Chemicals

Ohio is also a national leader in chemical production. Major chemical industry establishments headquartered in Ohio include Lubrizol, Sherwin-Williams, PolyOne, Scotts, Hexion, and Procter & Gamble. Other industry establishments include GOJO, PPG, Abbott, and West-Ward, among others.[7] These chemical companies, along with the streamlined permitting process from Ohio EPA and the low costs of energy helped Ohio to become a regional leader in producing polymer, plastics, and polyolefin. The state's chemical manufacturing industry has increased by 36 percent in GDP since 2010, reaching $19.3 billion.[8]

Cincinnati is home to a high concentration of employment in the Energy and Chemicals industry, with over 400 Energy and Chemical employees per square mile within one Cincinnati cluster. This is reflected in the county-level sales values in Figure 12. Hamilton County has sales values more than eight times any other Ohio county. In addition to the dense concentration in Cincinnati, the Energy and Chemicals industry has activity in and around Cleveland, Columbus, and Lima, with clusters along US-23 south of Columbus. In southeast Ohio, along I-77, there are only a few small clusters of business activity, which does not represent the large volume of natural gas mining in that region.

Figure 12: Counties with the Top 5 Highest Sales Volume for the Energy and Chemicals Key Industry (in billions of dollars)

County	Hamilton County	Cuyahoga County	Summit County	Franklin County	Allen County
Energy and Chemicals	$16.24	$2.11	$1.02	$0.98	$0.88

Source: Data Axle 2019 Business Establishment Data

Food and Agribusiness

Ohio is home to over 14 million acres of farmland, several controlled-environment facilities for organic and year-round production of select products, and 28 dedicated cold-storage facilities. $11.6 billion in GDP, or 1.7 percent of Ohio's total GDP, comes from food, beverage, and tobacco manufacturing. This makes up 4.4 percent of the nation's total food, beverage, and tobacco industry GDP – the seventh most of any state in the nation. Since 2010, industry GDP contributions have increased by 4.2 percent.[9]

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[6] JobsOhio, Ohio: The Center of American Energy Transformation, https://www.jobsohio.com/industries/energy-chemicals/; JobsOhio, The New Home of American Energy (Energy Brochure), 2020, https://www.jobsohio.com/wp-content/uploads/2020/08/Energy-Brochure-2020-08-13-HighRes.pdf.

[7] Ohio Development Services Agency, Office of Research, Ohio Industry Series: Chemicals, May 2018, https://www.development.ohio.gov/files/research/B1018.pdf

[8] Bureau of Economic Analysis, GDP by state 2010 and 2019. Values are adjusted to 2019 dollars.

[9] Bureau of Economic Analysis, GDP by State 2010 and 2019. Values are adjusted to 2019 dollars.

The state is home to over 1,100 food, beverage, and tobacco manufacturers, including headquarters of Kroger, Bob Evans, Smucker's, and Wendy's. Other food processing and beverage establishments in the state include Campbell Soup, Nestlé, Cooper Farms, J.M. Smucker, and General Mills, among many others.

Figure 13: Ohio Food Production (US)

No. 1	Producer of Swiss Cheese
No. 2	Largest hub for flavoring and seasoning is located in Cincinnati
	Producer of eggs
No. 3	In tomato processing

Source: JobsOhio, Ensuring Quality and Freshness from Farm to Table (Food Brochure), 2019

The food and agribusiness industry is dispersed throughout the state, with the greatest concentration of employment occurring in Akron, where several food and agribusiness clusters surround the city. Clusters are also present in Cincinnati along the I-75 corridor and within Columbus. In addition, there are areas of dense employment in food and agribusiness surrounding Toledo and along the US-35 corridor near Chillicothe.

Figure 14: Counties with the Top 5 Highest Sales Volume for the Food and Agribusiness Key Industry (in billions of dollars)

County	Franklin County	Summit County	Hamilton County	Cuyahoga County	Jackson County
Food and Agribusiness	$5.72	$3.02	$2.62	$2.03	$1.50

Source: Data Axle 2019 Business Establishment Data

Logistics and Distribution

Ohio is a top state for logistics and distribution. Transportation and warehousing services – which include trucking, rail, water, air, pipeline warehousing and storage, and couriers and support – contribute $22.3 billion to the state's GDP, making up 3.2 percent of the nation's industry GDP.

The transportation and warehousing industry employs over 188,000 people in Ohio.[10] Trucking is the largest employer in the industry (over 65,000 people), followed by warehousing and storage (over 54,000 employed) and couriers/messengers (over 26,000 employed). Transportation and warehousing has seen significant growth in the past decade, with over 30 percent GDP growth since 2010.[11] Between 2012 and 2018, Ohio saw an additional 800 establishments and an additional 36,500 employees in the transportation and warehousing industry.[12] Logistics and distribution businesses thrive in Ohio largely due to the state's central proximity to key markets and its multimodal statewide infrastructure

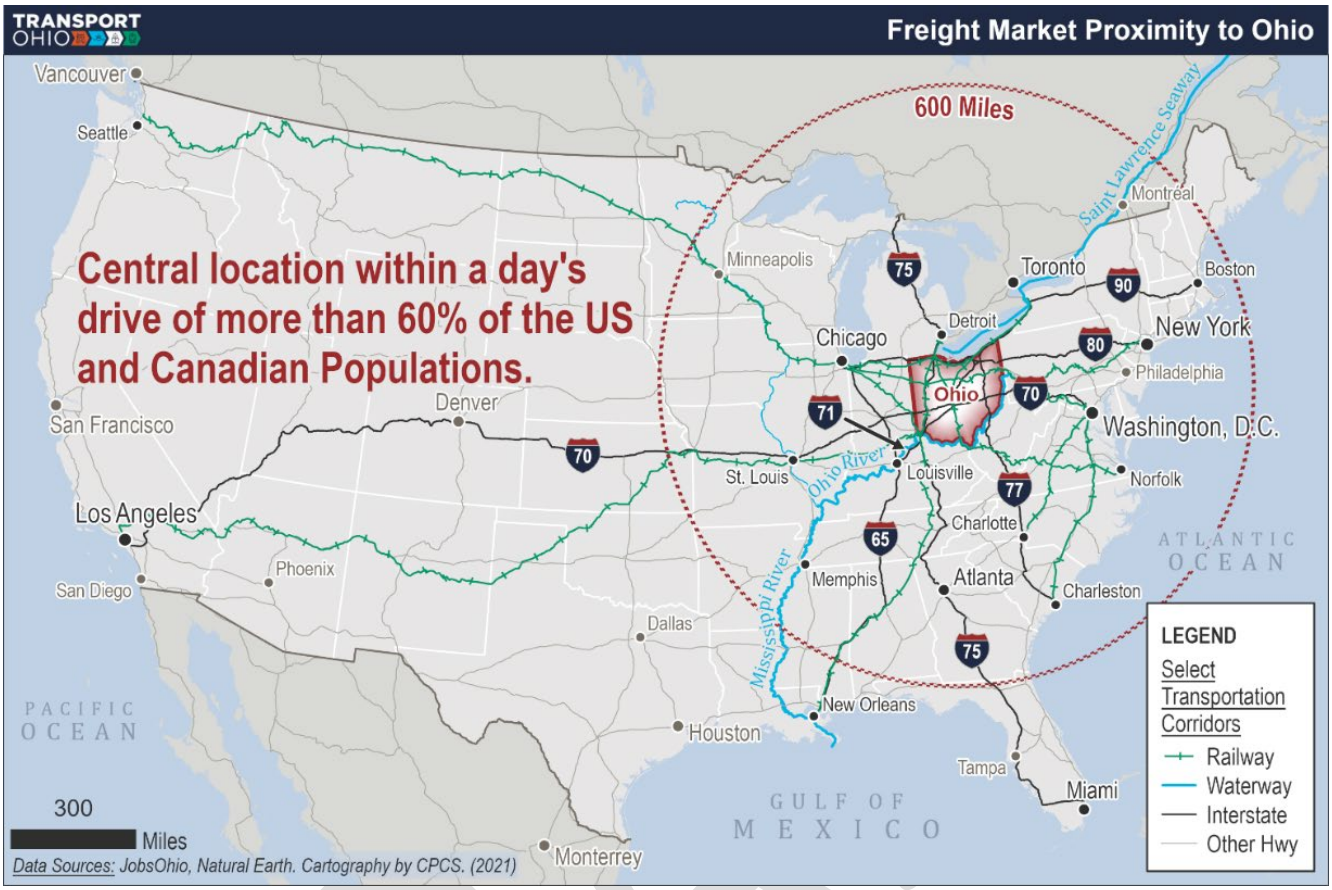
Figure 15 illustrates Ohio's proximity to customers and markets across the US. Logistics and distribution businesses thrive in Ohio largely due to the state's central proximity to key markets and its multimodal statewide infrastructure

[10] US Census Bureau, County Business Patterns, 2012 and 2018; the Association of American Railroads (2019) from Ohio Development Services Agency, Office of Research, Ohio Industry Series: Logistics

[11] Bureau of Economic Analysis, GDP by State, 2010 and 2019. Values are adjusted to 2019 dollars.

[12] US Census Bureau, County Business Patterns, 2012 and 2018.

Figure 15: Freight Market Proximity to Ohio



Source: CPCS adapted JobsOhio, Logistics and Distribution for a Real-Time Economy (Logistics and Distribution Brochure), 2020

Ohio is the only Midwest state with direct shipping routes to Europe for both container and heavy goods. The state also has nine FTZs that encourages foreign trade.

UPS, DHL, FedEx, and USPS collectively have six distribution and processing hubs in Ohio, offering businesses negotiating power in choosing services. The steady growth of e-commerce, further accelerated by COVID-19, created additional demand for logistics and distribution services and supporting operations (e.g., cloud computing, digital supply chain management).

Logistics and distribution establishments are located across the state with activity is particularly concentrated in the triangle between Cincinnati, Dayton, and Columbus, as well as between Cleveland, Canton, and Youngstown. Sales values, as assessed at the county level, do not show major spikes within any given county, though Franklin County (which contains Columbus) is the leader in total sales value for logistics and distribution, as shown in Figure 16.

Figure 16: Counties with the Top 5 Highest Sales Volume for the Logistics and Distribution Key Industry (in billions of dollars)

County	Franklin County	Cuyahoga County	Hamilton County	Lucas County	Butler County
Logistics and Distribution	$2.45	$1.34	$0.88	$0.80	$0.73

Source: Data Axle 2019 Business Establishment Data

Ohio's Freight Commodity Flows

The transportation network in Ohio moves goods and products to markets within the US and internationally. Figure 17 provides an overview of the amount of cargo (tons) and value of cargo ($Billions) flowing into, within, and out of Ohio.

Ohio's freight system transported over 1 billion tons of goods worth over $1.2 trillion in 2018.

Figure 17: Ohio Tonnage and Value of Total Freight Flows by Direction (2018)

Direction	Tons (Millions)	Percentage of Total	Value ($Billions)	Percentage of Total
Outbound	278	26.8%	466	37.6%
Inbound	319	30.7%	478	38.6%
Within	441	42.5%	296	23.9%
Total	**1,038**	**100.0%**	**1,240**	**100.0%**

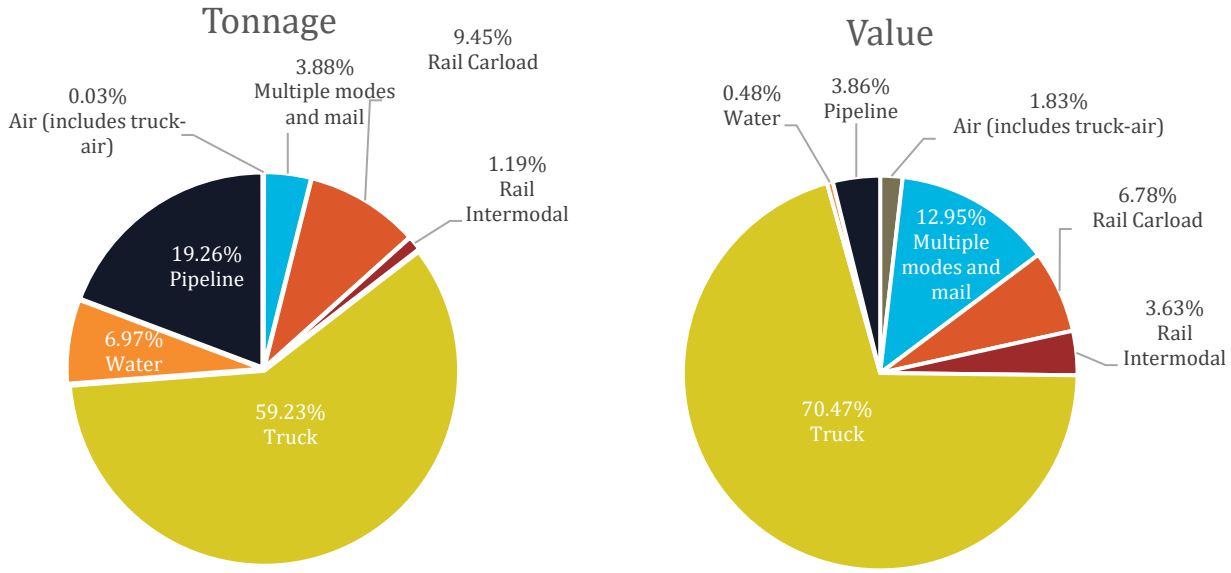
Source: FHWA FAF 5, Analysis of WSP, 2021

Ohio ranks seventh among US states for both population and GDP signifying its importance to the national economy. Given its stature, the needs of Ohio residents and industry require shipping and receiving of a wide range of commodities. Ohio's economy depends on reliable delivery of raw materials and finished goods, which in turn requires access to multiple freight modes. The value of goods originating in Ohio (sum of outbound and within) topped $762 billion and a total of 719 million tons carried by all modes.

Tons and Value by Mode

Commodities carried inbound, outbound and within Ohio differ by freight mode with the roadway system serving as the state's most utilized infrastructure asset. Figure 18 shows that trucks dominate goods movement both by weight (59 percent) and by value (70 percent).

Figure 18: Total Tonnage and Value by Mode (2018)



Source: WSP Analysis of FHWA FAF5, 2021

Other findings from the base year commodity analysis include:

- Energy products transported by pipeline, such as natural gas, contribute significantly to the Ohio economy, carrying 19 percent of the total tonnage in the state.

- Rail carload and intermodal serve distinct commodity groups, with rail intermodal differing more than carload between weight and value.
- Water mode carries 7 percent of goods by weight but less than 1 percent by value, demonstrating the efficiency of transporting bulk goods such as gravel and stone by water.
- Air mode carries .03 percent of goods by weight but 1.83 percent by value, demonstrating the importance of this mode for transporting high-value goods efficiently.

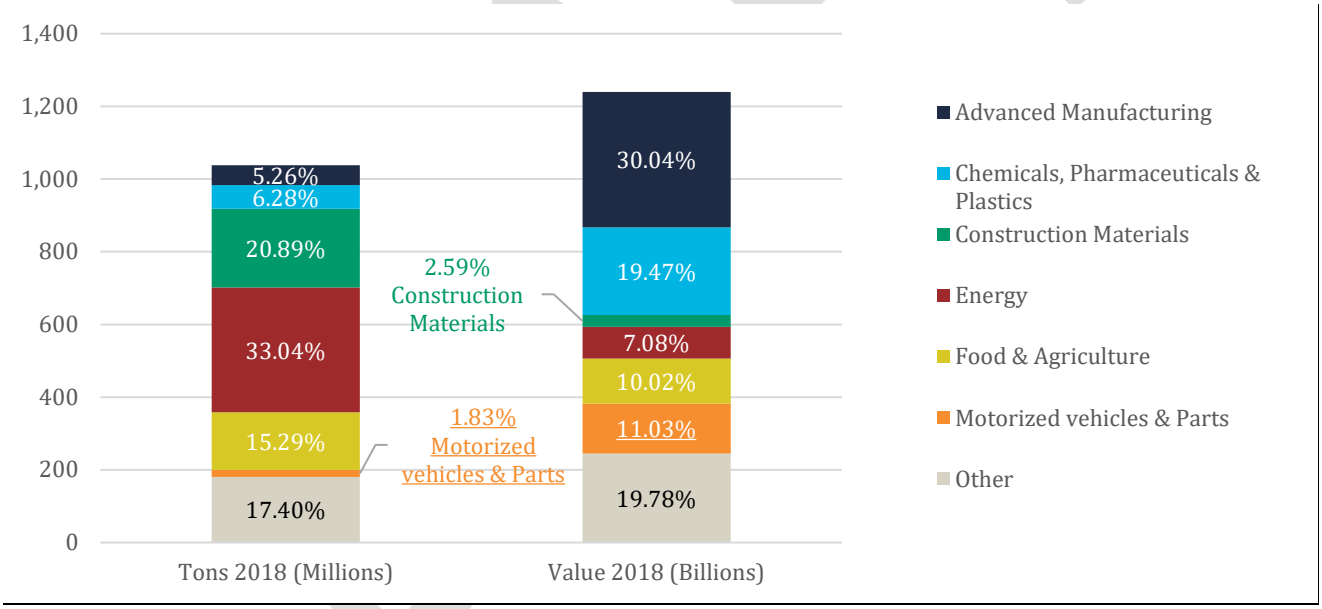
Top Industry Commodity Groups

To enhance the ability to understand commodity flows, six **industry groups,** customized to Ohio, were developed to generally align with JobsOhio freight-reliant industries (as commodity data were available and classifiable). These groups are composed of one or more related commodities; for example, the Advanced Manufacturing Industry group includes the commodities for Machinery, Electronics, Transport equip., Precision instruments, among other commodities. Together, these six groups account for 83 percent of Ohio-based traffic by tonnage and 80 percent by value, summed over six freight modes: truck, rail, water, air, multimodal and pipeline.

Ohio Industry Groups

- Advanced Manufacturing
- Chemicals, Pharmaceuticals, and Plastics
- Construction Materials
- Energy
- Food and Agriculture
- Motorized Vehicles and Parts

Figure 19: Total Value by Commodity Group (2018)



Source: WSP Analysis of FHWA FAF5, 2021

Ohio has a well-rounded economy with a strong profile in all industry groups. Looking at all commodities – including "Other," which includes all other commodities outside the top six – by all freight modes highlights how Ohio's transportation system supports the state's economy. Energy products – extracted in eastern Ohio – dominate tonnage in Ohio (33 percent), while contributing 7 percent of the value. Advanced manufacturing, motorized vehicles and parts, along with chemicals, pharmaceuticals, and plastics are also important drivers of Ohio's economy, and show shares of value far exceeding that of tonnage. The presence of food and agriculture and construction materials show Ohio holding a strong position on these important sectors of the state's economy. Food and agriculture makes up 15 percent of the Ohio-based tonnage and 10 percent of the value.

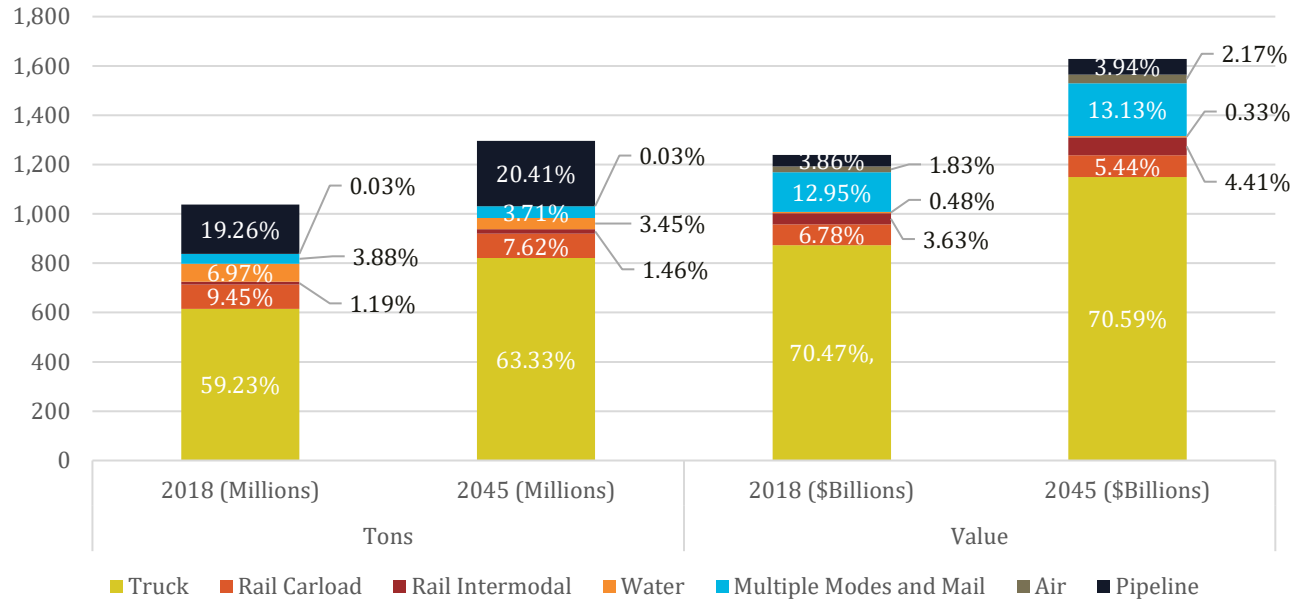
Commodity Flow Growth – Base Year (2018) to Future Year (2045)

Based on the FAF5 data and HIS Markit's post-pandemic FAF forecast, Transport Ohio assesses the changes in freight movements between 2018 and 2045. The projection helps ODOT to better anticipate and plan for freight needs in the future.

Tons and Value by Mode

Commodities carried inbound, outbound, and within Ohio differ by freight mode, with the roadway system serving as the state's most utilized infrastructure asset. Figure 20 shows that trucks dominate goods movement in 2018 and in 2045 both by weight (59 percent vs. 63 percent) and by value (70 percent vs. 71 percent). Construction materials, along with food and agriculture, are the top commodities carried by truck over the roadway system, while pipeline, which is the second most significant mode by tonnage, primarily carries petroleum and natural gas. After truck traffic, multiple modes carry goods with the highest value in 2045, accounting for approximately 13.3 percent of the total value of Ohio-based traffic.

Figure 20: Tonnage and Value by Mode (2018 and 2045)



Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021

Growth rates from 2018 to 2045 by tonnage and mode are shown in Figure 21. Truck traffic tonnages, for example, are expected to increase 34 percent between 2018 and 2045 (a compounded annual growth rate of 1.08 percent per year), leading to incremental truck traffic of 206 million tons (and 276 billion dollars) in 2045.

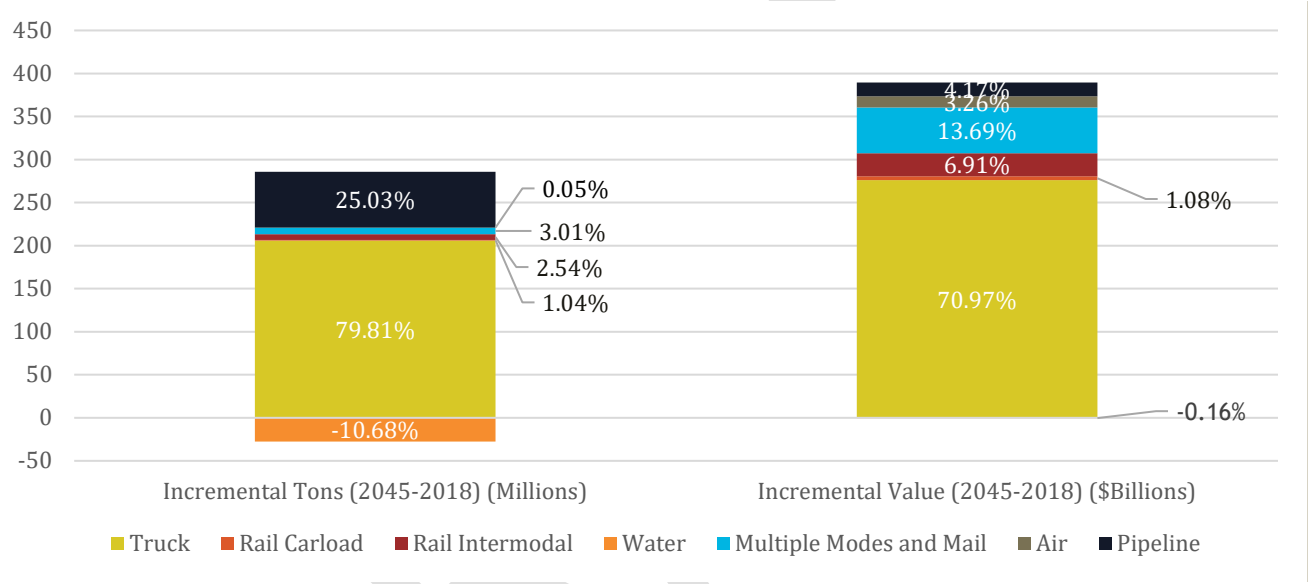
Figure 21: Growth Rates by Tonnage and Value 2018-2045 by Mode

Mode	Tonnage growth (2018-2045)	Value growth (2018-2045)
Truck	33.50%	31.60%
Rail Carload	0.63%	5.35%
Rail Intermodal	53.16%	59.79%
Water	-38.12%	-10.21%
Multiple Modes and Mail	19.32%	33.18%
Air	41.64%	55.97%
Pipeline	32.31%	33.82%

Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021

Figure 22 shows the incremental change of tonnage and value across the seven freight modes. While truck-based freight movements are the greatest source of incremental traffic on an absolute basis, intermodal rail and air traffic show the highest growth in percentage terms. Intermodal rail tonnages are expected to grow 56 percent between 2018 and 2045, leading to a 60 percent increase in value transported by this mode. Construction materials and food and agriculture are expected to contribute the most to incremental gains in intermodal rail. Carload rail by contrast grows modestly by value and is flat in tonnage terms, held back in total tons by declining coal shipments. Air traffic is expected to grow similarly at a 56 percent increase in value transported in 2045 compared to 2018, with pharmaceuticals and advanced manufacturing commodities expected to account for the majority of incremental value transported. Water-based movements are the only mode where traffic is expected to decrease from 2018 to 2045, with a 38 percent drop in tonnages transported. Energy commodities disproportionately account for this drop in tonnages moved by water.

Figure 22: Incremental Tonnage and Value by Mode (2018 and 2045)



Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021

Industry Commodity Group Growth

Figure 23 shows the changes expected to take place between 2018 and 2045 in tonnage and value by industry group. Construction materials; advanced manufacturing; and chemicals, pharmaceuticals & plastics are expected to have the highest growth by tonnage and value. Energy products show slower growth, due to declining coal traffic and the influence of renewables on demand for natural gas.

Particularly concerning to Ohio is the forecast decline in automotive goods – motorized vehicles and parts, which has two sources. First, the shift to electric vehicles has a profound effect on auto parts – both for automotive assembly and in the after-market. Because electric drivetrains are simpler than those using internal combustion, they have far fewer components to assemble and fewer to wear out with use.[13] In addition, efforts in the industry to develop a million-mile battery mean that cars will last longer.[14] Second, demographic shifts, remote working, and the emergence of mobility-as-a-service are expected to lead to more people owning fewer cars.[15] The convergence of these factors implies a reset in the way the

[13] The electric GM Bolt has 80 percent fewer parts than a comparable gasoline automobile, according to research reported in "Shift to electric vehicles will radically change auto factories", The Detroit News, 1/5/19.

[14] "GM says it is 'almost there' on million-mile electric vehicle battery", Reuters, 5/19/20.

[15] One of many sources is "The Days of Personal Car Ownership Could Be Numbered", Forbes, 1/19/21.

automotive industry will function in Ohio. The forecast drop in freight traffic does not indicate an industry in trouble, but rather an industry with very different needs by 2045.

The accelerating growth in e-commerce registered during 2020-2021 is a change in the method of consumer retail distribution and not a change in retail demand. Nevertheless, e-commerce activity will be prominent in three major industry groups, all of them with projected increases in freight traffic.

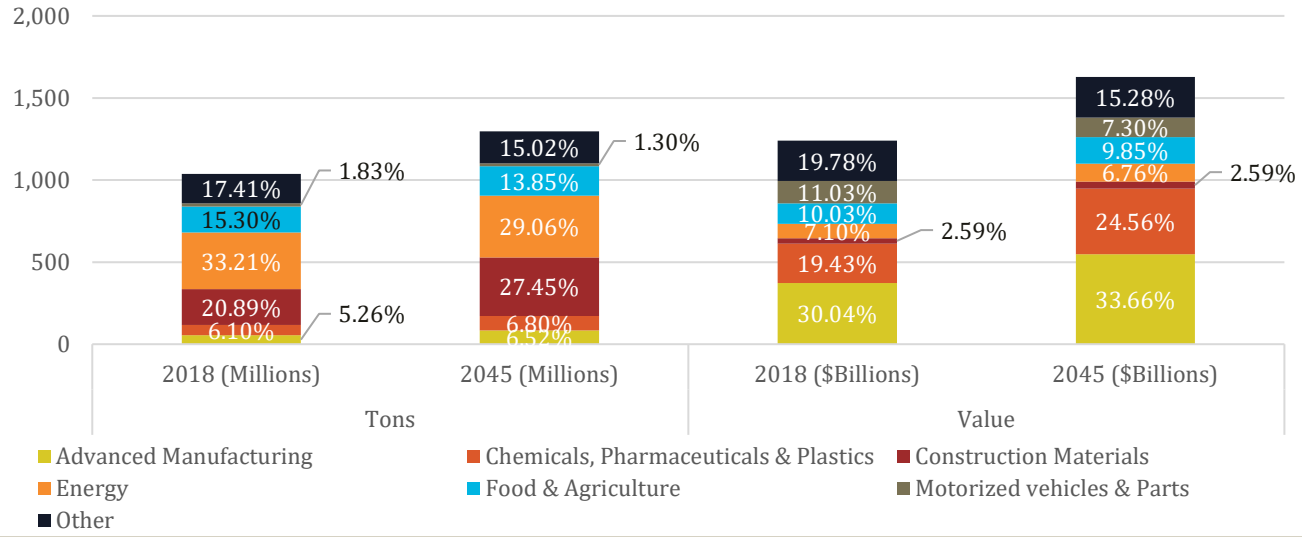
Figure 23: Ohio-Based Traffic (Including Pipeline) Tonnage and Value Growth by Industry Group

Industry	Tonnage Growth (2018-2045)	Value Growth (2018-2045)
Advanced Manufacturing	54.68%	47.22%
Chemicals, Pharmaceuticals & Plastics	39.07%	66.04%
Construction Materials	64.06%	31.14%
Energy	9.27%	25.19%
Food & Agriculture	13.08%	29.07%
Motorized vehicles & Parts	-11.58%	-13.09%
Other	7.76%	1.48%

Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021

Figure 24 shows the industry-based forecast by the percentage of the whole, for both tonnage and value for all freight modes for 2018 and 2045. The influence of each industry group on Ohio freight can be seen as it changes over time. Energy products—extracted in eastern Ohio—dominate tonnage in Ohio (33 percent in 2018 and 29 percent in 2045) while contributing 7 percent of the value in both years. Advanced manufacturing; chemicals, pharmaceuticals, and plastics; and motorized vehicles and parts are important drivers of Ohio's economy. The first two grow strongly between 2018 and 2045 and show shares of value well exceeding that of tonnage. Motor vehicles and parts – small by tonnage but significant by value – drop in their contribution to total value by nearly 4 percentage points. Construction materials tonnage grows the fastest and climbs in its portion of the total, while food and agriculture maintain a relatively consistent position by tons and value between 2018 and 2045, indicating a favorable outlook for Ohio in these important sectors of the state's economy.

Figure 24: Ohio-Based Traffic (Including Pipeline) Incremental Tonnage and Value by Industry Group

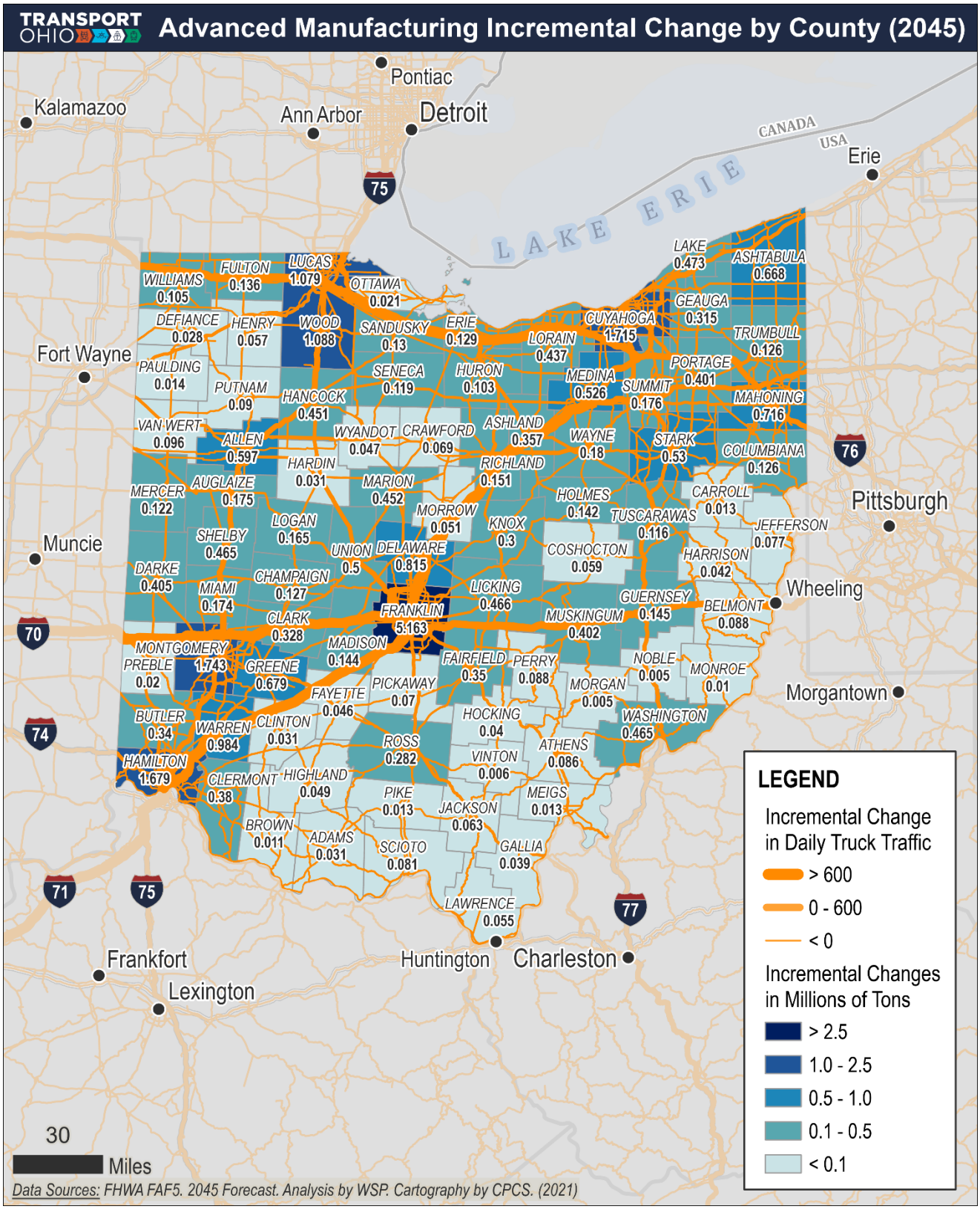


Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021

Advanced Manufacturing

Figure 25 shows the incremental growth in commodities in the advanced manufacturing industry group as well as the incremental daily truck traffic carrying this class of goods. Franklin County (Columbus) alone accounts for 17 percent of the growth in advanced manufacturing between 2018 and 2045. Other counties leading the increase in forecast tonnage are in major urban areas: Montgomery (Dayton), Cuyahoga (Cleveland), Hamilton (Cincinnati), and Wood and Lucas (metropolitan Toledo). Large increases in daily truck traffic are found on the I-71, I-70, and I-80/I-90 corridors, while I-75 and I-77 both show growth. Relationships between Ohio and adjacent states can be seen in the growth of truck traffic flows on these same routes.

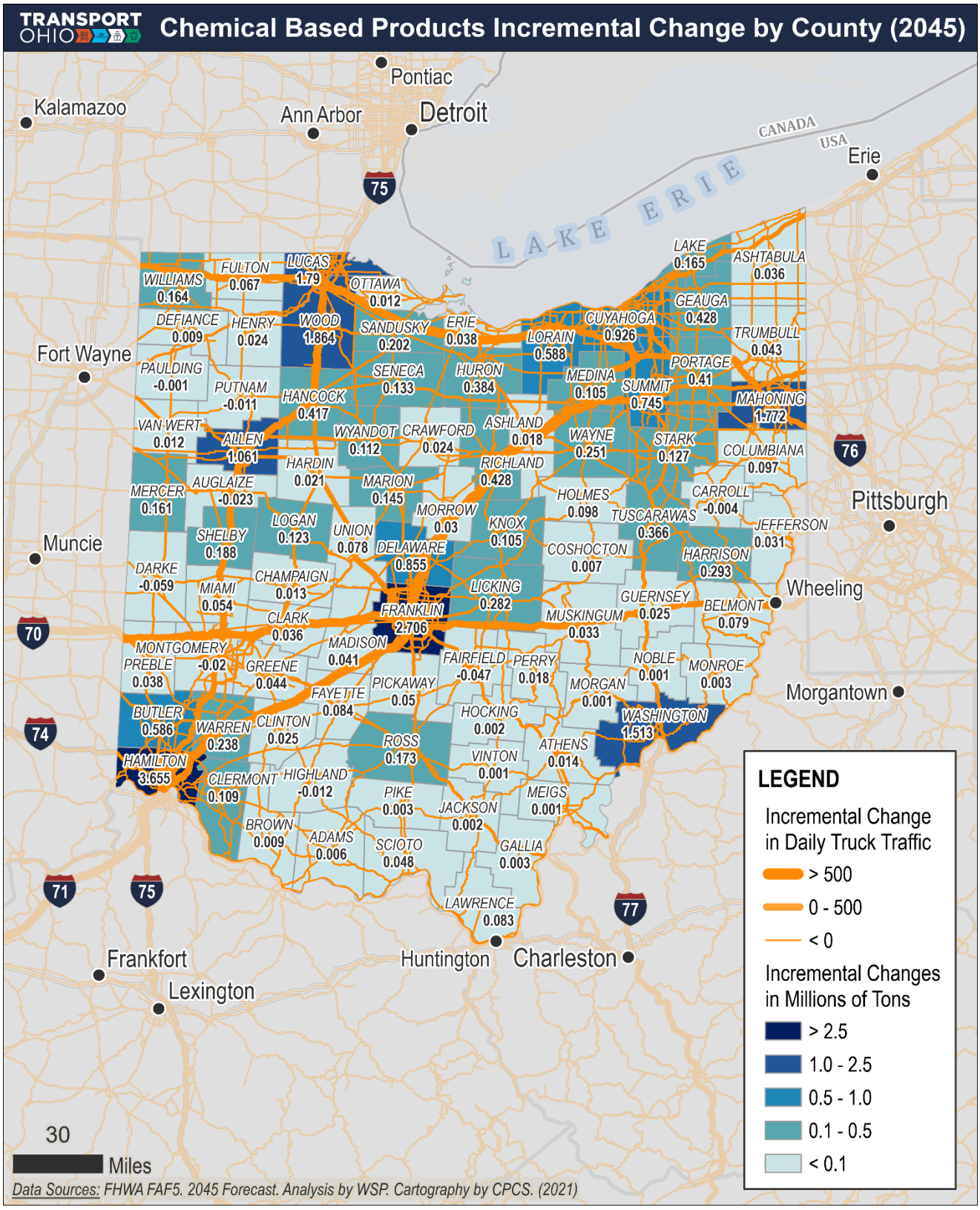
Figure 25: Total Incremental Tons by County – Advanced Manufacturing



Chemicals/Pharmaceuticals/Plastics

Figure 26 shows the incremental growth in commodities in the chemicals/pharmaceuticals/plastics industry group along with the incremental daily truck traffic carrying this class of goods. The counties that contribute most to the increase in tonnage between 2018 and 2045 are Hamilton, Franklin, Wood, Lucas, Mahoning, and Washington. Hamilton County (Cincinnati) accounts for 15 percent of the growth in this industry commodity between 2018 and 2045. I-71 again plays a critical part in carrying chemicals/ pharmaceuticals/plastics by truck within and beyond Ohio. Volumes also grow notably on I-80/I-90 between Toledo and Cleveland, I-70 (especially west of Columbus), and I-75 between Toledo and Cincinnati through Dayton.

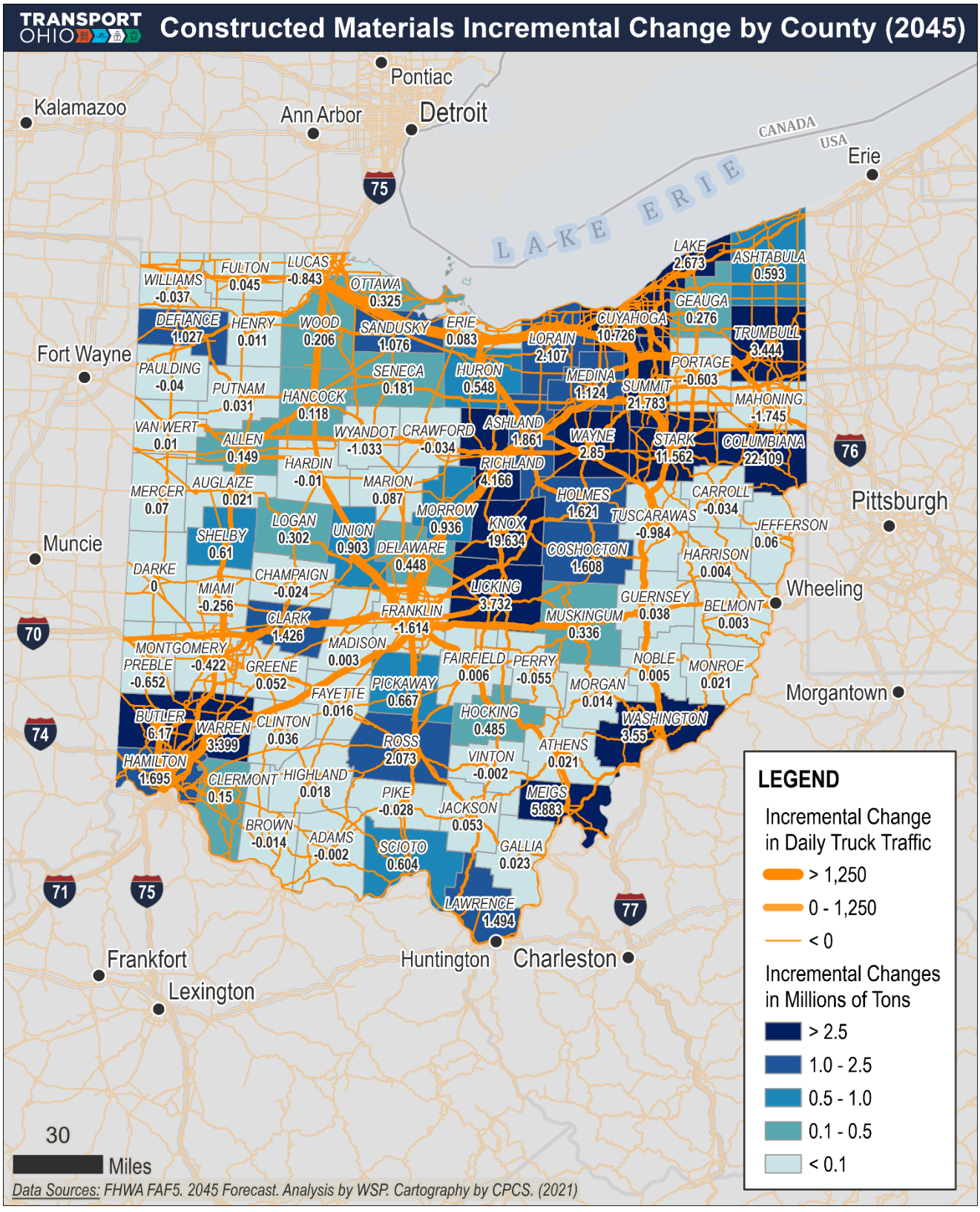
Figure 26: Total Incremental Tons by County – Chemicals/Pharmaceuticals/Plastics



Construction Materials

Figure 27 shows the incremental growth in commodities in the construction materials industry group alongside the incremental daily truck traffic carrying this set of goods. This group is the top source of tonnage growth between 2018 and 2045, and the counties that contribute most to the increase are Columbiana, Summit, Knox, Stark, and Cuyahoga. These counties are active in producing or receiving construction materials and show a mix of urban (construction in progress) and more rural locations (source of construction materials). Truck traffic growth reflects the more local sourcing and use of these goods – the truck traffic shows hub and spoke patterns around urban corridors. Once mined or produced, construction materials carried on trucks are not typically transported far from their source. I-71 continues to be important to the transport of these goods in the future with I-80/I-90, I-75, I-77, and US 33 contributing as well.

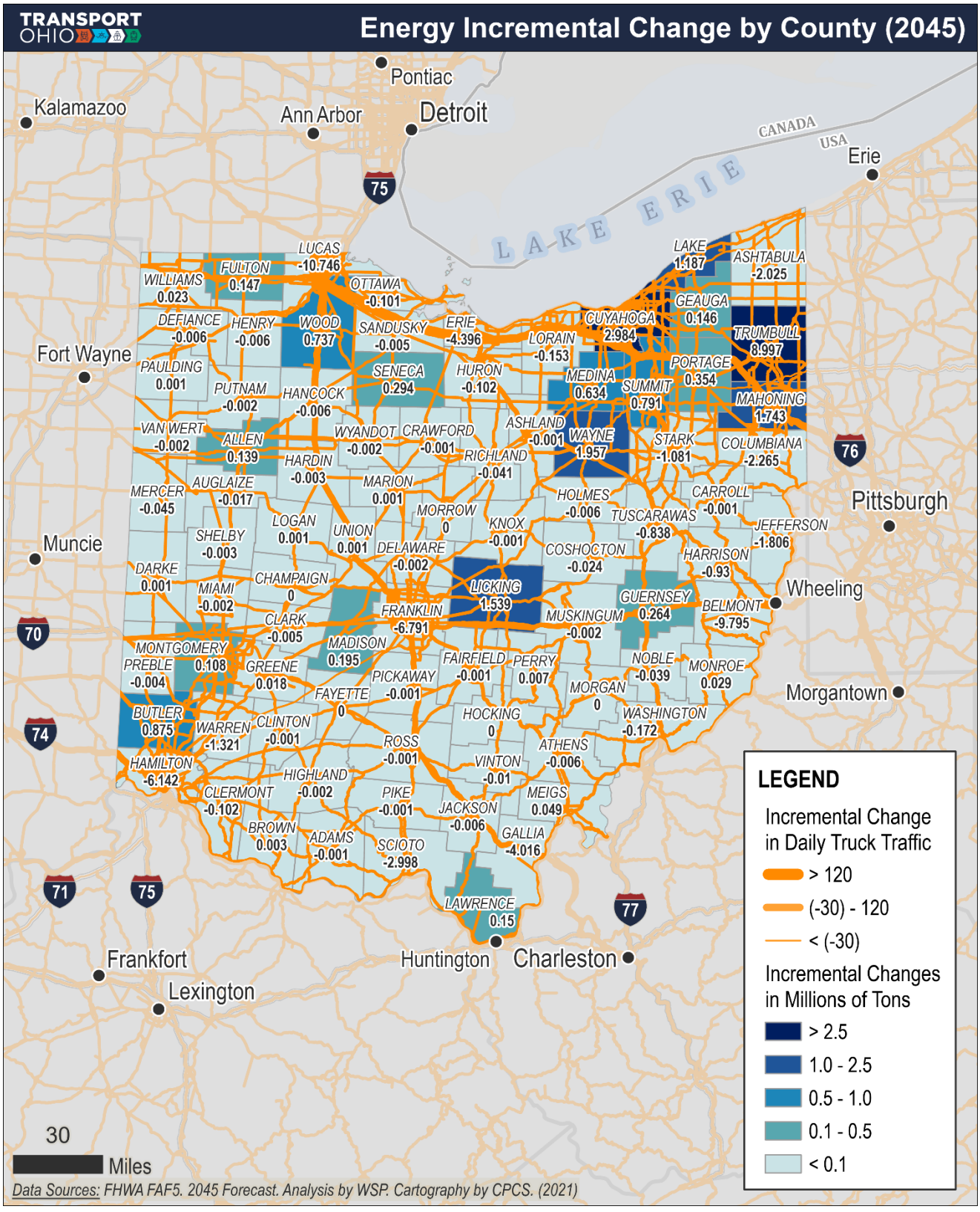
Figure 27: Total Incremental Tons by County – Construction Materials



Energy Products

Figure 28 shows the incremental growth in commodities in the energy industry group along with as the incremental daily truck traffic carrying this class of goods. The counties that contribute most to the increase in tonnage between 2018 and 2045 are Trumbull, Cuyahoga, Wayne, Mahoning, Licking, and Lake Counties. Decreases in energy industry group volumes are expected to occur in Erie, Hamilton, Franklin, Belmont, and Lucas Counties. This mixed picture reflects growth in the northern sections of shale country combined with falling volumes of coal, particularly by water. The forecast also does not include the ethane cracker plant planned in Belmont County, which would boost tonnage and add to the traffic on the Ohio River. Trucks carrying energy products show growth on I-76/I-80 between Youngstown and Toledo and have some limited corridors of reduced traffic as well.

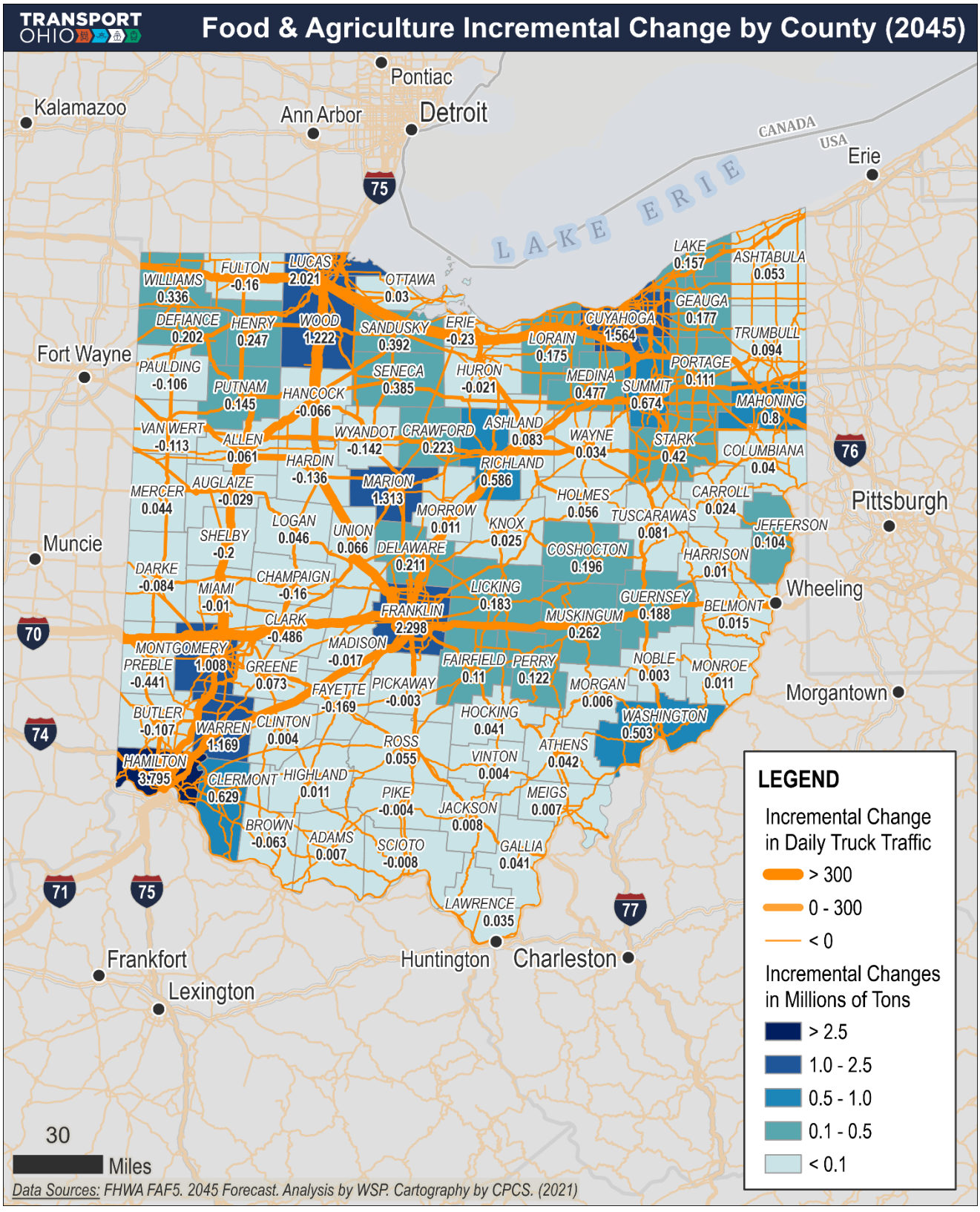
Figure 28: Total Incremental Tons by County – Energy Products



Food and Agriculture

Figure 29 shows the incremental growth in commodities in the food and agriculture industry group as well as the incremental daily truck traffic carrying this class of goods. The counties that contribute most to the increase in tonnage between 2018 and 2045 are the urban areas of Cincinnati (Hamilton), Columbus (Franklin), and Toledo (Lucas), which are both processing and consumption centers. The agricultural areas of northwestern Ohio are projected to remain stable in food production. Trucks carrying agricultural products and food for processing remain close to the farm source while also delivering final products to urban areas, which are growing. I-70 and I-80/I-90 serve both Ohio and neighboring states with food-related deliveries. Also, I-75 is a key corridor with US 33 contributing a connecting route to and from Columbus.

Figure 29: Total Incremental Tons by County – Food & Agriculture

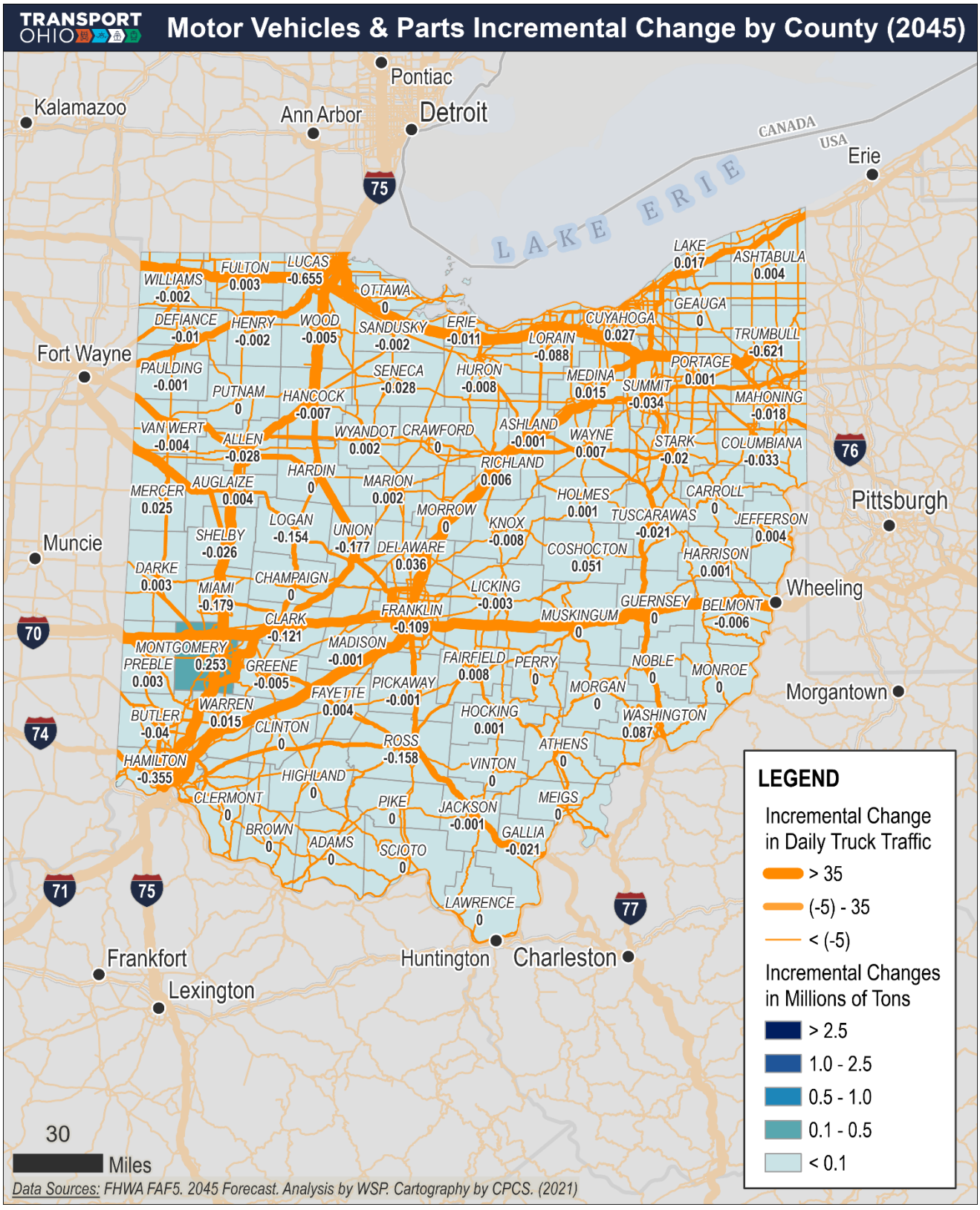


Motor Vehicles & Parts

Figure 30 shows the incremental change in commodity traffic in the motor vehicles and parts industry group, as well as the change in daily truck traffic carrying this class of goods. Most Ohio counties have some degree of involvement in the automotive industry and most of them are projected to see freight in this sector decline, including all counties with automobile and truck assembly plants. The exceptions with projected growth include the Dayton region (Montgomery County), home to the Duramax (GM/Isuzu) diesel engine plant and other facilities, and Cuyahoga County in the northeast. The forecast does predict modest (less than 4 percent) growth in inbound volumes, but this is more than offset by large decreases in outbound and intrastate traffic.

The causes for this outlook derive primarily from the effect of electric drivetrains on auto parts volumes and the longevity of vehicles. With 80 percent fewer components and the promise of million-mile batteries, the volume of parts needed in manufacturing and the after-market will be radically lower. Fewer components to move means less consolidation at cross-dock parts depots as well. The net effect on the highway system is lower truck traffic on most smaller roadways, and very modest increases on I-75, other interstates, and US 33. (Note that the scale of the incremental roadway traffic on this map is in double digits, not in the hundreds or thousands displayed for the other industry groups.) Finally, while this forecast is an appropriate reflection of the direction of the automotive industry, the future of electric vehicles and where they will be manufactured and assembled is by no means settled. ODOT and the State of Ohio will certainly monitor this sector closely in the coming years and support it with economic development efforts.

Figure 30: Total Incremental Tons by County – Motor Vehicles & Parts



Ohio's Freight System Designations

There are several key freight system designations that ODOT uses to plan and make investment decisions on the freight system. The designation of these networks is largely dependent on their use, the share of freight that they carry, and the commodities and industries served.

Ohio's Primary Highway Freight System

Under MAP-21, the FHWA designated 1,425.56 miles of Ohio highways as part of the Primary Highway Freight System (PHFS) (see Figure 31). Ohio's PHFS system makes up more than two percent of the national network, making it the state with the fifth-highest number of miles on the PHFS.

The Fixing America's Surface Transportation (FAST) Act, established the National Highway Freight Network (NHFN). The NHFN includes the following subsystems.[16] ODOT has elected to not designate critical urban- or critical rural- freight connectors.

- **Primary Highway Freight System (PHFS):** This is a network of highways identified as the most critical portions of the US freight transportation system determined by measurable and objective national data. The network consists of 41,518 centerlines miles, including 37,436 centerline miles of interstate and 4,082 centerline miles of non-interstate roads across the US.
- **Other Interstate portions not on the PHFS:** These highways consist of the remaining portion of Interstate roads not included on the PHFS. These routes provide important continuity and access to freight transportation facilities. These portions amount to an estimated 9,843 centerline miles of Interstate, nationwide, and will fluctuate with additions and deletions to the Interstate Highway System.

[16] https://ops.fhwa.dot.gov/freight/infrastructure/nfn/index.htm

Figure 31: Ohio's FHWA Designated Primary Highway Freight System

Designated Strategic Freight System

A Strategic Freight System (SFS) was designated to highlight the most critical multimodal freight systems and facilities in Ohio, and to build a broad awareness of the system among Ohio's freight stakeholders, elected officials, and the public.

Three key principles guided the SFS designation for Transport Ohio: a focus on current freight demand, a data-driven process, and a connected and contiguous network (Figure 32).

Figure 32: Guiding Principles for Strategic Freight System Designation

	**Focus on Current Freight Demand:** focus on the quantity of freight using the mode currently, as opposed to future flows. While performance has a role in designation, the primary focus is freight demand.
	**Data Driven:** use multiple data sets to triangulate and validate data. Consider input from ODOT staff and others on the variables and not the outcome of the analysis.
	**Connected and Contiguous Network:** assets should be connected to other portions of the NHFN and Ohio's strategic system and form a linked network of modes rather than being composed of disparate assets.

Figure 33 displays the final SFS designation for Ohio's road, rail, maritime, and aviation systems.

As part of the SFS designation process, multiple datasets were reconciled to compile a long list (not exhaustive) of Ohio's multimodal facilities connecting key freight corridors. While these multimodal facilities are *not* part of the designated SFS, Figure 34 presents a selection of Ohio's key multimodal facilities.

Figure 33: Ohio's Strategic Freight System

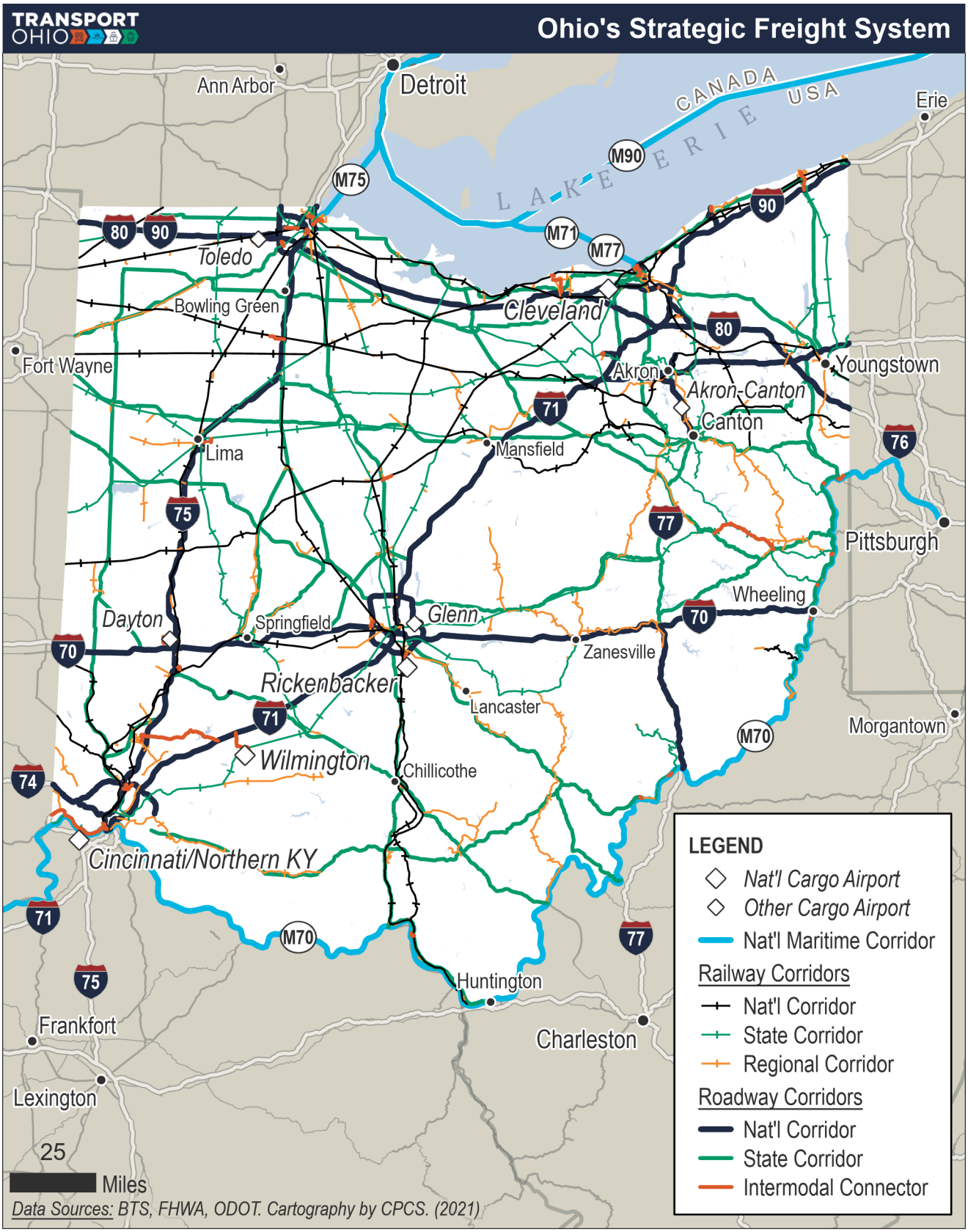
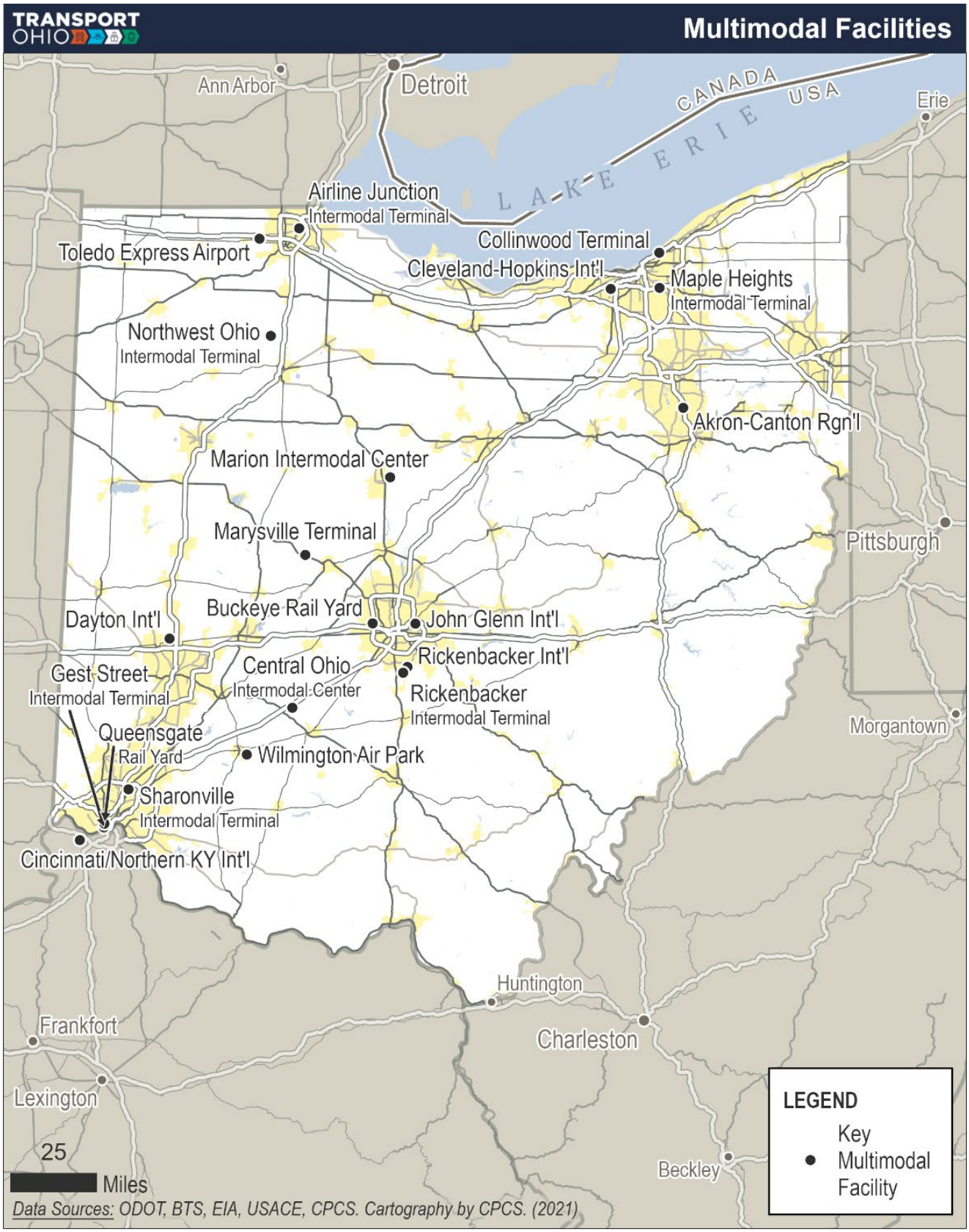


Figure 34: Ohio's Key Multimodal Facilities



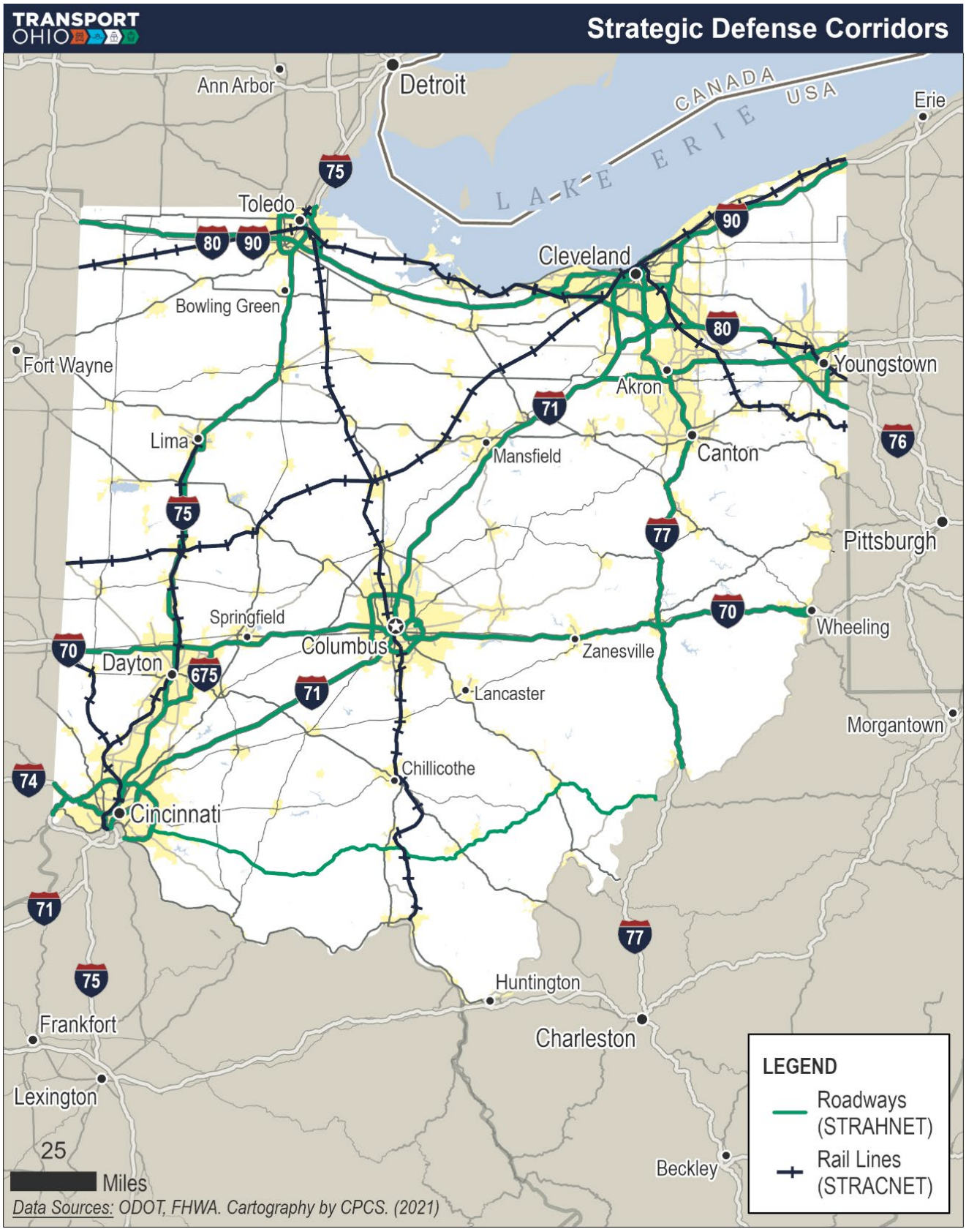
Ohio's Strategic Defense System

In addition to serving a critical role for Ohio's businesses and industries, the freight system also serves a broader role, as key portions of the highway and rail systems are designated by the US Department of Defense (DoD) as essential to the national defense. These designated corridors, including the bridges on the routes, meet required design standards and weight limits for ease of movement between key ports, airports, military installations, and other locations important for quick response and recovery. Figure 35 shows the STRAHNET (Strategic Highway Corridor Network) and STRACNET (Strategic Rail Corridor Network) corridors.

The national STRAHNET consists of nearly 63,000 miles of roads deemed necessary for emergency mobilization and peacetime movement of heavy armor, fuel, ammunition, repair parts, food, and other commodities to support US military operations. While DoD primarily deploys heavy equipment by rail, highways serve a critical role.

The national STRACNET consists of 38,800 miles of rail track that link 193 military installations to maritime ports of embarkation. The STRACNET main and connector lines must meet defense readiness requirements regarding maintenance condition, clearance, and gross weight. The National Defense Program coordinates the railroad operations with DoD's deployment and peacetime needs.

Figure 35: Strategic Defense Corridors



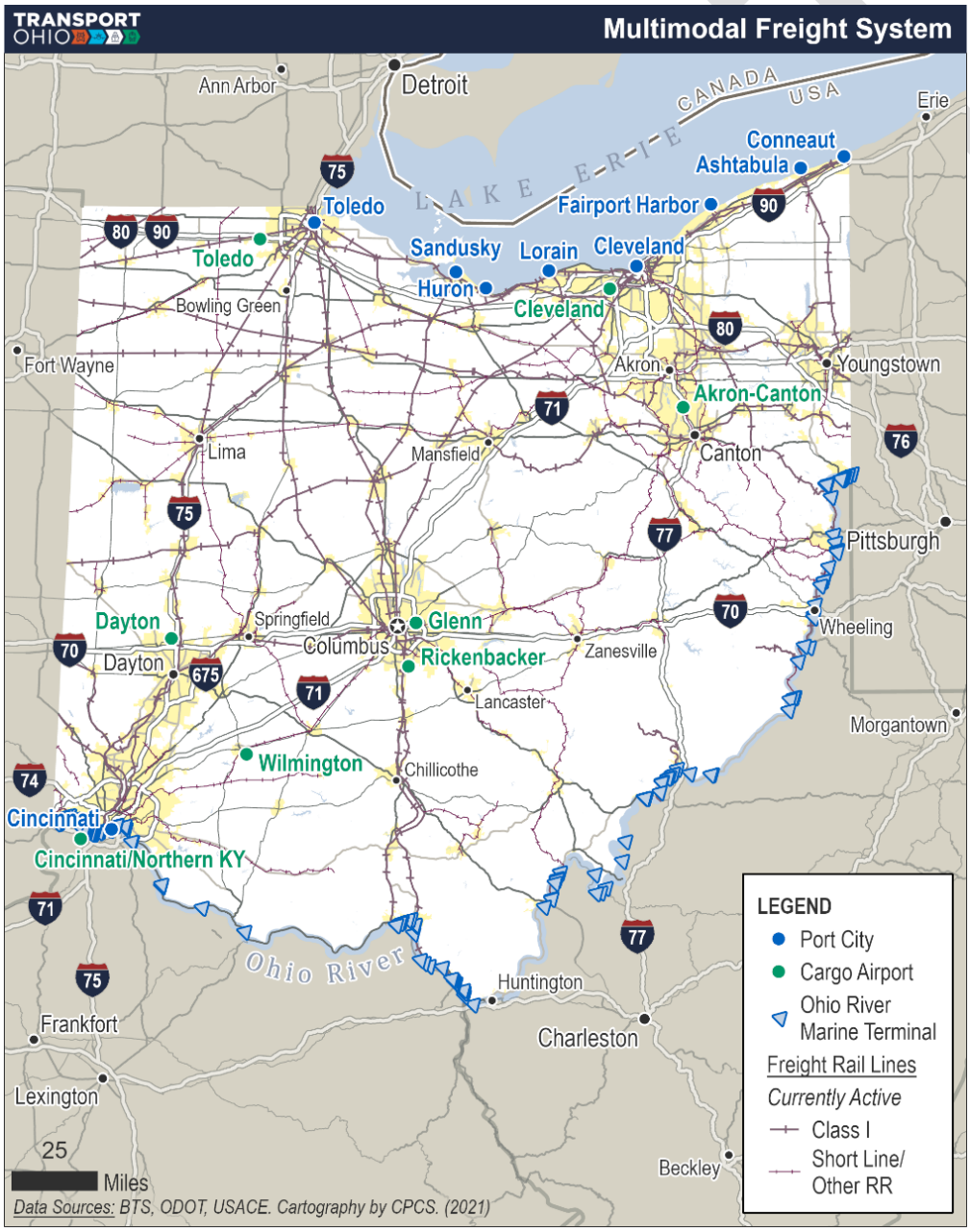
Ohio's Multimodal Freight System Summaries: Extent, Use, and Performance

Ohio has a vast freight system (Figure 36) that makes the state the trade hub for the Midwest and an anchor for global and domestic supply chains, including for Ohio's key industries of advanced manufacturing, automotive manufacturing, energy and chemicals, and food and agriculture, among others.

1,330	5,081	736	8	110,000+
Interstate Miles*	**Active Rail Miles**	**Maritime System Miles**	**Airports with regular cargo service**	**Miles of Gathering and Transmission Pipeline**

*ODOT owned, operated, and maintained, only.

Figure 36: Ohio Multimodal Freight System



Road Network

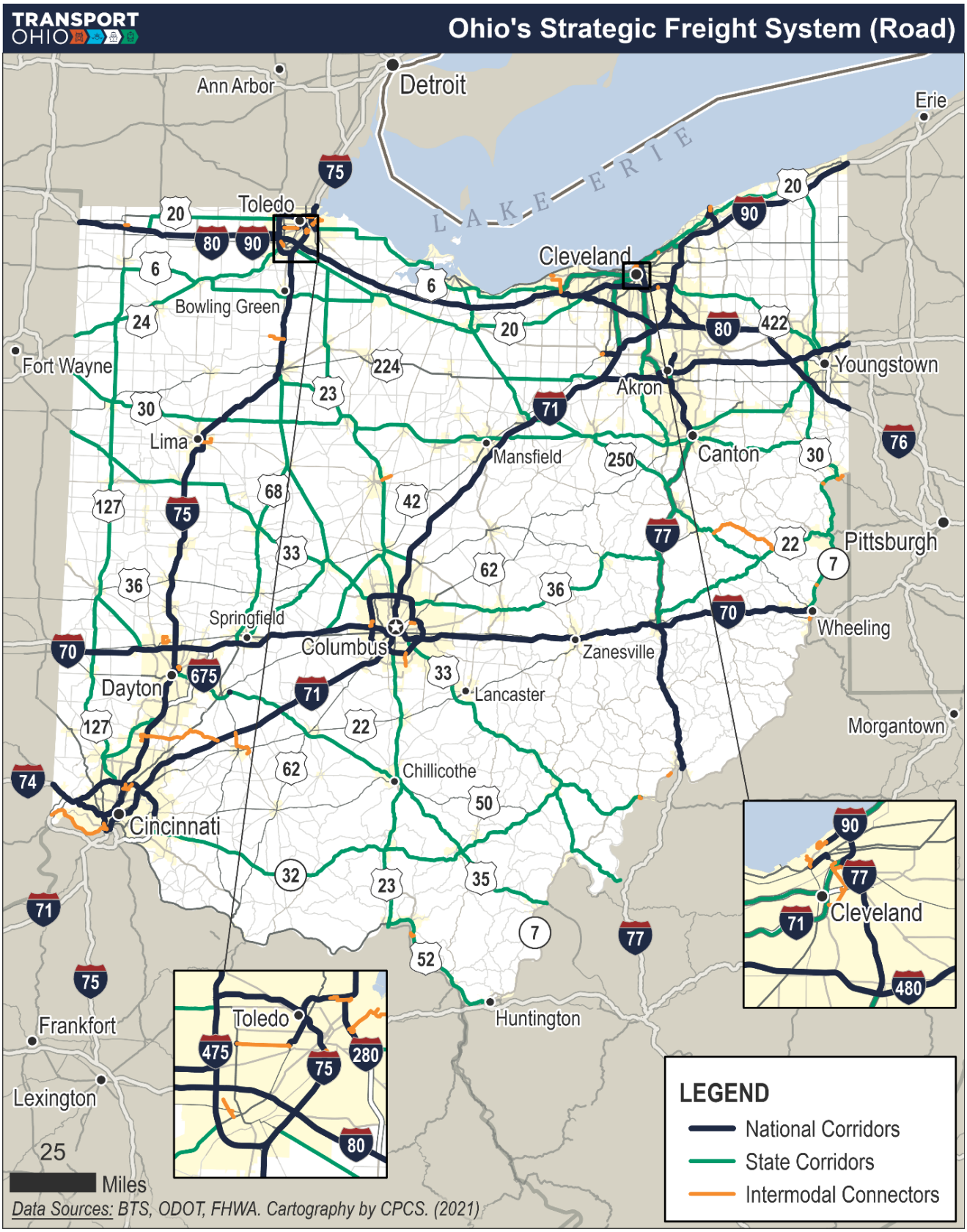
Ohio's road network (see Figure 37) can reach nearly any destination, providing direct connections to freight industries, facilities, and other modal systems. Due to the flexibility of trucking operations, trucks move most of Ohio's freight by both weight and value. Trucks carry a wide range of commodities in short- and long-haul moves and are the primary provider of critical "last mile" services for most businesses.

1,330	272	3,900
Interstate Miles*	**Ohio Turnpike Miles**	**US Highway Miles***

*ODOT owned, operated, and maintained, only.

While truck transport is suited to move a variety of freight across industries, it is generally preferred for moderate to high-value items of low to moderate weight-to-volume.

Figure 37: Ohio's Strategic Freight System (Road)



Strategic Freight System Use

Among the modes, truck is the dominant mode of freight transportation in Ohio. Figure 40 depicts the truck volume on the Strategic Freight System in 2018. National corridors all experienced more than 10,000 daily truck movements.

Although state corridors and intermodal corridors do not share as much truck traffic as the national corridors, they are forecast to see higher percentages of increase in truck volumes in 2045, with the truck movements on state corridors and intermodal corridors growing by 17.6% and 18.1% (Figure 38).

Figure 38: Daily Multi-Unit Truck Volume by Strategic Freight System

	2018 Truck Volume	2045 Truck Volume	Percentage of Increase
National Corridors	40,511,044	46,503,014	14.8%
State Corridors	7,270,336	8,549,952	17.6%
Intermodal Corridors	156,528	184,903	18.1%

Source: FHWA FAF 5, Analysis of WSP, 2021

The national and state corridors of the Strategic Freight System serve a dominant role in Ohio's economic activity, as well as an outsized role in interstate commerce. Figure 39 highlights the share of truck vehicle miles traveled (VMT) on the national and state corridors as compared to all Ohio roadways. The figure also indicates the share of VMT that is passthrough; over half of national corridor VMT was passthrough highlight the importance of these routes for national goods movement.

Figure 39: 2018 Vehicle Miles Traveled by Trucks on the Strategic Freight System

	Truck VMT	Truck Pass Through VMT	Percentage Passthrough VMT
National Corridors	16,987,876	9,426,547	55%
State Corridors	2,157,108	371,705	17%
National and State Corridors Combined	19,144,984	9,798,252	51%
All Ohio Roadways	21,521,188	9,992,263	46%

Source: FHWA FAF 5, Analysis of WSP, 2022. Note the term All Ohio Roadways refers to the network used to route the FAF 5 data.

Figure 40: 2018 Truck Volume on Strategic Freight System

Changes on the Road Network

In 2002, Ohio released its first freight study, *Freight Impacts on Ohio's Roadway System,* which noted the freight transportation industry was responding to global competition, new technology, and deregulation. The study noted, "businesses have moved from push-logistics systems that rely on large inventories to meet customer demand to pull-logistics systems that rely on timely information and reliable, just-in-time freight transportation to meet demand." These trends are ever-present today, and combined with technological and automation advances are further placing pressure on the roadway network.

Growing and Changing Freight Demand. Factors such as population growth and economic growth drive increasing vehicle miles traveled (VMT) and increased demand for goods, resulting in more freight transportation. The growth of e-commerce and demands for next day delivery have impacted freight movements, with more need for on-demand and short distance transportation. This has resulted in the development of warehouses and distribution centers on the urban periphery and into urban areas. These new warehouses and distribution centers in these areas generates additional and, in some cases, new truck traffic near and on last-mile corridors. Further, e-commerce growth has driven an increase of parcel delivery traffic on local street networks and two-lane systems. With these changing patterns come new challenges including: potential land use conflict and a need to incorporate freight land uses into urban area development; need to match traffic operations and infrastructure to meet increased traffic; and need to mitigate the exacerbation or creation of new problems, such as facility access and corridor management.

Freight Technology Deployments. Current and emerging technology deployments have the potential to enhance the performance of Ohio's freight transportation system in the short- and long-term. Decreasing hardware costs, maturing communications technology, and improved analytics have enabled the increasing use of technology in the transportation and logistics sector. Current and emerging technologies also enhance system performance monitoring and enable increased data collection and application. These technologies are increasingly applied to freight operations. Because of the work of DriveOhio, the Transportation Research Center Inc. (TRC) SMARTCenter, the Ohio State University Center for Automotive Research and others, Ohio is home to a range of current and emerging freight-focused technology deployments and programs that seek to explore and advance the transformative potential of several current and emerging technologies.

Truck Electrification. The potential to reduce costs and emissions have driven commercial and public interest in using electric powertrains for commercial motor vehicles. As a result, commercial vehicle manufacturers are developing, testing, and selling medium and heavy-duty electric trucks. Currently, the primary use of electric trucks has been for medium-duty trucks operating in urban environments. Challenges such as the cost and weight of batteries, availability of charging infrastructure, and uncertainty about the longevity of vehicles pose barriers to the widespread use of heavy-duty long/line-haul electric truck operations. ODOT released the Electric Vehicle (EV) Charging Study in June 2020 to assess the need for electric vehicle charging along Ohio's highway corridors. The study offers a strategy and recommendations for installing electric vehicle charging sites throughout the state.

Smart Projects Impacting Freight Throughout Ohio

- **Truck Parking Information Management System:** Ohio was part of a multi-state group collectively awarded a $25 million TIGER grant to develop and deploy a regional Truck Parking Information and Management System (TPIMS). The TPIMS, which launched in Ohio in 2019, monitors available public and private truck parking spaces and publishes the information in real time through dynamic messaging signs, smartphone applications, in-cab technology, and traveler information websites. In Ohio, the TPIMS provides real-time information about available parking spaces at nine rest areas along I-70, I-75, and US 33.
- **33 Smart Mobility Corridor:** This 35-mile highway corridor in Ohio will be equipped with high-capacity fiber-optic cable to facilitate data exchange between wireless sensors and data platforms. Sensors will collect real time data to inform travel flow, weather conditions, and incident management, which will in turn enhance highway mobility and safety. The corridor will also facilitate autonomous and connected vehicle research, development, and testing. Since 2016, over $100 million has been pledged by public and private partners to support the 33 Smart Mobility Corridor.[17]
- **Columbus Smart City:** The City of Columbus won the Smart City Challenge in 2016, receiving $40 million from US DOT with an additional $10 million from private-sector matches to support innovative projects in Columbus that enhance communication between vehicles, people, and infrastructure to efficiently manage the flow of people and goods throughout the city. Projects encompass real-time traffic management, V2X enabling technology, and electric vehicle charging stations, among others.[18]
- **Connected Marysville:** In conjunction with the 33 Smart Mobility Corridor, the City of Marysville is upgrading the city's 27 traffic signals and equipping them with Dedicated Short Range Communication (DSRC) radios to be used at Road Side Units (RSUs). As a result, the traffic signal devices will be able to exchange data with connected vehicles. Project partners have also committed to equipping at least 1,200 vehicles with On Board Units (OBUs), upgrading them to connected vehicles.[19]
- **I-90 Lake Effect Corridor:** A stretch of I-90 through Lake and Ashtabula counties receives significantly more snow than the rest of northeast Ohio. The whiteouts, caused by lake-effect snow, create treacherous driving conditions and lead to snow incidents. In response, ODOT has installed Dynamic Message Signs (DMS), traffic cameras, weather sensors, and networking and software devices along the corridor to enhance safety and reduce crashes and fatalities along the corridor.
- **I-670 SmartLane:** As Ohio's first SmartLane, this nine-mile stretch between downtown and Columbus and John Glenn Columbus International Airport, features Variable Speed Limits, Dynamic Hard Shoulder Running, and DMS to proactively manage traffic and reduce congestion in downtown Columbus. Enabled by live data streams, SmartLane is used as a travel lane during peak hours, but becomes a shoulder during other points of the day. ODOT also publishes the current speed limit and live camera feeds on the ODOT OHGO app and website. The cost to develop the SmartLane is significantly less than the cost of building an additional lane.

[17] https://www.33smartcorridor.com/; https://www.33smartcorridor.com/mobility

[18] https://smart.columbus.gov/

[19] https://www.33smartcorridor.com/connected

Performance Needs

Safety

The safety of roadways in Ohio may be measured in a variety of ways, including using the truck fatality rate, which refers to the number of truck-involved injuries per 100 million truck miles traveled. Figure 41 shows that, using the truck fatality rate as a measure, safety has improved on national corridors within Ohio, but has worsened on state corridors and intermodal connectors. Since the bulk of vehicle miles traveled occur on national corridors, average safety has improved on all roads. The figure also notes that more frequent and severe crashes occur near urban areas. Intermodal connectors also tend to see more severe crashes.

Figure 41: Key Highway Safety Needs

Performance Measure / System Segment	Trend	Key Findings
Truck Fatality Rate (Truck-involved injuries per 100M truck miles traveled)		• The truck crash rates on all system segments have been decreasing. • The truck-involved fatalities show an increasing trend after factoring in the truck-mile-traveled. • Intermodal connectors have higher fatality rate and severe injury rate for truck-involved crashes. • More crashes and higher fatality and severe injury densities occur near urban areas, including Cincinnati, Columbus, Cleveland, Toledo, and Dayton.
All Roads	⌄	
National Corridors	⌄	
State Corridors	⌃	
Intermodal Connectors	⌃	

Source: CPCS Analysis and stakeholder feedback

Preservation

Preservation refers to the condition of pavement and bridges on different corridor types. Figure 42 shows that national corridors have the lowest percentage of roadways in poor condition, at 0.3 percent. State Corridors have the highest percentage of roadways in poor condition, at 2.7 percent. Similar differences are present for bridges. National corridors have no bridges in poor condition. Intermodal connectors have the highest percentage of bridges in poor condition at 2.2 percent, constituting nine bridges. Despite these differences, pavement condition is generally good throughout the entire system.

Figure 42: Key Highway Preservation Needs

Performance Measure / System Segment	2019/2020 Statistics	Key Findings
Pavement Condition (Poor)		• State corridors have higher pavement maintenance needs, even though the pavement conditions are generally good on the entire system. • Intermodal connectors present higher needs in bridge preservation.
National Corridors	0.3%	
State Corridors	2.7%	
Intermodal Connectors	1.8%	
Bridge Condition (Poor)		
National Corridors	0	
State Corridors	9 bridges (0.4%)	

Performance Measure / System Segment	2019/2020 Statistics	Key Findings
Intermodal Connectors	3 bridges (2.2%)	

Source: CPCS Analysis and stakeholder feedback

A review of the top segments with preservation needs shows that national corridors constitute the largest number of segments that demonstrate urgent needs for infrastructure repair and improvement. Yet, the segment with the poorest infrastructure condition is an intermodal connector that serves Buckeye Yard in Franklin County. The facility went through a $59 million expansion, which was completed in 2013, adding 24 acres and doubling the capacity from 180,000 to 360,000.[20] As the only path that connects the intermodal terminals and multiple warehouses to the adjacent I-270, the intermodal connector segment has poor pavement and bridge conditions, which could be detrimental to the freight movements at the CSX Columbus facility.

Efficiency & Reliability

Efficiency and reliability refer to how quickly and reliably vehicles can maneuver on Ohio's road network. The truck travel time reliability (TTTR) index was used to evaluate efficiency and reliability. The state's target is a TTTR index of 1.5 or lower for the interstate system. Figure 43 shows that both national corridors and state corridors meet this target, with TTTR indices of 1.41 and 1.39, respectively. Intermodal connectors, however, fail to meet this target, with a TTTR index of 1.86. The figure also notes that four segments on the Ohio road network – three of which are located in the Greater Cincinnati area – are among the top 100 truck bottlenecks in the US according to ATRI. The bottleneck on I-71 at I-75 has been classified as one of the nation's top ten bottlenecks in recent years, reaching its highest ranking in 2021, while the bottleneck on I-75/I-71 at I-275 (in Kentucky) increased over 60 spots from the prior year's ranking.

Figure 43: Key Highway Efficiency and Reliability Needs

Performance Measure / System Segment	2019 Statistics	Key Findings
Truck Travel Time Reliability (Target is 1.5 or lower)		• Four locations in Ohio appeared on the Top 100 Truck Bottlenecks List developed by the American Transportation Research Institute (ATRI). ○ #2. Cincinnati, OH: I-71 at I-75 ○ #24: Cincinnati, OH: I-75/I-71 at I-275 ○ #67: Columbus, OH: I-71 at I-70 ○ #81: Cincinnati, OH: I-75 at I-74 • Three out of the four ATRI-identified bottlenecks are located in Greater Cincinnati. • Ohio needs to be resilient to unexpected roadway changes. For example, the closure of the Brent Spence Bridge led to a sudden decrease of capacity in the Cincinnati region. • Roadway capacity needs to accommodate the volumes and weights of the trucks that serve the new distribution centers and manufacturing facilities. • Some rail overpasses have inadequate height clearance, causing trucks stuck under those overpasses.
National Corridors	1.41	
State Corridors	1.39	
Intermodal Connectors	1.86	

Source: CPCS Analysis and stakeholder feedback

[20] Mid-America Freight Coalition. CSX Columbus, OH. https://midamericafreight.org/index.php/rfs/network-inventory/rail/intermodal-facilities/csx-columbus-oh/

First-/Last-Mile Roadway Connector Needs

Adequate access to freight facilities (e.g., business establishments generating freight, freight transfer points such as airports, truck/rail terminals, and pipeline terminals and refineries) is crucial to the efficient and reliable operation of the transportation system. The condition and performance of intermodal connectors – the access roads connecting freight facilities to the broader transportation system – are indicators of the ease of mobility and accessibility of the system. Ohio Freight Advisory Committee (FAC) meetings and individual stakeholder consultations revealed several key needs of these first-/last-mile connectors:

- Growing e-commerce demand and an increasing number of distribution centers require first-/last-mile connectors to prepare for higher traffic volume.
- Intermodal connectors that serve as linkages between non-highway modes, such as logistic centers at Cincinnati/Northern Kentucky International Airport (CVG) and Rickenbacker International Airport (LCK), experience higher delay.
- Delay on intermodal connectors compromises the region's economic competitiveness and increases local safety concerns.

Mobility and Accessibility

The evaluation of intermodal connectors by safety, preservation, and efficiency and reliability provides insight into the ability of those key first-/last-mile connectors to adequately serve Ohio's multimodal freight system and support economic growth. The results of the needs synthesis suggest that the intermodal connectors with the greatest needs are located in areas with multiple key freight assets:

- **The Greater Cincinnati – Dayton Region** has a nexus of roadway, railway, aviation, and maritime freight systems. Multiple interstates (I-71, I-74, I-75), as well as and multiple bridges crossing the Ohio River, pass through the region. The region is also served by two Class I railroads, including NS and CSX, and a few short lines. Additionally, various intermodal terminals and transload facilities provide access to the Ohio River for fleeting operations to move cargo from barge to trucks. CVG is also located in this region, serving as Ohio's largest cargo airport and home to one of DHL's global hubs, handling over 80 percent of the company's US volume, as well as an Amazon air hub. The region's ILM cargo airport also serves Ohio's growing e-commerce and Amazon freight. With significant existing freight infrastructure, intermodal connectors are essential for conveying goods in the region.
- **The Greater Columbus Region** is located at the center of Ohio and has four intermodal terminals and two airports, along with I-70, I-71, and I-270. The cargo-dedicated LCK is situated in the North American International Freight Center, has one of the nation's top ten FTZs, and provides global access to shippers in Ohio and its surrounding states. The result of the needs evaluation indicates that the intermodal connector linking the Columbus CSX and NS container facility to I-270 – known as Alum Creek Drive – is one of the state's highest need segments. Though not evaluated as a high need intermodal segment, the connector between LCK and I-270 also experiences preservation and safety issues.
- **The Greater Cleveland area** has the Port of Lorain and the rail-served Port of Cleveland that both offer access to the Great Lakes / St. Lawrence Seaway System. As the only Great Lake port on the US side of the Great Lakes to regularly handle containerized cargo, the Port of Cleveland is an important hub for import and export goods from Europe and other regions overseas. The intermodal connectors with the highest overall needs are located at the two ports, and accessibility by road is essential to their efficient operations.
- **Toledo** has the second-largest lake port by tonnage in Ohio and is located near Detroit and the US-Canada border. It also receives service from multiple Class I railroads, including CSX, NS, and Canadian National Railway. I-75 provides a roadway connection between the Port of Toledo and inland markets. The accessibility of multimodal facilities directly impacts the utilization of the region's freight assets.

Two intermodal connectors impact the accessibility of the Norfolk Southern Junction Intermodal Facilities, the grain elevators near the port, and the BP Husky refinery's truck-pipeline facility.

- **Ashtabula**'s port area provides connections to NS and CSX rail lines, as well as to I-90. The intermodal connector at this site is the only link between the port and I-90; therefore, it is critical for preserving the access to Ashtabula's port on Lake Erie. Particularly given the declining coal demand impacting tonnage handled at this facility, access to water will help the Ashtabula region utilize its freight assets and attract other industries.

Intermodal connectors with top needs are also within the US Environmental Protection Agency (EPA)'s non-attainment areas or maintenance areas. These are areas that do not meet the air quality standards set by EPA. The lack of mobility on those intermodal connectors may add additional air pollution and impact the health and wellbeing of surrounding communities negatively.

The CSX North Baltimore Intermodal Facility

The North Baltimore Intermodal Facility is strategically situated between Chicago and CSX's Northeast mainlines, and is only three miles away from I-75, providing easy access to local and regional markets. In 2018, CSX announced their plan to expand this intermodal facility, including a 500-acre logistics park development. According to CSX's 2020 Environmental, Social, and Governance Report, the investment in the North Baltimore facility brought seven zero-emission, wide-span electric cranes, with each crane having a 46-ton capacity to move containers efficiently between trains and trucks allowing the facility to increase throughput while minimizing environmental impact.

Truck Parking Needs

Truck driver access to safe and available truck parking is critical to the safe and efficient movement of freight throughout Ohio. Truck drivers count on truck parking locations to get the rest they need, as required by Federal Hours of Service (HOS) regulations. Truck parking is also important as drivers wait for pick-up and delivery appointments (known as staging). Inadequate truck parking leads to economic and social costs for both truck drivers and the public (Figure 44).

Figure 44: Impacts of Inadequate Truck Parking

Truck Driver Option	Impact	Goal Area
Truck driver stops early	• Lost drive time, reduced economic efficiency	• Efficiency & Reliability • Economic Competitiveness
Truck driver parks in undesignated location	• Citations add to the cost of doing business • Reduced safety for truck driver and other roadway users • Damage to roadway and ramp shoulders • increased noise and emissions impacts, and associated environmental costs from idling trucks	• Safety • Preservation • Economic Competitiveness • Quality of Life
Driver exceeds HOS looking for truck parking	• Citations add to the cost of doing business • Reduced safety for truck drivers and other roadway users • Increased noise and emissions impacts, and associated environmental costs from additional miles spent looking for truck parking	• Safety • Efficiency & Reliability • Economic Competitiveness • Quality of Life

Source: CPCS

In addition to the adverse safety, infrastructure, quality of life, and economic issues that result from inadequate truck parking, Ohio stakeholders cited the following top truck parking trends, needs, and challenges in the state.

Need for truck parking for HOS breaks and staging: Trucks parked in undesignated areas for longer periods of time (7+ hours) suggest a truck parking capacity issue for drivers trying to find a place to take long HOS breaks. Trucks parked in undesignated areas for less than seven hours and in urban areas or near freight generators suggest a truck parking capacity issue for drivers waiting for shipper/receiver appointments (staging). Truck drivers often need space to stage, since many shippers/receivers do not allow trucks to park on-site early. Truck parking must be provided at locations with high demand – along existing key freight corridors and near freight-generating facilities, particularly in and near urban areas. Adding truck parking to address excess demand in urban areas is further challenged by the high price of land and land-use conflicts in urban areas.

Need for truck parking infrastructure that accommodates existing truck sizes: Many truck parking locations are not designed to handle the length and width of today's trucks. At these locations, longer trucks with wider loads have difficulty maneuvering in and out of truck parking facilities and spaces. Without sufficient space, truck drivers may be forced to drive over curbs or through undesignated areas.

Need for improved access to amenities: Truck drivers, particularly those on long-haul routes that require overnight parking stays, require basic amenities, notably lighting, security, restrooms, showers, food options, and trash cans. However, these amenities are not available at all truck parking locations, particularly those not developed with overnight truck parking needs in mind. Access to restrooms is important at both overnight and staging locations, as shipper/receivers may not allow truck drivers to use their facilities. Amenity issues have been exacerbated by the COVID-19 pandemic. As some facilities closed, many drivers were unable to access restrooms and other basic amenities, with limited information about which facilities were open/closed. Additionally, as new trucking technologies emerge, truck parking facilities will need to consider providing additional amenities, such as alternative fuel/electric charging stations and idle reduction technologies.

Need for accessible, accurate, reliable, and up-to-date parking information for truck drivers: Undesignated parking occurring near truck parking facilities with availability suggests there is an information gap between actual truck parking availability and truck drivers' knowledge of truck parking availability. This may be due to a lack of available information itself, driver knowledge about available information sources, or information that is provided in a way that is not useful to drivers. For truck parking information to positively impact decisions, it must be accurate and easily accessible by truck drivers.

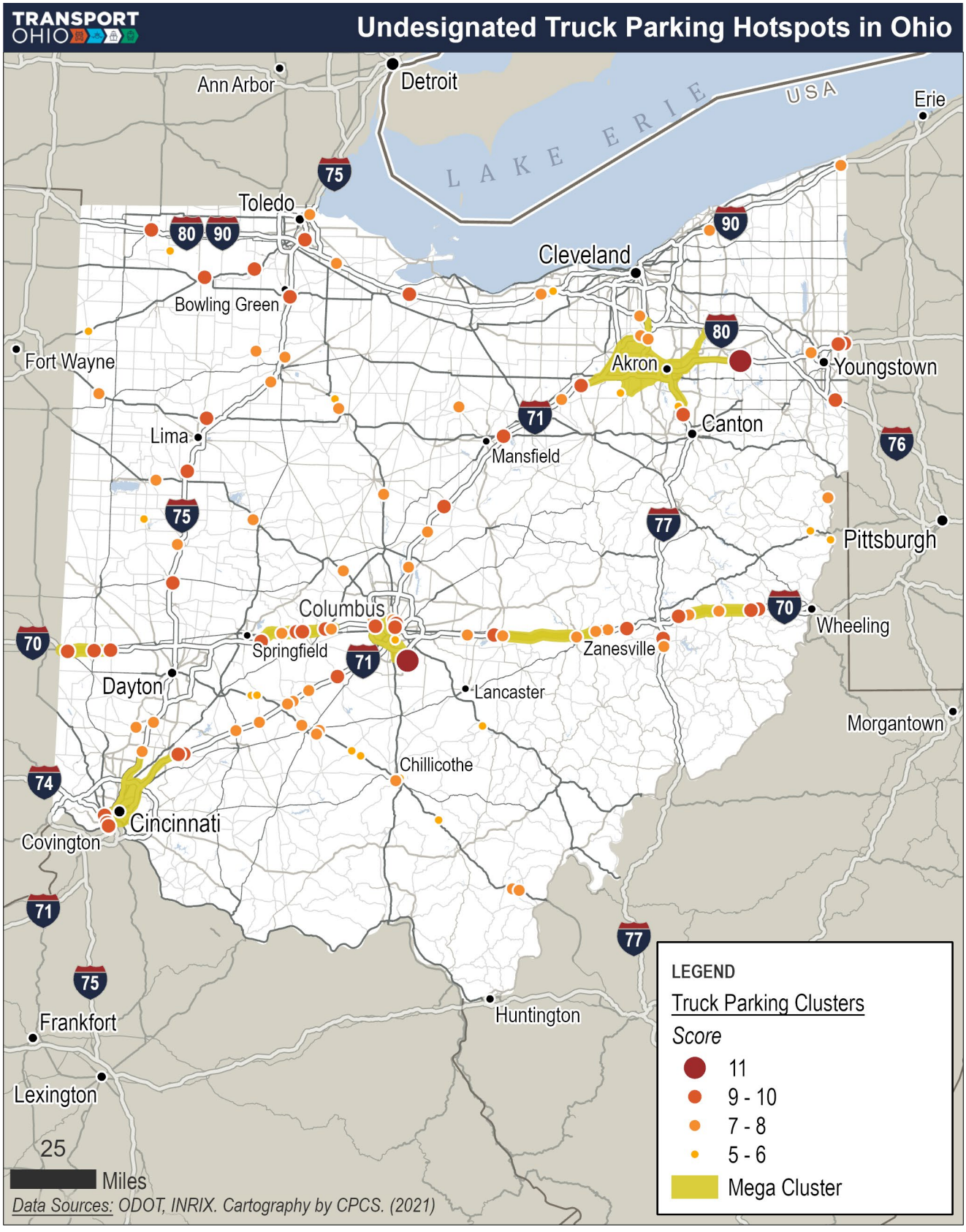
Need for truck parking information at the regional and local levels: Stakeholders in Ohio noted a lack of truck parking information and data on truck parking demand, utilization, issues, needs, and areas of opportunity at the regional and local levels. There is also a lack of widespread awareness among local stakeholders about the link between truck parking and local economic development. Meanwhile, there is limited understanding – from both local agencies and the private sector – on the role of local agencies in addressing truck parking issues.

To locate the greatest truck parking needs in Ohio, the Ohio Truck Parking Study identified and evaluated locations of undesignated truck parking throughout the state. Undesignated truck parking refers to unmarked locations where trucks park. The prevalence of these locations constitutes the most noticeable indicator of truck parking issues, providing insight into both the locations and magnitude of unmet truck parking demand. High concentrations, or clusters, of undesignated truck parking were prioritized based on safety impacts (frequency and severity of crashes related to truck parking), capacity shortage (count and duration of undesignated parking), and proximity to key freight corridors. Top-ranked undesignated truck parking clusters located close to one another were then grouped to form Mega-Clusters (Figure 45).

The resulting mega-clusters (shown in yellow) denote where there is a concentration of high prioritization scores, but that does not imply that other parts of the state do not have truck parking issues. Rather, areas such as I-75 or the connecting roadways around Toledo have areas of undesignated truck parking, but they did not rank as high as other clusters in Ohio.

In total, seven undesignated truck parking mega-clusters were identified. Each mega-cluster is anchored by at least one high-priority cluster and includes several additional undesignated truck parking clusters as well as major highways on which the clusters are located. Together, the combination of the four mega-clusters along I-70 and the Columbus and Cincinnati mega-clusters suggests significant truck parking needs in Southwest Ohio and through Central Ohio. Additionally, the final mega-cluster is around Akron and between Akron and Youngstown, which has many priority truck parking clusters scattered along several major corridors including I-71, I-76, I-77, I-80, I-271, and SR 21.

Figure 45: Undesignated Truck Parking Hotspots in Ohio



Rail Network

Ohio's rail network (see Figure 46) has historically played a large role in Ohio's freight system and the state's economy. Ohio has the third-highest number of rail miles and the fourth-highest number of freight railroads in the country.

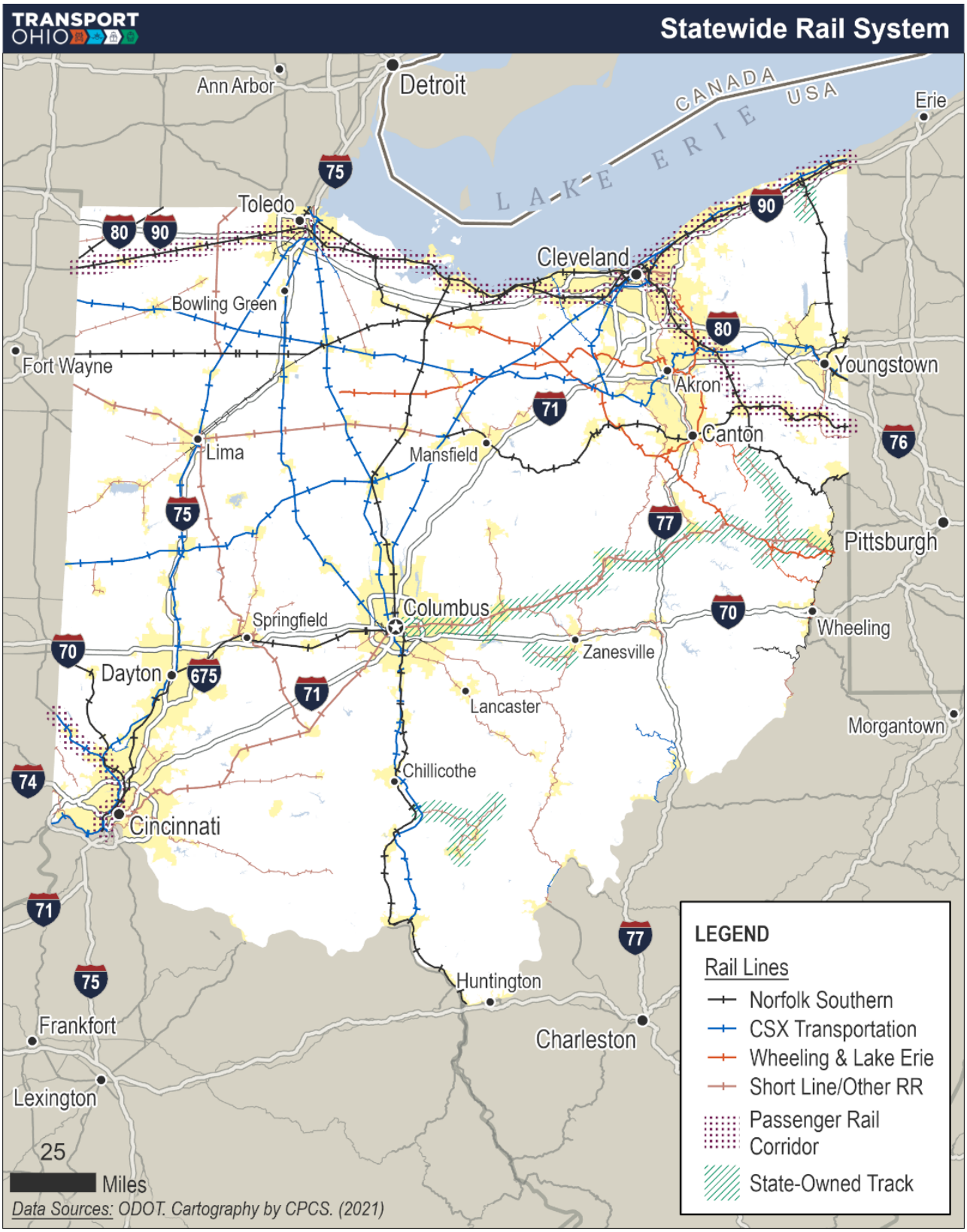
5,081	3.7%	41	8,700+
Active Rail Miles	**Percent of US Rail System**	**Operating Railroads**	**At-grade Rail Crossings**

Rail traffic in Ohio is comprised of both heavy, bulky moves (e.g., agriculture-related) and lighter, higher-value intermodal moves (i.e., containers).

Ohio has a "high density" rail network (compared to geographically larger states such as Texas and California) and a lower average shipment distance for commodities carried by rail (619 miles in Ohio compared to more than 1,000 miles nationwide).

Rail connects Ohio to deep water on the east and west coasts and provides higher-speed rail service for higher-value goods.

Figure 46: Statewide Rail Network



Changes on the Rail Network

Improvements in technology are dramatically improving the operations of Ohio's rail network. When combined with evolving industry requirements and a changing commodity mix, the rail network of the future will be quite different in terms of extent, service, and safety compared to the network of the past.

Positive Train Control (PTC) systems are advanced communication-based and processor-based train control technologies that can automatically stop trains to prevent accidents. PTC technology is particularly useful in preventing train-to-train collisions, over-speed derailments, incursions into established work zone limits, and trains' movements through a misaligned route. After multiple fatal rail incidents around the US, including two incidents that involved commuter trains in California, the US Congress passed the Rail Safety Improvement Act (RSIA) in 2008 to address the underlying causes of these incidents. In addition to the highway-rail grade crossing safety, pedestrian safety, and trespasser prevention regulations, the RSIA required PTC systems to be "fully implemented … on Class I railroads' main lines that transport poison- or toxic-by-inhalation hazardous materials and any main lines with regularly scheduled intercity or commuter rail passenger service." 100 percent of PTC installation required for Amtrak and Class I railroads serving Ohio is complete.

Precision Scheduled Railroading (PSR) is an operating model utilized by almost all North American Class I railroads to increase operational efficiency. PSR focuses on five principles: improve service, control costs, optimize asset utilization, operate safely, and develop employees. Operationally, a railroad using PSR operates trains on a fixed schedule rather than using the number of loaded cars to determine when a train should depart. PSR also focuses on minimizing the number of times a railroad handles a railcar, decreasing network complexity, and eliminating unprofitable origin and destination pairs. Impacts of PSR may include the closing rail yards and the elimination/abandonment of unprofitable lanes leading to changes in the rail freight origins/destinations and shipper options. PSR also may impact the safety of at-grade rail crossings including longer trains that block vehicle and pedestrian access at grade crossings.

The Future of Appalachian Rail Lines. Coal production east of the Mississippi River was dominated by West Virginia, Kentucky, Pennsylvania, Illinois, Indiana, and Ohio. The majority of Appalachia's coal is consumed domestically and relatively close to where it is mined. When modal options, distances, and volumes allow, coal can be moved by truck, barge, and rail. However, direct rail connections available between coal mines, preparation facilities, and coal-fueled power plants have made rail the dominant mode of transport in Appalachia. With this close commercial relationship between coal and rail operations, the recent changes in the production and demand for coal are being borne out as decreased rail volumes with declining coal production. Additionally, the increased supply of natural gas has allowed the electricity production sector to have a smooth transition from coal without impacting the electricity prices. Meanwhile, the coal-hauling railroads have started to respond by taking measures that can significantly affect the Appalachia region's economy, including idling or downgrading specific facilities and routes to mitigate the financial effects of diminished coal volumes.[21]

[21] Appalachian Regional Commission, Access vs. Isolation Preserving Appalachia's Rail Connectivity in the 21st Century, 2017.

Rail Network Needs

Safety

The safety of railroads in Ohio is measured by rail-related casualty risk. Figure 47 shows that using this measure, safety has improved on state corridors and regional corridors but worsened on national corridors in Ohio. Average safety has improved on all railroads. The figure also notes that the southwest portion of Ohio between Cincinnati and Dayton experiences the highest concentration of rail-involved casualties.

Some of the needs mentioned by stakeholders include the application of new technologies to improve operation safety, as well as the occurrence of blocked crossings.

Figure 47: Key Rail Safety Needs

Performance Measure / System Segment	Trend	Key Findings
Rail-related Casualty Risk		• More than half of the rail-related casualties in Ohio happened on the National Corridors between 2015 and 2019. • The southwest part of Ohio between Cincinnati and Dayton shows the highest density of rail-involved casualties. • Ohio has a large number of highway-rail crossings, which could pose potential safety threats. • Blocked crossings have become another safety issue in Ohio.
All Rail Lines	↓	
National Corridors	↑	
State Corridors	↓	
Regional Corridors	↓	

Source: CPCS Analysis and stakeholder feedback

The majority of the rail safety needs are located on the National Corridors. The segments with the most safety concerns are located in the northern part of the state. Many of the top safety needs hot spots form two clusters in the Toledo and the Cleveland areas, with most unsafe segments within urban areas. This may be due to a higher possibility of collision occurrence with heavier traffic and denser population.

Preservation

Preservation refers to the physical condition of railroads. This analysis assesses preservation by examining the percent of railroads that have 286,000-pound capable track. This is effectively a measure of the capacity, or weight limit, of the railroad. Figure 48 shows that national rail corridors in Ohio have the highest percentage of 286,000-pound capable track at 60 percent. Regional rail corridors have the lowest at 14 percent. The average for all rail lines in Ohio is 53 percent. The figure also notes that some lightly used branch and local rail lines cannot handle these heavier cars, which limits their ability to accommodate certain trains.

Figure 48: Key Rail Preservation Needs

Performance Measure / System Segment	2021 Statistics	Key Findings
Percent 286,000 Pound Capable Track		• Some lightly used branch lines and local rail lines cannot handle these heavier cars, limiting their abilities to transport heavier trains.
All Rail Lines	53%	
National Corridors	60%	
State Corridors	25.4%	

Performance Measure / System Segment	2021 Statistics	Key Findings
Regional Corridors	14%	• There is a need to rehabilitate and upgrade the traffic control devices at some railroad crossings.

Source: CPCS Analysis and stakeholder feedback

Efficiency and Reliability

Efficiency and reliability refer to how quickly and reliably trains can move around on Ohio's railroad network. This analysis measures efficiency and reliability using stakeholder-identified bottlenecks on Ohio's railroad network. Figure 49 reports nine identified bottlenecks on national rail corridors, four on state corridors, and one on regional corridors in Ohio. The figure also lists the five main causes of bottlenecks identified in the Ohio State Rail Plan.

Figure 49: Key Rail Efficiency and Reliability Needs

Performance Measure / System Segment	2018 Statistics	Key Findings
Number of Railroad Bottlenecks (Identified by Stakeholders)		• Five main causes of bottlenecks identified by the Ohio State Rail Plan include ○ Service delay ○ Lack of onsite track capacity ○ Rail congestion ○ Lack of rail car availability ○ Switching delay
National Corridors	9	
State Corridors	4	
Regional Corridors	1	

Source: CPCS Analysis and stakeholder feedback

A high-level needs assessment, conducted as part of the State of Ohio Rail Plan (2019), identified the following needs that are not explicitly reflected in the rail system needs analysis:

- Rail access to industrial locations
- Rail-to-rail connections
- Bridge and track maintenance

Maritime Network

Ohio's maritime system (see Figure 51) is made up of two distinct sub-systems: Lake Erie and the Ohio River. Each of these systems plays an important role in connecting Ohio's industries to raw materials, suppliers, and customers. Given their fundamentally different geographic settings and markets, each of these sub-systems has its own commodity mix, as well as unique needs and issues.

736
Maritime System Miles

8
Active Great Lake Ports

65
Great Lakes Commercial Terminals

97
Ohio River Commercial Terminals

The roles of the Lake Erie and Ohio River ports are distinct, and, while the volumes on the maritime network are smaller compared to other modes, the facilities serve a critical trade role in Ohio.

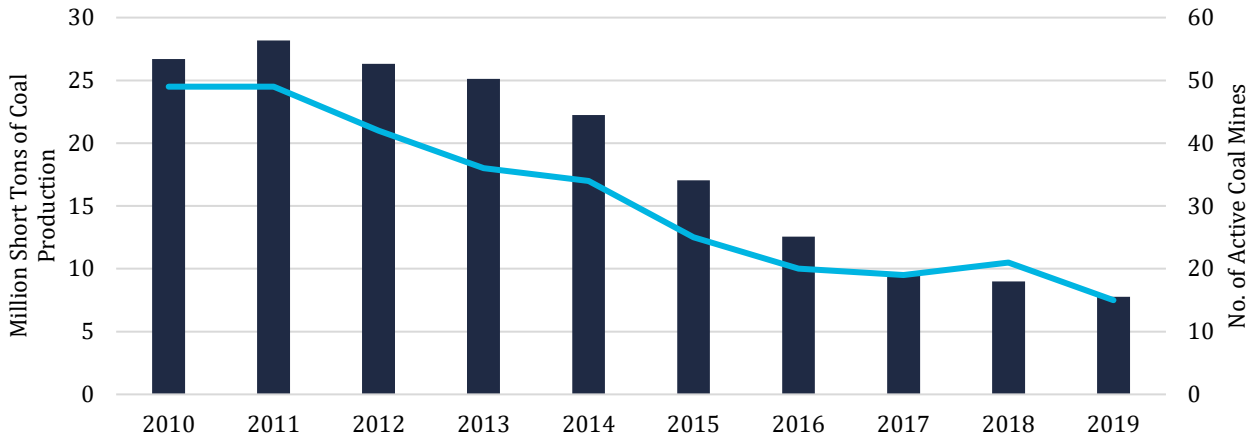
Changes on the Maritime Network

Ohio's maritime system continues to experience economic and environmental changes. Many of these changes are driven by market forces, but there are notable changes in how the system is invested in, as well as environmental changes affecting system condition and reliability.

Declining Coal and Iron Ore Tonnages. Coal and iron ore are two are the top two commodities carried on Ohio's maritime system, and these two commodities have been undergoing a continued structural decline as the US shifts fuel sources used to generate electricity (Figure 50). Coal has been rapidly replaced by natural gas and renewable energy: from its peak in 2007 to 2019, the amount of electricity of generated by coal has declined by 52 percent, and the share of power generated from renewables exceeded coal's share of power in 2019. Furthermore, continued use of coal, or development of new coal-fired plants faces extremely strong economic and environmental headwinds. In addition to the economic benefits, concern about coal-fired power's contribution to climate change and other forms of environmental degradation has also led many utilities to develop aggressive plans to discontinue their use of coal. The consequence of this decline in coal tonnage is declining revenues for waterway maintenance, which could make infrastructure maintenance more difficult to fund in the future.

Volatile Water Levels. Within the past decade, the Great Lakes and Ohio River have experienced a significant swing in water levels. For example, from 1998-2012, the lakes were below average levels, with recent low levels in the early 2010s, followed by record highs in 2018 and 2019. Lake Erie followed a similar pattern to the rest of the lakes, with below-average levels for much of the 2000s, followed by an all-time high record in 2020.[22] These wide swings in lake change present two problems: 1) At lower levels vessels are forced to carry less cargo to avoid grounding, particularly at ports. This limited loading reduces the capacity of the transportation system, and increases transportation costs for materials carried by vessels. 2) High water levels increase the likelihood for damage to shoreline and port infrastructure during storms or flood events, which is costly to repair. If river and lake levels continue to remain volatile in the future, maintenance and increasing the resiliency of maritime infrastructure is likely to become costlier, while shipping capacity may be reduced.

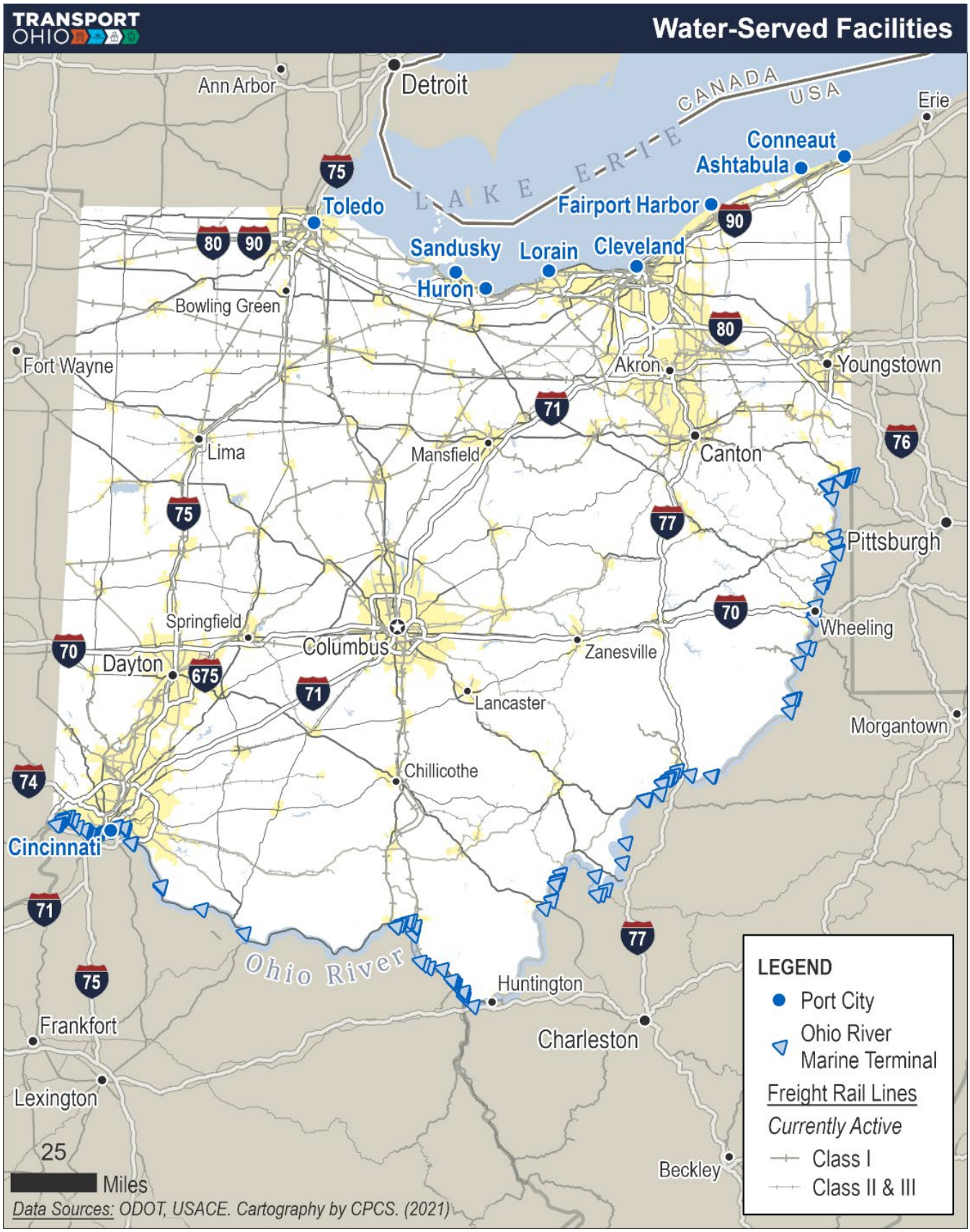
Figure 50: Coal Mine Production Trend in Ohio



Source: CPCS analysis of EIA Coal Production Data, 2015-2019

[22] Johnston, Laura. Lake Erie broke May high water record – again. Cleveland.com Jun 16, 2020.

Figure 51: Water-Served Facilities



Maritime Network Needs

Ohio's maritime system and assets play an important role in connecting Ohio's industries to raw materials, suppliers, and customers. This system includes two distinct sub-systems – Lake Erie and the Ohio River. Lake Erie ports provide connections to the rest of the Great Lakes and the Atlantic Ocean via the St. Lawrence River. Ohio River ports provide connections to southern, eastern, and Midwestern states that touch the Ohio and Mississippi River systems, and they link the state to foreign markets through New Orleans and other Gulf Coast Ports. A detailed needs assessment was conducted as part of the Ohio Maritime Strategy (2018). Since Ohio does not govern the maritime system and its assets, the state must collaborate with neighboring states and other local and private stakeholders to address issues on the maritime system.

The maritime system faces institutional constraints, with the need for increased recognition and integration of the maritime system in transportation and economic development planning

Preservation

Issues related to the state of Ohio's maritime system and assets have been highlighted through data analysis and stakeholder feedback. American Society of Civil Engineers (ASCE) rankings indicate that Ohio's maritime system and assets remain below average, with a risk of failure. Notably, Ohio's ports scored below the national average (Figure 52).

Figure 52: Ohio's Maritime System Performance

Infrastructure	Ohio	National	Ohio Compared to National Rating
Dams	C-	D	▲
Inland Waterways	D+	D+	▶
Levees	D	D	▶
Ports	C	B-	▼

Source: ASCE Infrastructure Report: Ohio 2021

▲ Ohio Better ▼ Ohio Worse ▶ Same

Ohio's locks and dams are also aging. United States Army Corps of Engineers (USACE) estimates the service life of maritime infrastructure to be between 60 and 75 years.[23] Currently, two-thirds of Ohio's locks and dams are over 50 years old. This includes the New Cumberland Locks, which have already reached their expected life threshold at 62 years old. Meanwhile, the Pike Island Locks (58 years old) require rehabilitation, the Belleville Locks (56 years old) require lock chamber repairs, the Racine Locks (54 years old) require repairs, and the Cpt. Anthony Meldahl Locks (59 years old) have reliability concerns.

[23] US Army Corps of Engineers – Capital Stock: Infrastructure Age. https://www.iwr.usace.army.mil/Missions/Value-to-the-Nation/Fast-Facts/Capital-Stock/Infrastructure-Age/#:~:text=The%20maximum%20age%20for%20both,exceed%20their%20expected%20service%20life.

Aging and damaged maritime assets further impact the efficiency and reliability, as well as the economic competitiveness, of the state's maritime system, by leading to unplanned delays or outages that impact maritime system users.

Efficiency & Reliability

Delays at locks, which are based on the wait time between the vessel/tow arrival and the inception of a lockage process, provide insight into the efficiency and reliability of Ohio's maritime system. While most locks in Ohio have not seen increases in monthly average delay between 2012 and 2019, most locks have seen an increasing percentage of vessels delayed during this time. In 2019, over half of the vessels were delayed at two-thirds of Ohio's locks.[24] The share of vessels delayed reached 75 percent at the New Cumberland and Belleville locks.[25]

Additionally, maritime users face delays due to modal conflicts. For instance, several movable rail bridges on the Maumee River routinely become stuck in a closed position, halting maritime traffic to and from much of the Port of Toledo until the problem is resolved.[26]

Economic Competitiveness

The Ohio maritime system is an important asset for many industries that transport goods to, from, and through Ohio, with bulk (e.g., iron ore, limestone, coal) and high-value (e.g., steel, machinery, general cargo and containers) goods moving through Lake Erie ports and dry and liquid bulk commodities (e.g., coal, chemicals, cement, grain) moving through Ohio River ports. Despite a decline in tonnage of certain commodities – notably coal and iron ore – the Ohio maritime system remains critical to trade in Ohio.

An increase in future barge traffic is expected for certain industries, with four national/international companies considering moving their ports from the coast to the River.[27] However, there are several existing needs related to Ohio's maritime system and assets, that inhibit the capacity and competitiveness of the maritime system. Certain ports and terminals in Ohio have physical and operating constraints that restrict cargo movements, including the inability to handle oversized/dimensional cargo at specific facilities and a lack of access to existing maritime infrastructure from certain locations.[28]

An additional economic consideration includes Great Lakes and other maritime system fee charges (e.g., pilotage, Harbor Maintenance tax, etc.) that increase costs for maritime system users.

Environmental Stewardship

Environmental factors also restrict and/or threaten the capacity of the maritime network. Seasonality during winter months (ice conditions from late December to late March) restrict navigation on and access to certain waterways. The Great Lakes and Ohio River have also experienced volatile water levels over the past few decades. High water levels may lead to flooding, posing a risk to shoreline and port infrastructure, and their associated operations. Meanwhile, dropping lake levels impact the navigability and capacity of cargo ships. At lower water levels, vessels are forced to carry less cargo to avoid grounding which reduces capacity and increases transportation costs. Dredging is required to mitigate these impacts and enable maritime system and asset usability.[29] Environmental conditions like these require further maintenance and funding. Maritime Ports in Ohio have opportunities to reduce air emissions and modernize through

[24] Note: Unusual delays at Willow Island caused by chamber closure between July-October 2019.

[25] US Army Corps of Engineers

[26] Ohio State Rail Plan

[27] Consultation with Shale Directories

[28] Ohio Maritime Strategy.

[29] ODOT, Access Ohio 2045, White Paper: Resiliency, October 2018, https://www.transportation.ohio.gov/static/Programs/AccessOhio/White+Papers/AO45_WhitePaper_SystemResiliency.pdf

shore power systems, wind, solar and renewable energies and investments in electric or alternative energy equipment.

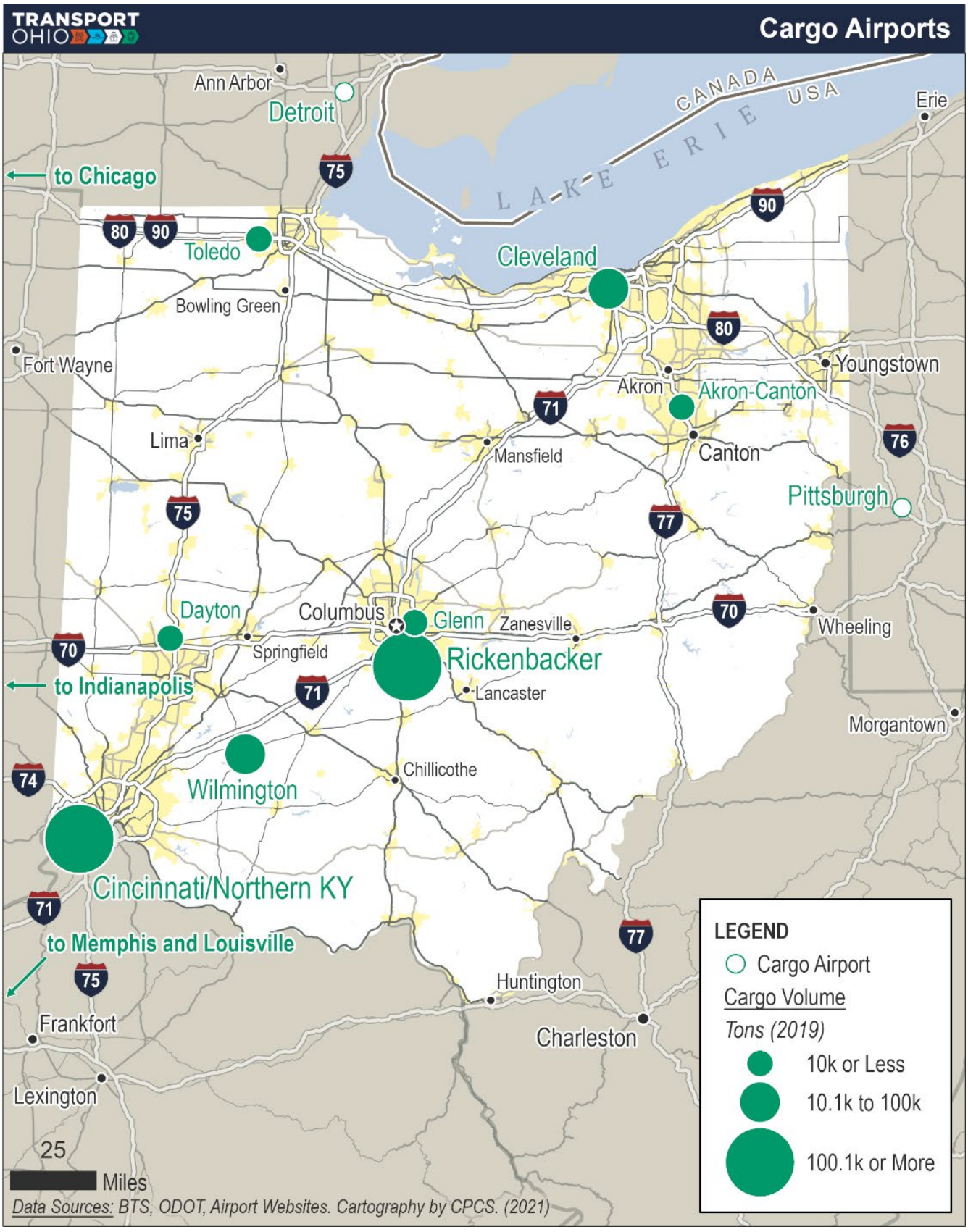
Air Cargo Network

Air cargo is an essential part of any state's freight transportation system. Whether for the overnight shipment of plasma and medicine, just-in-time machinery parts and equipment, or consumer e-commerce shipments, rural and urban communities rely on air cargo. In Ohio the air cargo network (see Figure 53) takes on greater significance.

8	1.5+	750%	1st
Airports with regular cargo service	**Million tons of cargo moved in and out in 2019**	**Cargo growth at CVG 2009-2019**	**US air cargo flight (Dayton to Columbus) in 1910**

Given its geographic location and its airports' capabilities, Ohio makes a critical contribution to the movement of freight by air, regionally, nationally, and internationally.

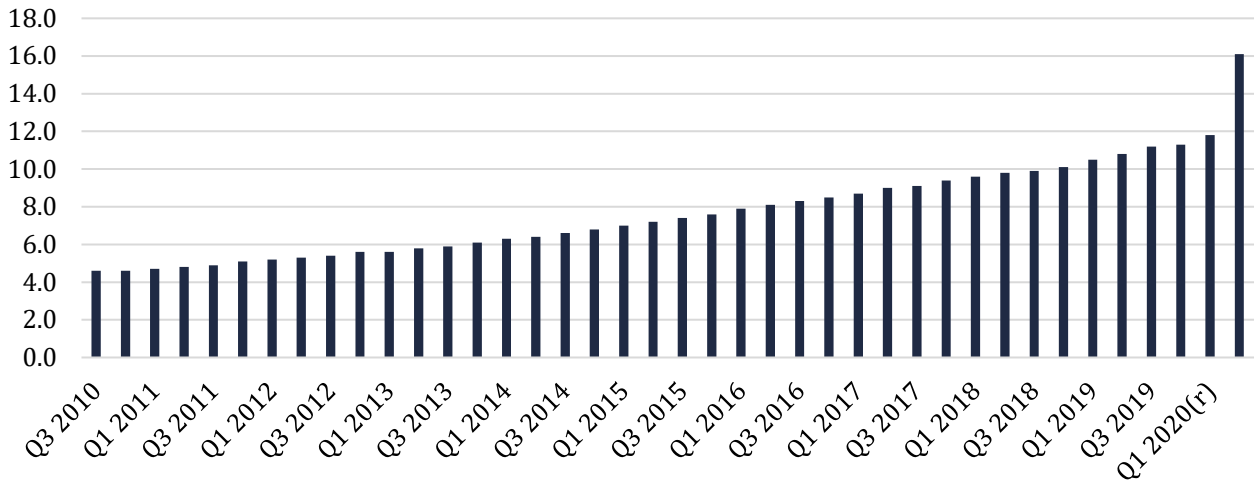
Figure 53: Cargo Airports



Changes on the Aviation Network

Due to aviation's key role in quickly delivering time-sensitive and high-value goods and Ohio's role as a center for retail distribution, it is not surprising that each of the key aviation trends relates to e-commerce in some way. Since the US Census Bureau began collecting data on e-commerce in Q4 1999, e-commerce as a share of total quarterly retail sales has never declined (Figure 54). E-commerce is one of the largest growth opportunities for the air cargo industry; some experts believe growth rates of 25 percent are likely in the coming years.[30]

Figure 54: E-commerce as a Percentage of US Quarterly Retail Sales (2010-2020)



Source: Retail Indicators Branch, US Census Bureau

DHL Invests in Global Hub. Over the last decade, DHL has invested $280 million in its hub at Cincinnati/Northern Kentucky International Airport (CVG). Its most recent investment was a $108 million expansion of its facilities.[31] DHL re-located to CVG from Wilmington Air Park (ILN) in 2009, where it had operated its US sort facility after moving to ILN from CVG in 2005. Industry dynamics have played a large role in DHL's evolution in Ohio. The move from CVG to ILN was a result of its acquisition of Airborne Express. The hub at ILN handled both domestic and international parcels, with domestic operations competing directly with UPS and FedEx. DHL changed its business model to focus on the international parcel market, leading to the return to its CVG facility.[32] Today, as a result of the move to CVG and the nearly $300 million investment in parcel-handling capacity expansion, CVG is one of DHL's three global mega-hubs alongside Hong Kong and Leipzig.

[30] Air Cargo World, "Cargo Insights: 'I get no respect!' – Dangerfield or air cargo at LAX?", Brand Fried, December 2, 2019, https://aircargoworld.com/news/cargo-insights-i-get-no-respect-dangerfield-or-air-cargo-at-lax/

[31] Cincinnati-Northern Kentucky Airport website, "DHL and CVG", accessed September 2020. https://www.cvgairport.com/about/next/dhl-and-cvg

[32] Cincinnati Business Courier, April 17, 2009, "DHL will move back to CVG", https://www.bizjournals.com/cincinnati/stories/2009/04/13/daily67.html

Amazon Develops Ohio Mega-hub. Amazon's PrimeAir continues to establish a large footprint in Ohio to support its national overnight and second-day delivery service windows. In 2015, Amazon began testing an express network with a base at ILN using leased dedicated freighters from Wilmington-based Air Transport Services Group (ATSG). By the next year, seeing the need to develop a large hub facility, Amazon announced it would build a $1.4 billion hub, the largest in its network, and moved operations from ILN to CVG in May 2017.[33] Just over a year later, the company announced it would open a new air gateway and package sorting facility at ILN. Operations at ILN commenced in June 2019 and by September the airport was averaging 14 flights per day.[34] Amazon operates its CVG hub using DHL's facility. Given the global nature of DHL's business model, its operations are at night, whereas Amazon operates during the day. This allows Amazon to operate and grow its hub as it constructs its own facility on 900 acres it has on a 50-year lease from the airport. One of the reasons Amazon cited when it decided to move its current operations and build its future hub at CVG was the airport's "great connectivity to nearby fulfillment locations."[35]

Hyperloop is a pod- and magnetic levitation-based mode of transportation in a vacuum-sealed tube or system of tubes that operates in a low-pressure environment to reduce draft, increasing efficiency to drastically reduce travel times. New Hyperloop routes offer potential as a new, air-competitive, freight mode for goods that rely on corridor transportation between major cities in Ohio and its neighboring states. Feasibility studies have been conducted for several Hyperloop corridors in Ohio including connecting 1) Chicago, Columbus, and Pittsburgh, and 2) Cleveland, Toledo, and Chicago.

Air Cargo Network Needs

There are eight airports in Ohio with regularly scheduled air cargo service, enabling international freight service for high-value manufactured and perishable goods, integrated/express carriers for same-, next-, and two-day deliveries, and belly freight for smaller manufactured items and perishable goods handled by passenger carriers.

In 2019, Ohio's top four cargo airports by tonnage accounted for 99 percent of the state's cargo volume, indicating the importance of those airports and their surrounding regions for air freight movement

Preservation

Maintaining pavement in good condition is important not only for the efficient operation of air freight, but also to prevent runway excursions or other safety incidents that may arise due to runway pavement condition issues that decrease runway friction. Maintaining pavement also avoids high costs of major pavement rehabilitation or reconstruction.

[33] Airport Improvement, October 2018, "New Amazon Facility Bodes Significant Cargo Growth for Cincinnati Int'l", https://airportimprovement.com/article/new-amazon-facility-bodes-significant-cargo-growth-cincinnati-int-l

[34] Chaddick Institute for Metropolitan Development DePaul University, September 2020, "Amazon Air's Summer Surge Strategic Shifts for a Retailing Giant", https://las.depaul.edu/centers-and-institutes/chaddick-institute-for-metropolitan-development/research-and-publications/Documents/Amazon%20Air%20Summer%20Surge-1.pdf

[35] Airport Improvement, October 2018, "New Amazon Facility Bodes Significant Cargo Growth for Cincinnati Int'l", https://airportimprovement.com/article/new-amazon-facility-bodes-significant-cargo-growth-cincinnati-int-l

All of Ohio's cargo airports have runway pavement conditions that are fair or better. However, there are opportunities to improve runway pavement conditions at Ohio's largest cargo airports, each of which has at least one runway rated as fair, indicating mid-surface cracking, unsealed joints, and slab edge spalling (Figure 55). Stakeholders also note that infrastructure close to and at airports need continued attention and maintenance, especially as aviation assets and facilities handle increasing volumes.

Figure 55: Ohio Airport Cargo Tonnage, Runway Pavement Conditions

Airport	Tonnage (2019)	Runway	Pavement Condition	Runway Dimension
Cincinnati/Northern Kentucky International Airport (CVG)	1,248,025	09/27	Fair	12,000 ft. * 150 ft.
		18C/36C	Good	11,000 ft. *150 ft.
		18L/36R	Good	10,000 ft. * 150 ft.
		18R/36L	Good	8,000 ft. * 150 ft.
Cleveland Hopkins International Airport (CLE)	90,400	06L/24R	Good	9,000 ft. * 150 ft.
		06R/24L	Fair	9,953 ft. * 150 ft.
		10/28	Fair	6,018 ft. * 150 ft.
Rickenbacker International Airport (LCK)	143,362	05L/23R	Fair	11,902 ft. * 150 ft.
		05R/23L	Good	12,102 ft. * 200 ft.
Wilmington Air Park (ILN)*	56,724	04L/22R	Fair	10,701 ft. * 150 ft.
		04R/22L	Fair	9,000 ft. * 150 ft.

Source: CPCS analysis of data available on airport websites, unless otherwise noted. Note: *estimated from T-100 all carrier segment data; Federal Aviation Administration (FAA) Airport Data and Information Portal (ADIP). Pavement conditions as of May 2021.

Economic Competitiveness

Ohio's aviation system and assets must maintain and/or expand their physical and operational capacity in order to meet increasing customer and carrier needs and demands, as well as capture new opportunities to handle growing air cargo volumes driven by e-commerce.

Runway lengths determine the type and weight of aircraft that can take off and land at a particular airport, impacting the extent and efficiency of cargo activities. Airports with sufficient runway lengths – 10,000 feet or more – can handle heavy cargo, enabling greater physical and operational capacity. Six out of Ohio's eight cargo airports have runways longer than 10,000 feet. However, runway lengths at CLE – which is the third-largest cargo airport in Ohio by tonnage – remain near, but below 10,000 feet.

A pressing need identified by Ohio's top cargo airports is for new and improved facilities. LCK noted the need for on-airport space, with no existing space for lease as all of the airport's facilities are fully occupied. Accommodating new or additional space for a carrier or forwarder would require construction. Similarly, the current cargo facilities at CLE are limited, with undersized facilities limiting the airport's capacity. Further, existing buildings at CLE are outdated. There is likely a need for a new cargo area at CLE, especially given requests from the airports' two biggest carriers – FedEx and UPS – for more ramp space. CLE is also working to create more separation for its air cargo operations from other airport uses. Meanwhile, ILN faces slightly different challenges. The airport has significant air cargo facility ready for lease and is looking to secure customers and attract forwarders to utilize its facilities. To accommodate future growth and optimize the land and existing cargo facility, ILN's most pressing need is to reactivate their second runway and to increase the total runway capacity.

Across all cargo airports, lack of adequate and efficient access to facilities may also inhibit air cargo operations. Adequate road infrastructure is needed to link airport and cargo facilities to the highway system. This includes the need to designate air facility connectors to the NHS, as well as expand and/or enhance efficiency on these last-mile connectors.

Pipeline Network

In Ohio, there are over 122,000 miles of pipelines that carry either natural gas, landfill gas, propane gas, Highly Volatile Liquids (HVL), refined petroleum, or crude oil. Since 1860, over 275,000 oil and gas wells have been drilled in Ohio; and currently, there are more than 50,000 producing wells in 49 of the state's 88 counties. Figure 56 highlights the wells in the Utica and Marcellus Shales.

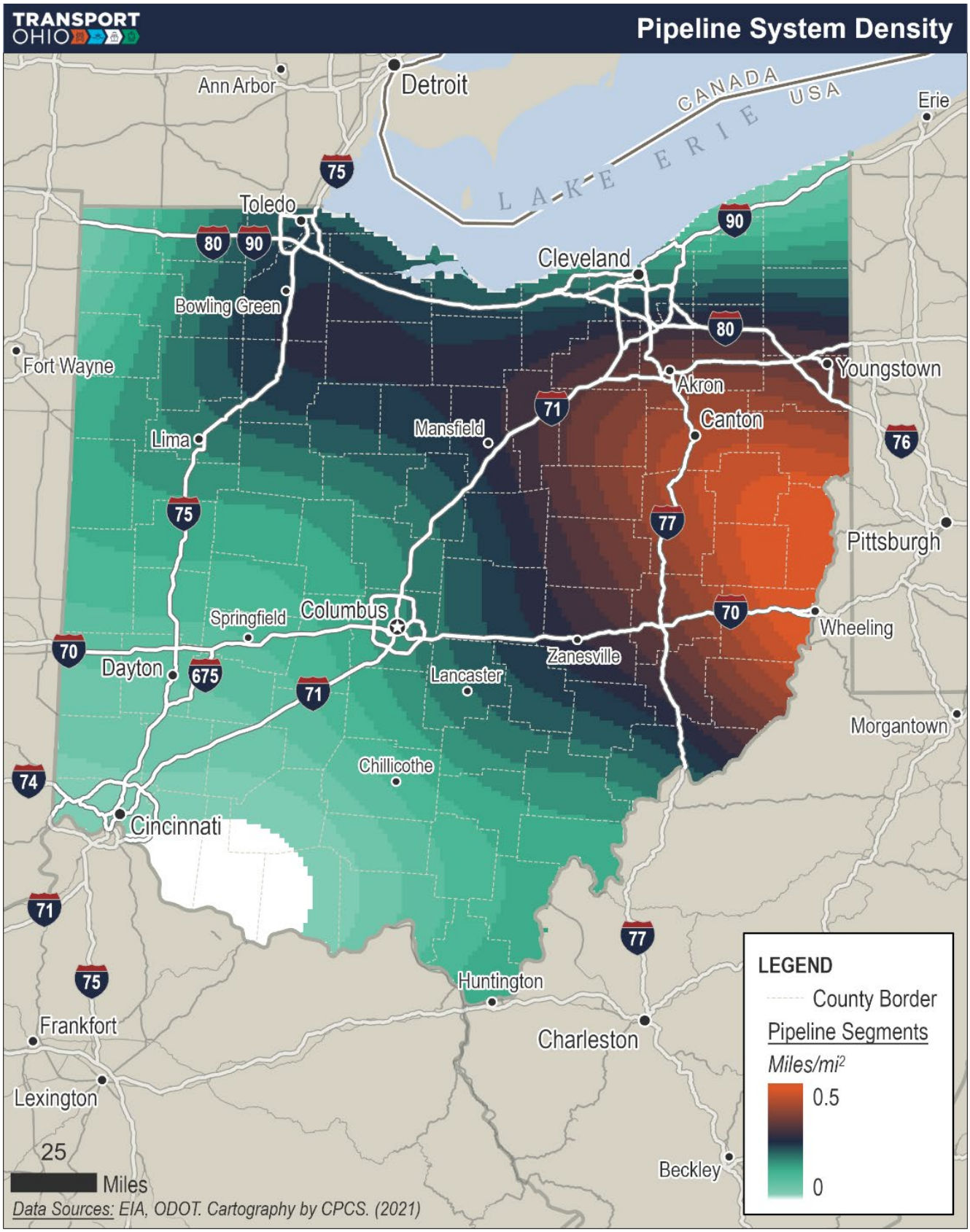
110,261
Miles of Gathering and Transmission Pipeline

57
Number of Terminals and Refineries

50,000+
Number of Oil and Gas Wells

Pipelines are widely considered the safest and most economical way to carry hazardous and high vapor pressure liquids as opposed to rail and truck.

Figure 56: Pipeline System Density



Changes on the Pipeline Network

Driven by Ohio and the Nation's new energy future, pipeline development in the state has increased significantly to support the economic need.

Oil and Gas Production Potential Effect on Safety and Roadway Conditions. Since 1984, the number of producing wells in Ohio has grown from roughly 31,000 to 56,000 wells in 2019.[36] As oil and natural gas production and fracking continue to increase, truck traffic around the well locations also increases. Trucks transport stone, heavy equipment, and other materials needed to build well pads and drill for oil and gas. As a result, the unplanned uptick in the number of heavy trucks is causing safety concerns and accelerated wear-and-tear on the roads around the wells and drilling rigs. In 2012 the Ohio Legislature passed Senate Bill 315[37] that required private oil and gas companies planning to or currently drilling for oil or gas in Ohio to enter or make a "good faith effort" to enter into a Road User Maintenance Agreement (RUMA) with the local county or township where the well or rig is located. A RUMA directs the private company to assume a contractual obligation for improving the road around the well or rig before the drilling begins and/or after the completion of drilling.

Proposed Pipeline Projects in Ohio. As the demand for natural gas rises, and Utica and Marcellus Shales and other fracking/drilling activities significantly increase, existing and prospective pipeline operators in Ohio are proposing new pipelines and investing in existing infrastructure upgrades.

Pipeline Network Needs

Ohio is home to over 110,000 miles of gathering and transmission pipeline, 57 terminals and refineries, and over 50,000 oil and gas wells, leading to 2.8 million barrels of oil and 2.9 billion cubic feet of gas produced annually. The pipeline system is vital to transporting commodities from drilling operations, pipeline terminals, and commodity storage facilities around the state. Commodities moved by pipeline are key for the state's economy, serving the transportation, commercial and residential heating, manufacturing, refining, energy production, and agricultural communities. Pipeline development in Ohio has increased significantly to support growing economic needs.

To ensure continued and efficient operation of the pipeline system, there is a need for the state to engage in resiliency planning. If a pipeline shuts down for any reason (e.g., the unexpected Colonial Pipeline shutdown[38]), impacts may include commodity shortage, higher commodity prices, and transportation security vulnerability. Additionally, lost commodity flows due to pipeline shutdowns must be accommodated by other transport modes on the rail, road, and maritime systems. As a result, there is a need for the state to prepare and plan for potential pipeline disruptions.

Stakeholders also note the importance of statewide pipeline access, particularly to get natural gas resources to all parts of the state. In particular, there is a need for better access to natural gas in Southwest Ohio.

[36] https://cdn.ymaws.com/www.ooga.org/resource/resmgr/files/debrosse_report/01_gs1-1_shumway_the_debross.pdf

[37] https://legiscan.com/OH/bill/SB315/2011

[38] Akron Beacon Journal, Colonial Pipeline cyber attack causing Northeast Ohio's highest gasoline prices since 2014, May 10, 2021, https://www.beaconjournal.com/story/news/2021/05/10/cyber-attack-pipeline-causing-gasoline-prices-rise/5024366001/

Freight System Strengths, Weaknesses, Threats, and Opportunities

In AO45, ODOT developed four scenarios based on high-level assumptions about how population, economy, development, and technology could change in the future. This process allowed stakeholders and transportation experts to explore uncertainty in trends and to stress test the transportation system against different potential futures. Transport Ohio continued using the scenario planning method and examined various trends/factors specific to freight movements. A broad Strengths, Weaknesses, Threats, and Opportunities (SWOT) assessment was conducted to find the common threads that should be considered no matter what the future may hold. The results of the SWOT analysis (see the summary in Figure 57) help ODOT strategize and plan for the future freight system.

AO45 Scenarios

- **Current Trends.** The future looks a lot like our experience from the past few years.
- **Innovation.** The future is driven by technology and innovation.
- **Global Markets.** The future is driven by global trade in goods and services.
- **Ohio Renaissance.** The future is driven by increased population growth, innovation, and global competitiveness.

Figure 57: Summary of SWOT for Ohio's Freight System (All Scenarios Considered)

Strengths

- Ohio is **anticipating a transition to connected and automated vehicles** and is investing in this future with the DriveOhio program, and partnerships with organizations including **the Transportation Research Center (TRC)**
- The **presence of Wright-Patterson** in Ohio makes the state particularly competitive in the unmanned aircraft systems (UAS) air freight space
- Ohio is already in the process of **rebranding Mahoning Valley as Voltage Valley**, aiming for the region to become a hub for electric vehicles industries
- Having the only active container port on the US side of the Great Lakes provides shipping options that do not include east or west coast ports. is well-positioned to **serve as a regional and national transportation hub** due to the abundance of transportation infrastructure

Weaknesses

- Electric vehicle infrastructure in Ohio lags the country as a whole
- Ohio currently has **low public transit ridership and generally weak transit infrastructure**, meaning population growth will add significant infrastructure demand on the state's roads
- Ohio is **highly reliant on roadways for freight movements**, and these already experience significant congestion abundance of Transportation infrastructure is costly to maintain
- Ohio's intermodal facilities require modernization and safety improvements for seamless movements of good between modes
- Ohio has an inadequate supply of truck parking facilities
- Ohio is at **higher risk for extreme rainfall and flooding events** including hillside slides along the Ohio River
- The seasonality of the St. Lawrence Seaway

Opportunities

- Ohio should **position itself as a national leader in the adoption of connected and automated vehicle technologies**, drawing in and retaining talent and businesses; US 33 could be a testbed for these technologies
- Ohio should support additional safe truck parking locations
- Ohio should **leverage Wright-Patterson** and the **Ohio UAS Center** to become a leader in unmanned aerial vehicle (UAV) technology
- Ohio should leverage its medical, manufacturing, and construction industries to **become a leader in additive manufacturing**
- Ohio should **transition to electric vehicle and component manufacturing** in order to compensate for losses in the traditional automotive industry
- Ohio has capacity to move more freight by water
- Ohio should prepare itself to **introduce retraining programs** for those whose jobs were lost to automation

Threats
• **Climate risks like flooding** threaten the reliability of freight movements • **Cyber security** will become an ever-growing issue • Uncertainty in global supply chain conditions will create volatility and unpredictability in freight movements • Increased labor costs, global competition, and climate disasters may **threaten the competitiveness of Ohio's agriculture industry** • Water port infrastructure, locks and dams are aging • The rapid adoption of UAVs and other technologies risk introducing new safety issues unless monitored and pre-emptively addressed • If labor force participation and educational attainment remain weak, this may cause **labor shortages in certain industries**, including trucking, advanced manufacturing, and freight technology • Ohio is dependent on road transportation, so **growth in the state will tend to exacerbate road congestion** in the absence of countermeasures

3. Recommendations

Figure 58 details recommended strategies to improve Ohio's multimodal freight system. Strategies are organized around programmatic areas and classified to provide insight into how each policy, program, or other strategy aligns with ODOT's goals for the transportation system.

Each of these strategies will be initiated in the next 4 years, before the next Transport Ohio update. These strategies have been refined based on feedback from ODOT and discussion with the FAC and other freight stakeholders, including metropolitan planning organizations (MPOs) and regional transportation planning organizations (RTPOs).

Figure 58: Recommended Freight System Strategies aligned with Plan Goals

Focus Area / Strategy	Safety	Preservation	Efficiency & Reliability	Economic Competitiveness	Environment	Quality of Life	Mobility & Accessibility
Planning							
Develop/conduct freight specific plans and studies	✓	✓	✓	✓	✓	✓	✓
Monitor and track progress to Transport Ohio goals/performance	✓	✓	✓	✓	✓	✓	✓
Expand access to freight related data and information	✓	✓	✓	✓	✓	✓	✓
Encourage Ohio's regions to develop multimodal freight transportation plans and assessments	✓	✓	✓	✓	✓	✓	✓
Operations & Maintenance							
Maintain transportation assets (including enabling technologies) in a state of good repair		✓		✓			
Employ Transportation System Management and Operations (TSMO) strategies to address congestion and improve reliability along key Strategic Freight System corridors	✓		✓		✓		
Identify and mitigate extreme weather and other risks to freight transportation	✓		✓		✓	✓	
Reduce the number of freight traffic-related fatalities and serious injuries	✓						
Expand access to truck parking within Ohio	✓	✓	✓	✓			
Innovation & Technology							
Continue to position Ohio as a national leader and support the adoption of connected and automated vehicle technologies for freight	✓		✓	✓			✓
Study and support the expanded use of drones/Advanced Air Mobility (AAM) for last-mile freight deliveries			✓	✓			
Encourage adoption of alternative fuel vehicles for goods movement, including trucks, locomotives, and vessels		✓	✓		✓		
Coordination & Partnerships							

Focus Area / Strategy	Safety	Preservation	Efficiency & Reliability	Economic Competitiveness	Environment	Quality of Life	Mobility & Accessibility
Facilitate and strengthen ongoing dialogue between ODOT and freight stakeholders	✓	✓	✓	✓	✓	✓	✓
Partner with public agencies on project delivery and strategic initiatives	✓	✓	✓	✓	✓	✓	✓
System Investment							
Prioritize transportation system investments that grow the economy and improve access to jobs	✓	✓	✓	✓	✓	✓	✓
Support multimodal freight transportation investments that align with community values, public health, environment, and equity		✓			✓	✓	
Manage and distribute pass-through freight funding to modal agencies	✓	✓	✓	✓	✓	✓	✓
Engage the private sector in Public-Private Partnership opportunities	✓	✓	✓	✓	✓	✓	✓

The implementation plan, which includes actions and timing for each strategy, is included in **Appendix C**.

Role of Partnerships

ODOT will lead the implementation of these strategies with a variety of partners noted in the implementation plan in **Appendix C** including:

- **Ohio Freight Advisory Committee.** The FAC will convene three times per year to assist with the implementation of Transport Ohio recommendations.
- **Partnerships with other State of Ohio agencies.** Ohio's sister agencies including JobsOhio, Public Utilities Commission of Ohio, DriveOhio, the Ohio Rail Development Commission, the Ohio State Highway Patrol, and others will be critical to advancing industry- and modal-focused strategies.
- **Local government agencies.** These include cities, counties, Metropolitan Planning Organizations (MPOs), Regional Transportation Planning Organizations (RTPOs), ports, and airport authorities that enable the implementation of targeted solutions within local contexts.
- **Freight stakeholders.** These include multimodal freight system owners and operators, including those in the trucking, rail, marine, and air cargo sectors who could benefit from plan implementation.
- **Private sector businesses.** Businesses could include a private truck parking company, a logistics or other freight-generating facility, or a technology vendor, among others, who could partner with ODOT to enable implementation that could not otherwise be advanced by just a single party.

What do Ohioans need from the freight system?

It was once the responsibility of retail stores to manage freight orders and deliveries. Customers would go shopping with the expectation that goods would be available. E-commerce has begun to remove this buffer between freight and the consumer. Delivery vans in residential neighborhoods are ubiquitous. Consumers track orders online and have control over their own supply chains. The recent pressures on supply chains have made it especially clear to consumers that the freight system is not a magical process. It demands real labor, real infrastructure, real land, and real thought.

As the visibility of freight grows, Ohioans should understand that freight transportation may sometimes not look or sound the way they'd like. Most Ohioans do not want truck parking in their neighborhood or a freight rail line in their backyard, but every Ohioan expects their package deliveries on time. Ohioans are right to expect quiet neighborhoods, clean air, and uncongested roadways.

However, the needs of Ohioans and the freight transportation need not always be in conflict. Investments in infrastructure and continued innovation will begin to eliminate some of the negative externalities of freight transportation while simultaneously improving freight flow. Electrification will reduce air emissions and noise. Autonomous and platooned trucks will reduce road congestion and the need for freight land. Investments in rail grade separations will continue to reduce delays and improve safety. Ohioans, as newfound stewards of their own supply chains, should understand now that the freight system is not invisible, magical, or perfect and that it can often be a nuisance. However, Ohioans can wield this understanding to advocate for strategic improvements to the freight system that benefit all.

Planning Strategies

Planning strategies will provide the tools for ODOT and the Ohio Freight Advisory Committee to further study and understand multimodal freight issues in Ohio, and to track progress toward Transport Ohio plan implementation. These strategies also provide MPOs, RTPOs, and other interested local governments data and guidance to broaden their understanding of freight systems within their own borders.

Develop/conduct freight specific plans and studies

ODOT will continue to conduct and update the marquee freight studies and plans that it has previously developed, including the Ohio Maritime Strategy and the Ohio State Rail Plan. Using the information from Transport Ohio, these studies can be focused, not on the broad statewide needs and opportunities, but at the regional and local level. Similarly, the data developed during Transport Ohio will continue to be examined on the corridor level through a series of studies focused on understanding the distinct needs of Ohio's Strategic Freight System corridors. These plans and studies in turn may be used to continually re-evaluate multimodal freight system designations – including the SFS, but also the USDOT designated Primary Highway Freight System and if there becomes a need to identify critical urban- and critical rural freight corridors in the state.

Monitor and track progress to Transport Ohio goals/performance

Transport Ohio identifies 18 distinct actions for ODOT to initiate in the next 4 years. These actions are described as part of Transport Ohio Recommendations, but are further delineated with recommendations for partners to engage, and the timing for that engagement in **Appendix C – Summary of Recommended Actions.** ODOT will adapt the implementation plan into a Transport Ohio Progress Report, and will engage the FAC three times per year to assess progress on each of the identified actions.

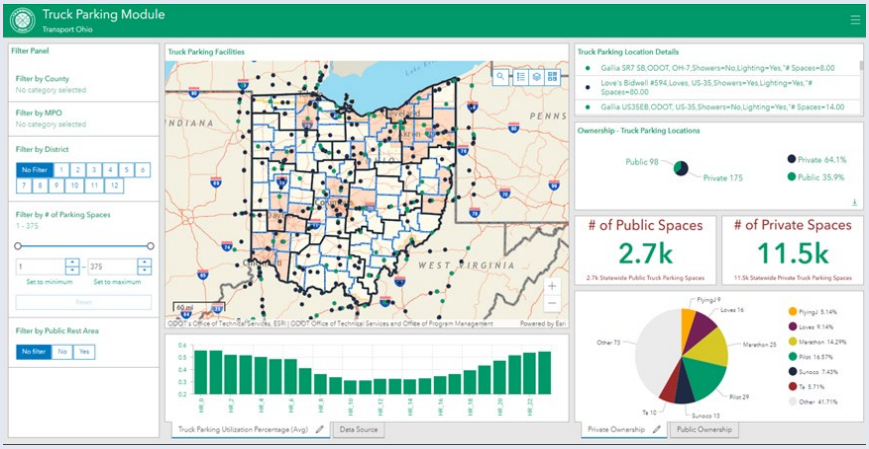
Additionally, Transport Ohio provides a deep dive into multimodal freight system performance and illustrates the existing system performance through a series of freight system performance report cards that quantify the safety, condition, reliability and other attributes of the Strategic Freight System. ODOT and the FAC will review and update select measures on an annual basis to help quantify the benefit of Transport Ohio implementation activities.

Expand access to freight-related data and information

ODOT will widely share the data and information developed with Ohio transportation system stakeholders. This data will be available via traditional means – ODOT's Transportation Information Management System (TIMS) – and will also be available through a Transport Ohio Tool/Dashboard (see below).

To complement the Transport Ohio data, ODOT will also consider making additional data purchases that support statewide and local freight planning activities.

The data developed during Transport Ohio has been analyzed and presented in this plan and working papers. But, data analysis is never finished. It is important that data be continually shared with the public for its use and analysis. This is why ODOT has developed a public-facing dashboard with key freight data. The online tool accommodates custom queries and custom data downloads for easy data analysis.



Encourage Ohio's regions to develop multimodal freight transportation plans and assessments

ODOT has provided a great freight planning resource to metropolitan planning organizations (MPOs) and regional transportation planning organizations (RTPOs) that would like to endeavor in their own local and regional freight planning activities. Various data and information to inform a regional freight plan is available, but local agencies may not be familiar with the components that should be included in this plan. ODOT will develop freight planning guidance for these organizations so that freight planning throughout the state may be conducted in a similar manner, and integrated in the future (if desired).

Additionally, ODOT will continue to serve as a technical resource to port agencies, local public agencies, and regional planning organizations on freight topics (including freight plan development) and will support the coordination of these agencies to continue convening the Ohio Conference on Freight on an annual basis.

Operations & Maintenance Strategies

Operations & Maintenance strategies are focused on ensuring the Strategic Freight System is safe, in good condition, and is operated in a manner to ease the movement of goods. This includes managing and mitigating truck bottlenecks and providing for adequate truck parking. These strategies will also help ODOT prepare the system for improved resiliency in the future, so that the impacts of extreme weather and other disrupting events that affect the freight system can be better managed.

Maintain transportation assets (including enabling technologies) in a state of good repair

As part of ODOT's core function, the agency will continue to maintain the freight system in a state of good repair. This action is partially focused on the pavement and bridge conditions on the Strategic Freight System, and improving their condition in the future, as compared to the freight system condition report card. ODOT will also proactively maintain the various enabling technologies that make the freight system work better.

ODOT will also help others more strategically invest to maintain their freight system assets through the continuation of the Maritime Assistance Program (MAP) that funds projects including dredging and other activities that improve port use and development opportunities.

Employ Transportation System Management and Operations (TSMO) strategies to address congestion and improve reliability along key Strategic Freight System corridors

As part of ODOT's core function, the agency will continue to operate the freight system in a manner that reduces congestion and improves the reliability of system. This action is specifically focused on improving the Truck Travel Time Reliability index on the Strategic Freight System, as compared to the freight system efficiency and reliability report card, and reducing the number of greater Ohio bottlenecks on the list of Top 100 Bottlenecks in the US (currently there are 4).

Identify and mitigate extreme weather and other risks to freight transportation

ODOT will take several actions to help preserve the resiliency and recovery of the freight system due to disruptive events. First, ODOT will develop a Resiliency Plan, with an emphasis on goods movement that identifies and prioritizes critical multimodal infrastructure.

ODOT will also take steps to improve their existing systems and processes by updating ODOT's design standards to harden against extreme weather and other events, including flooding, and to incorporate extreme weather considerations into future Transportation Asset Management Plan development.

Reduce the number of freight traffic-related fatalities and serious injuries

As part of ODOT's core function, the agency will continue to improve freight system safety through reducing the number of fatalities and serious injuries on the Strategic Freight System. This can be monitored by tracking the freight system safety report cards for both road and rail networks, and accomplished through several means.

For roadway safety, ODOT will advocate for the adoption of a modern Ohio distracted driving law by enacting a "Hands-Free" law with primary enforcement in the state of Ohio. ODOT can also improve commercial motor vehicle safety in work zones through policies, education, and in-cab messaging.

For railroad safety, ODOT will take steps to improve safety at road-rail grade crossings by expanding the use of new and proven crash prevention methods at grade crossings, identifying blocked crossing locations, and taking remedial action based on ORDC's rail crossing adaptive capacity study, as well as strategically work to eliminate crossings.

Expand access to truck parking within Ohio

The Ohio Truck Parking Study was developed as part of Transport Ohio, which includes a detailed series of recommendations to improve access to and expand truck parking. In parallel to implementing the recommendations of Transport Ohio, ODOT will implement the infrastructure, technology, and policy recommendations from the Ohio Truck Parking Study

What is a Truck Parking Information Management System TPIMS?

TPIMS aggregates real-time data about nearby truck parking availability and communicates it to drivers. Data is collected from truck parking facilities using Intelligent Transportation Systems (ITS) technology like cameras and sensors. TPIMS usually makes use of dynamic roadside signs to broadcast this information but may also post it online. TPIMS offers numerous benefits by decreasing the time drivers must search for parking, reducing illegal parking, and improving freight efficiency.

Innovation & Technology Strategies

Innovation and technology strategies continue the work that has been initiated by DriveOhio, and emphasizes those aspects of DriveOhio's work that improve the freight system. These strategies are focused on connected and autonomous vehicles and trucks, use of drones for last-mile deliveries, and encouraging the use of alternative fuels for goods movement.

DriveOhio
The Future of Smart Mobility

DriveOhio was created under ODOT in January 2018 to develop statewide technology and data frameworks to advance smart mobility projects throughout the state. DriveOhio brings together private industry, government, and research to serve as a hub for smart mobility in the state.

Continue to position Ohio as a national leader and support the adoption of connected and automated vehicle technologies for freight

ODOT will coordinate with DriveOhio on continuing to advance connected vehicle infrastructure along key multimodal freight corridors within Ohio, including along the Strategic Freight System corridors to benefit goods movement.

Goods movement will also benefit as ODOT will advance the adoption of freight automation technologies, including through use of Public-Private Partnerships and advanced vehicle testing programs.

Study and support the expanded use of drones/Advanced Air Mobility (AAM) for last-mile freight deliveries

To help ODOT study and support the expanded use of drones for goods movement, ODOT will establish an advisory team to advise ODOT and the State of Ohio on Advanced Air Mobility implementation. This advisory team will also provide guidance as ODOT develops Advanced Air Mobility policy guidance for Ohio's cities and county governments, economic development agencies, and airports as they seek to implement this new mode of goods movement.

Additionally, ODOT will work with state, municipal agencies and the legislature to implement programs and strengthen industry participation to advance key Advanced Air Mobility management strategies including for unmanned and vertical lift aircraft system traffic management.

Encourage adoption of alternative fuel vehicles for goods movement, including trucks, locomotives, and vessels

ODOT will encourage the adoption of alternative fuel vehicles, and will begin by evaluating the state fleet and duty cycles to determine which vehicles may be appropriate for electric vehicle (EV) conversion or other lower-emission emitting strategies. ODOT will ease the adoption and integration of electric fleets used for goods movement in Ohio by planning for freight-oriented EV corridor charging facilities, including

considering infrastructure gaps, power supply alternatives, and identifying priority locations for private sites to provide EV charging stations.

As ODOT lays plans for the agency it will also provide guidance to local governments on permitting, right-of-way easements, standardized Electric Vehicle Supply Equipment (EVSE) layouts and specifications, and ideal locations for freight EV charging.

Coordination & Partnership Strategies

Coordination and partnerships will be required to advance each of Transport Ohio's strategies, but specific to these strategies, the intent is to continue and to better engage with all freight system stakeholders so that planning and investment decisions can be improved throughout ODOT. These strategies also encourage ODOT to partner with public agencies at all levels of government, too.

Facilitate and strengthen ongoing dialogue between ODOT and freight stakeholders

ODOT will continue the engagement of the Ohio Freight Advisory Committee throughout plan implementation and will convene the group on an at least tri-annual basis. During the course of committee activities, ODOT will review the FAC membership to ensure it represents a cross-section of Ohio's key industries and freight stakeholders, and considers recommendations for membership included in the Bipartisan Infrastructure Law.

Ohio Freight Advisory Committee

The Ohio FAF was established in 2020, at the onset of Transport Ohio. The FAC has been organized to provide a direct connection to users of the state's freight system. By leveraging the insights and experience of the freight community, ODOT will be able to build a better statewide freight system.

ODOT will engage the freight community, including business establishments, shippers/receivers, carriers, third-party logistics providers and other private sector stakeholders via semi-regular (every 3-4 years) surveys. These surveys will make ODOT aware of current freight system needs and will gain feedback on the effectiveness of ODOT freight policies, programs, and projects to their overall business operations.

Additionally, ODOT will continually work to educate and inform Ohio's citizens and decision-makers about the public and private benefits of the freight transportation system and making investments.

Partner with public agencies on project delivery and strategic initiatives

ODOT is invested in protecting and attracting new businesses to Ohio. As part of this, ODOT will coordinate with JobsOhio to provide key industries with freight transportation information including data, planning resources, and funding opportunities so that they can make informed decisions. ODOT will also coordinate with JobsOhio to support the advancement of training and development programs to increase key industry labor supply – including in electric vehicle manufacturing, construction, infrastructure, and transportation.

ODOT will also continue its long history of collaboration with key transportation planning and programming stakeholders including with metropolitan planning organizations, regional transportation planning organizations, the Ohio Rail Development Commission, DriveOhio, JobsOhio and other state agencies on mutually beneficial projects. This collaboration will also extend to local planning agencies to identify, promote, and preserve locations for economic development with good transportation access and compatible land uses.

System Investment Strategies

System investment strategies not only encourage ODOT to invest in the freight system, but also to consider how investments can be targeted (i.e. aligned with the Strategic Freight System) and how projects can be approached in a manner that minimizes impacts on the environment and on communities. These strategies also encourage ODOT to support local governments that would like to invest in the freight system, as well as consider creative partnerships with the private sector to advance mutually benefitting projects.

Prioritize transportation system investments that grow the economy and improve access to jobs

ODOT will take a few key steps to ensure investments in the freight system are coordinated and strategic to provide access to jobs, and to grow jobs, beginning with using the Strategic Freight System as a project selection factor for ODOT's Transportation Review Advisory Committee (TRAC) and other funding programs. Making investments tied to the SFS will ensure that ODOT is making freight investments that benefit freight.

ODOT will also support the development of transportation system improvement plans for key shovel-ready sites, ensuring that infrastructure is not the limiting factor in new business growth. As well as, ODOT will support the development and enhancement of key multimodal facilities that handle goods, including intermodal, transload, bulk transfer, and other facilities so that an increasing volume of goods can be accommodated in the state.

Support multimodal freight transportation investments that align with community values, public health, environment, and equity

ODOT will be proactive in considering and mitigating the effects of the freight transportation system on public health by completing Ohio's first Carbon Assessment and working with the Ohio EPA on programs to finance diesel emission reduction improvement projects for Ohio's rail, maritime and trucking industries.

ODOT will also expand upon the Environmental Justice Index analysis conducted in Transport Ohio and advance an improved understanding of the overlap of the SFS with communities of concern.

Manage and distribute pass-through freight funding to modal agencies The Bipartisan Infrastructure Law has ushered in a new era of grant and other funding opportunities for freight benefitting projects. ODOT will make a concerted effort to submit and support freight-related applications for USDOT discretionary grant funding (e.g., Bridge, RAISE, CRISI Rural Surface Transportation, and others), and will provide grants and other funding to improve the safety, condition, and efficiency of the freight transportation system, including the rail and maritime systems.

Engage the private sector in Public-Private Partnership opportunities

In Ohio, a significant portion of the multimodal freight system is owned and operated by non-OODT, private sector stakeholders. As such, it is critical to engage these stakeholders on freight planning and investment decision making. As freight system needs are assessed and solutions identified, ODOT should proactively engage private sector in Public-Private Partnership opportunities that are deemed to be mutually beneficial.

Freight System Investment Plan

Historic Freight Spending

ODOT has a long history of funding freight projects. Figure 59 summarizes total funding by mode for the past 5 years for the various freight-related funding programs ODOT administers. The details of the funding amount by funding source are provided in **Appendix D**.

Between 2017 and 2021 over $300 million was spent on projects using freight-related funding. These freight projects leveraged additional funds to total an over $1.6 billion benefit to the freight system. More than 61 percent of freight-related funding went to projects on highways. Another 30 percent to rail, and over 8 percent went to maritime.

Figure 59: Total Freight Spending by Mode and Period ($millions)

Mode	2017-2021	
	Funding	Percent of Total
Highway	$176.1	61.3%
Rail	$87.1	30.3%
Maritime	$45.6	8.4%
Freight Total	$308.9	100.0%
Amount Leveraged	**$1,602.6**	**20.1% from program**

Source: CPCS analysis of Ohio ELLIS Project Data

National Highway Freight Program Funding

Decisions for projects anticipated for construction between 2022 and 2027 (investments in the next 5+ years) for many of ODOT's funding programs are still in process. However, as part of freight system investment planning ODOT has identified the projects that will receive National Highway Freight Program (NHFP) funding.

In November 2021, President Biden signed the $1.2 trillion Bipartisan Infrastructure Law (BIL). The legislation adds an additional $550 billion in federal funds over five years to invest in the country's infrastructure. Included is the updated apportionment for NHFP funds to states; Ohio is expected to receive just over $290 million as shown in Figure 60.

Figure 60: National Highway Freight Program Funding By Fiscal Year (Ohio) ($millions)

2022	2023	2024	2025	2026	2027
$ 46.5	$ 47.4	$ 48.3	$ 49.3	$ 50.3	$ 50.3

Source: IIJA-Highway-Apportionment-Estimates-August-2021, https://policy.transportation.org/wp-content/uploads/sites/59/2021/11/IIJA-Highway-Apportionment-Estimates-August-2021.pdf. Accessed December 16, 2021

Traditionally ODOT has used the NHFP allocation to support large projects on the primary highway freight system; project traditionally funded by Major New and Major Rehab programs. During the 2022-27 program period, this approach will continue. ODOT will also flex $1 million each year to be used on the rail system, at the discretion of ORDC (see Ohio's National Highway Freight Program Projects (2022-2027) ($millions)Figure 61).

Figure 61: Ohio's National Highway Freight Program Projects (2022-2027) ($millions)

Mode	Project	Project Description	National Highway Freight Program Funding						ODOT Matching Funds	Total Funding
			2022	2023	2024	2025	2026	2027		
Hwy	I-70/I-71 Downtown Ramp Up: Phase 4R/6R	The project includes the reconstruction and widening of I-70/71 in Franklin County. Works include but not limited to adding an extra lane through the 70/71 overlap area, constructing a new ramp onto Fulton St from 70 E and 71 N, and closing the existing ramps from 70 E to Front and 70 E to Livingston.	$45.5						$197.5	$243.0
Hwy	I-70/I-71 Downtown Ramp Up: Phase 4B	This project is the part 4 of the Big Build Pavement replacement of 70 WB & EB from Front to Grant. It also includes pavement replacement of 3rd & 4th St from Livingston to Fulton, 3rd & 4th St bridge replacements and 5 retaining walls.		$46.4					$182.6	$229.0
Hwy	Cleveland Innerbelt Moderniza-tion	Projects will improve I-90 east and westbound in the Central Interchange area between E. 9th St. and Carnegie Avenue and replace the E 22nd Street and Carnegie Avenue bridges over I-90.			$47.4				$112.6	$160.0
Hwy	Brent Spence Bridge Corridor Project	The project will reconstruct and widen I-75 from just north of the Linn St. overpass to the northern limits of the bridge over Findlay St. It will also replace the Linn St. overpass with 1-75 and reconstruct Gest Street from Freeman Avenue to US 50.				$48.3			$49.7	$98.0
Hwy	Akron Beltway Improve-ments	The project will improve the west side within the Akron "Beltway" freeway system to increase capacity and improve safety including structure rehabilitation and noise walls within the City of Akron, Summit County, Ohio.					$49.3		$35.7	$85.0
Hwy	Brent Spence Bridge Corridor Project	The project work contains the reconstruction of I-75 from Findlay St. to just south of Marshall Ave. This is the northern end of the Brent Spence Bridge Corridor Project. Project includes the construction of a new interchange on I-75 to connect to the new Western Hills Viaduct (WHV).						$49.3	$108.7	$158.0
Rail	Freight Rail Develop-ment	Various projects to benefit the rail system	$1	$1	$1	$1	$1	$1		TBD
		Total Funding	**$46.5**	**$47.4**	**$48.4**	**$49.3**	**$50.3**	**$50.3**		**at least $979.0**

Source: ODOT

Importance of ODOT Making Freight System Investments

There are few, if any, industries that do not rely on the freight system. Industries like manufacturing, agriculture, and retail see direct financial benefits from improvements to Ohio's freight system. The improved efficiency of goods movement reduces costs and increases productivity. Greater reliability reduces variability in the supply chain, facilitating more precise business decisions. Even safety improvements can have financial benefits, as reductions in liability risks and insurance premiums lead to lower transportation costs.

Additionally, improvements intended to reduce congestion and improve freight movement also benefit the movement of workers, emergency vehicles, and tourists sharing these same infrastructure assets. Improvements to freight efficiency and reliability also lower costs passed down to the consumer.

Expected Benefits of NHFP Funded Projects

These projects are expected to provide safety, condition, and efficiency benefits to the freight system (Figure 62). The six NHFP funded projects all address more than one area of major needs. The details of the needs addressed by the NHFP funded projects are elaborated on in the following section.

Figure 62: The Major Need Overlaps of the Ohio's National Highway Freight Program Projects (2022-2027)

Project Name	County	Major Needs Overlap		
		Safety	Preservation	Efficiency
I-70/I-71 Downtown Ramp Up: Phase 4R/6R	Franklin	✓	✓	✓
I-70/I-71 Downtown Ramp Up: Phase 4B	Franklin	✓	✓	✓
Cleveland Innerbelt Modernization	Cuyahoga	✓		✓
Brent Spence Bridge Corridor Project	Hamilton	✓	✓	✓
Akron Beltway Improvements	Summit	✓	✓	
Brent Spence Bridge Corridor Project	Hamilton	✓		✓

Source: CPCS Analysis of ODOT Data

Appendix A Federal Freight Planning Guidance

Federal FAST Act Guidance for Freight Planning

The Fixing America's Surface Transportation (FAST) Act, signed into law in 2015, established many "firsts" for freight planning that states need to consider as part of their long-range freight planning. A few of these "firsts" include:

- Establishing a national multimodal freight policy and goals,
- Establishing a National Multimodal Freight Network, including a National Highway Freight Network,
- Requiring states to develop state freight plans, and
- Establishing the National Highway Freight Program (NHFP) that apportions $1.2 B / year (average) to states by formula.

An additional requirement stated that the USDOT must develop a National Freight Strategic Plan (NFSP) to implement the goals of the national multimodal freight policy. The NFSP, published in September 2020, defines USDOT's vision and goals for the national multimodal freight system.

USDOT Vision for Freight: The freight transportation system of the United States will strengthen our economic competitiveness with safe and reliable supply chains that efficiently and seamlessly connect producers, shippers, and consumers in domestic and foreign markets.

USDOT will use the NFSP to guide national freight policy, programs, initiatives, and investments. States like Ohio will be able to use this USDOT information to inform the required state freight plans, including how to assess and compare the conditions and performance of the freight system within its borders.

The following figure provides a crosswalk between freight goal areas in the National Freight Strategic Plan (2020), the Fast Act (2015), and AO45 (2020). A requirement for state freight plans is to include a description of how the plan will meet USDOT goals. The intent of this crosswalk (Figure A-1) is to show that Transport Ohio can/will be developed while acknowledging and blending this federal guidance, through the application of a plan structure similar to Access Ohio 2045.

Figure A-1: Crosswalk Linking Federal Freight Goals to AO45 Goals

USDOT Strategic Freight Goals (NFSP)	USDOT National Freight Goals (adapted from FAST Act)	AO45 / Transport Ohio Goals
Safety Improve the safety, security, and resilience of the national freight system	Improve the safety, security, efficiency, and resiliency of multimodal freight transportation	Safety • Reduce fatalities and serious injuries • Enhance transportation system security • Support effective response to and recovery from natural disasters, emergencies, and incidents

USDOT Strategic Freight Goals (NFSP)	USDOT National Freight Goals (adapted from FAST Act)	AO45 / Transport Ohio Goals
Infrastructure Modernize freight infrastructure and operations to grow the economy, increase competitiveness, and improve quality of life.	Achieve and maintain a state of good repair on the National Multimodal Freight Network	Preservation • Maintain transportation assets in a state of good repair
	Improve the economic efficiency and productivity of the National Multimodal Freight Network	Economic Competitiveness • Improve access to job clusters • Enhance freight mobility • Improve transportation access to attractions
	Improve the reliability of freight transportation	Efficiency & Reliability • Increase the efficiency and reliability of moving people and freight • Improve the efficiency of connections between modes
	Improve the short- and long-distance movement of goods that—(A) travel across rural areas between population centers; (B) travel between rural areas and population centers; and (C) travel from the Nation's ports, airports, and gateways to the National Multimodal Freight Network	
	Reduce the adverse environmental impacts of freight movement on the National Multimodal Freight Network	Environmental Stewardship • Reduce air quality emissions related to transportation • Avoid, minimize or mitigate impacts of transportation on built and natural environment
		Quality of Life • Coordinate transportation policy and investments with community visions • Advance transportation policy and investments that improve public health
Innovation Prepare for the future by supporting the development of data, technologies, and workforce capabilities that improve freight system performance.	Use innovation and advanced technology to improve the safety, efficiency, and reliability of the National Multimodal Freight Network	N/A – however, the concept of innovation is embodied in ODOTs approach to strategic actions for the transportation system

Sources: Adapted by CPCS from USDOT National Freight Strategic Plan, FAST Act, Access Ohio 2045.

Additionally, both the USDOT National Freight Goals and the USDOT National Highway Freight Program Goals (i.e., the program that provides states sub-allocated funding to invest in their freight systems) indicate that certain principles must be adhered to while developing a state freight plan, including:

- Identify and invest in infrastructure improvements, policies, and operational innovations that:
  - Strengthen the contribution of the National Multimodal Freight Network (including the National Highway Freight Network) to the economic competitiveness of the US;
  - Reduce congestion and eliminate bottlenecks on the National Multimodal Freight Network (including the National Highway Freight Network);

- Improve the year-around reliability of the National Highway Freight Network; and
- Increase productivity, particularly for domestic industries and businesses that create high-value jobs.

These requirements have been addressed during Transport Ohio plan development.

Content Requirements

Besides the 10 content required for State Freight Plans listed in the FAST Act, the Bipartisan Infrastructure Law (BIL), signed by President Biden on November 15, 2021, makes certain changes to freight planning guidance. The BIL increases the frequency of freight planning from every five years to every four years. These freight plans also have certain new content requirements. Figure A-2 highlights the content requirements and where this information can be found in Transport Ohio.

Figure A-2: Crosswalk Between State Freight Plan Requirements and Transport Ohio

State Freight Plan Requirements	Transport Ohio Contents
FAST Act Requirements	
An identification of significant freight system trends, needs, and issues with respect to the State	• Chapter 2 contains National and Ohio-specific trends by mode. • Chapter 2 highlights multimodal freight system needs and issues.
A description of the freight policies, strategies, and performance measures that will guide the freight-related transportation investment decisions of the State	• Chapter 3 outlines strategies ODOT will act upon to improve freight system performance and decision making. • Working Paper on Existing Freight System Performance highlights a freight system performance report card that ODOT will use to track and improve the system.
When applicable, a listing of…	
multimodal critical rural freight facilities and corridors designated within the State under section 70103 of title 49 (National Multimodal Freight Network)	• Chapter 2 presents Ohio's multimodal freight system and describes the critical freight networks ODOT considers. • ODOT has designated a multimodal Strategic Freight System that articulates the most important urban and rural corridors and facilities in the state.
critical rural and urban freight corridors designated within the State under section 167 of title 23 (National Highway Freight Program)	N/A – ODOT has elected to not designate critical rural- or critical urban- freight corridors
A description of how the plan will improve the ability of the State to meet the national multimodal freight policy goals described in section 70101(b) of title 49, United States Code and the national highway freight program goals described in section 167 of title 23	Figure A-1 in Appendix A highlights the crosswalk between National freight goals and ODOT's goals for Transport Ohio. ODOT's approach is consistent with, and will support, Federal goals.
A description of how innovative technologies and operational strategies, including freight intelligent transportation systems, that improve the safety and efficiency of the freight movement, were considered	• Chapter 3 outlines strategies ODOT will act upon to improve freight system performance and decision making. • A subset of strategies focused on innovation and technology to improve the safety and efficiency of the freight system is included.

State Freight Plan Requirements	Transport Ohio Contents
In the case of roadways on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate the condition of the roadways, a description of improvements that may be required to reduce or impede the deterioration	• Chapter 3 outlines strategies ODOT will act upon to improve freight system performance and decision making. • A subset of strategies focused on operations and maintenance is included, specifically to "address pavement and bridge condition issues along the Strategic Freight System (SFS), with emphasis on intermodal connectors".
An inventory of facilities with freight mobility issues, such as bottlenecks, within the State, and for those facilities that are State owned or operated, a description of the strategies the State is employing to address those freight mobility issues	• Chapter 2 highlights multimodal freight system needs and issues. • Working Paper on Existing Freight System Performance identifies a long list of congestion bottlenecks based on calculating TTTR on the SFS. • Chapter 3 outlines strategies ODOT will act upon to improve freight system performance and decision making.
Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion or delay	• Chapter 3 outlines strategies ODOT will act upon to improve freight system performance and decision making. • A subset of strategies focused on operations and maintenance is included, specifically to "optimize travel time reliability on major freight corridors".
A freight investment plan that, subject to 49 U.S.C. 70202(c), includes a list of priority projects and describes how funds made available to carry out 23 U.S.C. 167 would be invested and matched	• Chapter 3 outlines the freight system investment plan, including how NHFP funds will be spent and the amount of matching funds.
Consultation with the State Freight Advisory Committee, if applicable	• The Ohio Freight Advisory Committee was convened throughout the development of Transport Ohio and is listed in Appendix B.
BIL Requirements	
Include supply chain cargo flows	• Chapter 2 illustrates multimodal commodity flows and the change between base year (2018) and 2045 by tonnage and value. • Chapter 2 highlights key industry commodity flows and the routing on Ohio's highway system. • Working Paper on the Existing and Future Commodity Flow Profile illustrates detailed commodity flows and changes by industry.
Include an inventory of commercial ports	• Working Paper on Characteristics of Ohio's Multimodal Freight System identifies multimodal facilities and commercial ports in Ohio. • Working Paper on Existing Freight System Performance highlights the modal connectivity of all multimodal facilities in the state.
Analyze the impacts of e-commerce on freight infrastructure	• Chapter 2 includes a discussion that examines the impacts of e-commerce on the roadway system. • Working Paper on Synthesis of Freight System Needs, Future Trends, and Opportunities provides additional discussion on the impacts of e-commerce.
Consider military freight	• Chapter 2 depicts Ohio's Strategic Defense System for both roads and railroads.

State Freight Plan Requirements	Transport Ohio Contents
Identify strategies and goals to address extreme weather, air pollution, flooding, and wildlife and habitat loss	• Chapter 3 identifies strategies to address extreme weather and other risks to freight transportation. • Chapter 3 identifies strategies that align with community values, public health, environment, and equity. • Appendix C provides actionable recommendations for implementation.
Assess truck parking facilities	• Chapter 2 includes a section dedicated to truck parking, which elucidates the impacts of truck parking needs and identifies undesignated truck parking clusters. • The standalone Ohio Truck Parking Study was developed as part of developing Transport Ohio.
Two broader priorities, one of which must be addressed by states conducting a freight plan: • Enhance reliability and redundancy of freight transportation, or • Improve the ability to rapidly restore access to freight transportation.	• Chapter 2 outlines the key efficiency and reliability needs. • Chapter 3 includes strategies to address congestion and improve reliability along Strategic Freight System corridors.

Appendix B Ohio Freight Advisory Committee Membership

Freight stakeholder engagement was important to Transport Ohio development for several reasons. Engagement supplemented quantitative data on freight system use, including the type and volume of goods moved, key modes, routes, and their origins and destinations. This helped identify relevant needs and issues as well as possible stakeholder solutions. It also helped validate data analysis and explain patterns in the data, such as major interchange nodes or traffic flows.

Ohio has a broad range of public and private sector freight stakeholders that served an important role in informing the recommendations for Transport Ohio and advancing Ohio's freight system toward the plan's goals and outcomes.

Figure B-1: Freight Advisory Committee Stakeholder Types

	Stakeholder Type	Organization	Contact(s)
1	Statewide Transportation	ODOT Office of Jobs & Commerce	**Jim Gates**, Administrator
		ODOT Special Hauling Permit Section	**Josh Thieman**, Section Manager
		ODOT Division of Operations	**Dean Otworth**, Deputy Director of Operations
		ODOT Division of Planning	**Scott Phinney**, Administrator
2	MPO and Regional Planning	Ohio Association of Regional Councils	**Dina Lopez**, Strategic Project Manager, MORPC
			Robyn Bancroft Strategic Initiatives Manager, OKI
4	Local Economic Development	Ohio Economic Development Association	**Jennifer Price**, Executive Director
5	Rural Development	Appalachian Regional Commission	**John Carey,** Director, Governor's Office of Appalachia
6	Trucking	Ohio Trucking Association	**Thomas A. Balzer, CAE**, President & CEO
7	State Rail Planning, Public Sector Rail Ownership	Ohio Rail Development Commission	**Matt Dietrich**, Executive Director
8	Private Sector Rail Operators	Ohio Railroad Association	**Art Arnold**, President
9	Great Lakes	Toledo-Lucas County Port Authority	**Joe Cappel**, VP, Business Development
10	Ohio River	Central Ohio River Business Association (CORBA)	**Eric Thomas**, President, ORCO
11	Key Industry – Advanced Manufacturing	Ohio Manufacturers' Association	**Ryan Augsburger**, Project Mgr., Transport
12	Key Industry – Aviation and Aerospace	Ohio Aviation Association	**Stacey Heaton**, Executive Director
13	Key Industry – Food and Agribusiness	Ohio Farm Bureau	**Mike Bailey**, Vice President, Strategic Partnerships

	Stakeholder Type	Organization	Contact(s)
14	Key Industry – Logistics and Distribution (Aviation)	JobsOhio Logistics	**Kevin Chambers**, Managing Director, Logistics and Distribution, Supply Chain
15	Regulations	Public Utilities Commission of Ohio	**John Williams**, Deputy Director – Transportation
16	Transportation Technology	DriveOhio	**Howard Wood**, Executive Director
17	Federal Transportation	FHWA	**Lorie Leffler**, Division Administrator, Ohio Division
18	Federal Transportation	MARAD	**Robert (Mike) Sullivan**, Great Lakes Gateway Office

Appendix C Summary of Recommended Actions

Transport Ohio Implementation Plan

The goal of the next steps of Transport Ohio are to share institutional knowledge on freight data and planning to provide a foundation to advance the continued study and mitigate of freight issues in the state. The following table provides a framework and set of preliminary actions to guide implementation.

Figure C-1: Implementation Action Plan – Transport Ohio

Transport Ohio Focus Area/Strategy	Action	Lead	Partners	Timeline (Short-0-2 years, Medium-2-4 years, Long- 4+ years)
Planning				
Develop/conduct freight specific plans and studies	Update the Ohio Maritime Strategy with specific focus on local priorities	ODOT	Maritime stakeholders	Medium
	Update the Ohio State Rail Plan	ODOT	Rail stakeholders	Long
	Conduct corridor studies on Strategic Freight System (SFS) corridors and facilities in order to prioritize safety, condition and efficiency improvements	ODOT	Local government	On-going
	Continually re-evaluate Primary Highway Freight System (PHFS), National Highway Freight System (NHFS), Critical Urban and Critical Rural Freight Connectors (CU/CRFCs), and National Highway System (NHS) intermodal connector designations	ODOT	Local government	On-going
Monitor and track progress to Transport Ohio goals / performance	Develop and maintain a Transport Ohio Action Item tracker	ODOT	Ohio Freight Advisory Committee	Short
	Track key freight indicators identified in Transport Ohio	ODOT	Ohio Freight Advisory Committee	On-going
Expand access to freight-related data and information	Develop and maintain statewide freight transportation asset inventories within ODOT's Transportation Information Management System (TIMS)	ODOT		Short
	Establish protocols to seamlessly and securely share transportation data among public agency freight partners (including via the Transport Ohio Tool/Dashboard)	ODOT	Other state agencies, Local government	Medium
	Consider data purchases that support statewide and local freight planning activities	ODOT	Other state agencies, Local government	On-going

Transport Ohio Focus Area/Strategy	Action	Lead	Partners	Timeline (Short-0-2 years, Medium-2-4 years, Long- 4+ years)
Encourage Ohio's regions to develop multimodal freight transportation plans and assessments	Develop freight planning guidance for metropolitan planning organizations (MPOs) and regional transportation planning organizations (RTPOs)	ODOT	Local government	Medium
	Provide Technical Assistance to port agencies, local public agencies, and regional planning organizations on freight plan development	ODOT	Freight stakeholders, Local government	Short
	Support the Ohio Conference on Freight	ODOT	Freight stakeholders, Local government	Short
Operations & Maintenance				
Maintain transportation assets (including enabling technologies) in a state of good repair	Address pavement and bridge condition issues along the Strategic Freight System (SFS), with emphasis on intermodal connectors	ODOT	Freight stakeholders, Local government	On-going
	Maintain and improve the hardware and enabling technologies along the SFS	ODOT		On-going
	Support maritime system preservation through the Maritime Assistance Program and advocate for continued funding (dredging, dams, levees, ports)	ODOT	Freight stakeholders, Local government	On-going
Employ Transportation System Management and Operations (TSMO) strategies to address congestion and improve reliability along key Strategic Freight System corridors	Maintain and improve the Truck Parking Information Management System (TPIMS) within Ohio	ODOT	Trucking stakeholders	Medium
	Optimize travel time reliability on major freight corridors	ODOT		On-going
	Collaborate with large companies to identify strategies that reduce personal trips and provide more/improved options to connect workers to jobs	ODOT	Other state agencies, Local government, Freight stakeholders	Medium
	Support activities (exercises and operations) that build coordination and interoperability during emergency response operations.	ODOT	Other state agencies, Local government, Freight stakeholders	On-going
Identify and mitigate extreme weather and other risks to freight transportation	Develop a Resiliency Plan, with an emphasis on goods movement that identifies and prioritizes critical multimodal infrastructure to better manage risks to the system.	ODOT	Other state agencies, Local government, Freight stakeholders	Short
	Update ODOT design standards to harden against extreme weather and other events, including flooding	ODOT		Short

Transport Ohio Focus Area/Strategy	Action	Lead	Partners	Timeline (Short-0-2 years, Medium-2-4 years, Long- 4+ years)
	Incorporate extreme weather considerations into Transportation Asset Management Plan development	ODOT		On-going
Reduce the number of freight traffic-related fatalities and serious injuries	Expand the use of new and proven crash prevention methods at grade crossings.	ODOT, ORDC	Rail stakeholders, Local government	On-going
	Reduce the overall number of public grade crossings in Ohio.	ODOT, ORDC	Rail stakeholders, Local government	On-going
	Identify blocked crossing locations and remedial action based on rail crossing adaptive capacity methodology.	ODOT, ORDC	Rail stakeholders, Local government	Short
	Modernize Ohio's distracted driving law by enacting a "Hands-Free" law with primary enforcement in the state of Ohio.	ODOT	Other state agencies	Short
	Improve commercial motor vehicle safety in work zones through policies, education, and in-cab messaging.	ODOT	Other state agencies, Trucking stakeholders	Short
Expand access to truck parking within Ohio	Implement the infrastructure, technology, and policy recommendations from the Ohio Truck Parking Study	ODOT	Other state agencies, Local government, Trucking stakeholders	On-going
Innovation & Technology				
Continue to position Ohio as a national leader and support the adoption of connected and automated vehicle technologies for freight	Advance connected vehicle infrastructure along key multimodal freight corridors within Ohio.	ODOT, DriveOhio	Local government, Trucking stakeholders	On-going
	Advance the adoption of freight automation technologies through Public-Private Partnerships and advanced vehicle testing programs.	ODOT, DriveOhio	Other state agencies, Local government, Private sector	On-going
Study and support the expanded use of drones/Advanced Air Mobility (AAM) for last-mile freight deliveries	Establish an advisory team to advise ODOT and the State of Ohio on AAM implementation	ODOT, DriveOhio	Other state agencies, Local government, Private sector	Short
	Develop AAM policy guidance for Ohio city and county governments, economic development agencies, and airports	ODOT, DriveOhio	Other state agencies, Local government	Medium

Transport Ohio Focus Area/Strategy	Action	Lead	Partners	Timeline (Short-0-2 years, Medium-2-4 years, Long- 4+ years)
	Work with state, municipal agencies and legislature to implement programs and strengthen industry participation for the key AAM supply chains (eVTOL, Ground Infrastructure, PSU/UTM low-altitude air traffic management)	ODOT, DriveOhio	Other state agencies, Local government	Long
Encourage adoption of alternative fuel vehicles for goods movement, including trucks, locomotives, and vessels	Evaluate state fleet and duty cycles to determine which vehicles may be appropriate for EV conversion	ODOT, DriveOhio	Other state agencies	Short
	Plan for freight-oriented EV corridor charging including gap identification, power supply analyses, and identifying priority locations for private sites	ODOT, DriveOhio	Other state agencies, Local government, Trucking stakeholders, Private sector	Medium
	Provide guidance to local governments on permitting, ROW easements, standardized Electric Vehicle Supply Equipment (EVSE) layouts and specifications, ideal locations for freight EV charging	ODOT, DriveOhio	Local government	Long
Coordination & Partnerships				
Facilitate and strengthen ongoing dialogue between ODOT and freight stakeholders	Conduct surveys of Ohio's key industries for awareness of current freight system needs and to understand user concerns and gain feedback on the effectiveness of ODOT freight policies, programs, and projects (every 3-4 years).	ODOT	Other state agencies, Local government, Freight stakeholders	On-going
	Retain the Ohio Freight Advisory Committee and convene on an at least tri-annual basis.	ODOT	Ohio Freight Advisory Committee	On-going
	Review the Ohio Freight Advisory Committee membership to ensure the cross-section of Ohio's key industries and freight stakeholders are represented	ODOT	Ohio Freight Advisory Committee	On-going
	Educate and inform Ohio citizens and decision-makers about the public and private benefits of the freight transportation system	ODOT	Ohio Freight Advisory Committee, Other state agencies, Local government, Freight stakeholders	On-going

Transport Ohio Focus Area/Strategy	Action	Lead	Partners	Timeline (Short-0-2 years, Medium-2-4 years, Long- 4+ years)
Partner with public agencies on project delivery and strategic initiatives	Provide key industries with freight transportation information including data, planning resources, and funding opportunities (through coordination with JobsOhio)	ODOT	Ohio Freight Advisory Committee, Other state agencies, Local government, Freight stakeholders	On-going
	Advance training and development programs to increase the labor supply in key industries including electric vehicle manufacturing, construction, infrastructure, and transportation (through coordination with JobsOhio)	ODOT	Other state agencies, Private sector	On-going
	Collaborate with metropolitan planning organizations, regional transportation planning organizations, Ohio Rail Development Commission, DriveOhio, JobsOhio and other state agencies on mutually beneficial projects	ODOT	Other state agencies, Local government	On-going
	Work with LPAs to identify, promote, and preserve locations for economic development with good transportation access and compatible land uses	ODOT	Other state agencies, Local government	On-going
System Investment				
Prioritize transportation system investments that grow the economy and improve access to jobs	Develop transportation system improvement plans for key shovel-ready sites	ODOT	Other state agencies, Local government	Short
	Support the development of intermodal, transload and other facilities to handle goods	ODOT	Other state agencies, Local government	On-going
	Use the Strategic Freight System (SFS) as a project selection factor for ODOT's Transportation Review Advisory Committee (TRAC) and other funding programs	ODOT		Short
Support multimodal freight transportation investments that align with community values, public health,	Work with the Ohio EPA on programs to finance diesel emission reduction improvement projects to Ohio's rail, maritime and trucking industries	ODOT	Other state agencies, Local government	On-going
	Complete a Carbon Assessment	ODOT	Other state agencies, Local government	Short

Transport Ohio Focus Area/Strategy	Action	Lead	Partners	Timeline (Short-0-2 years, Medium-2-4 years, Long- 4+ years)
environment, and equity	Advance an understanding of the overlap of the Strategic Freight System (SFS) with communities of concern	ODOT	Other state agencies, Local government	Short
Manage and distribute pass-through freight funding to modal agencies	Submit and support freight-related applications for USDOT discretionary grant funding (ex. Bridge, RAISE, Rural Surface Transportation)	ODOT	Other state agencies, Local government, Freight stakeholders	On-going
	Provide grants and other funding to improve the safety, condition, and efficiency of the freight transportation system, including the rail and maritime systems	ODOT	Other state agencies, Local government, Freight stakeholders	On-going
Engage the private sector in Public-Private Partnership opportunities	Proactively engage private sector in Public-Private Partnership opportunities	ODOT	Other state agencies, Local government, Private sector	On-going

Appendix D Ohio's Historic Freight System Investment by Program

Diesel Emissions Reduction Grant Program

The Diesel Emissions Reduction Grant (DERG) Program provided over $6 million in funding in the past period. This funding was leveraged to provide almost $25 million in total funding. Thus, among the freight projects receiving DERG Program funding, nearly 27 percent of the projects' total costs were funded using this source. The remaining 73 percent or so of project costs leveraged other funding sources. Figure D-1 provides a summary of this information.

Highway projects received about 60 percent of DERG Program funding. The remaining 40 percent or so was funneled to rail and maritime projects.

Freight projects are not expected to receive DERG funding in the future.

Figure D-1: Diesel Emissions Reduction Grant Program Funding ($millions)

Mode	2017-2021		2022-2026
	Funding	Percent of Total	
Highway	$3.9	59.7%	N/A
Rail	$1.4	21.4%	
Maritime	$1.2	18.9%	
Freight Total	$6.6	100.0%	
Amount Leveraged	**$24.7**	**26.6% from program**	

Source: CPCS analysis of Ohio ELLIS Project Data

Between the past and future periods, 20 projects received funding from the DERG Program. Figure D-2 provides three examples of projects funded with DERG funds, one highway, one rail, and one maritime. As the examples show, the DERG Program has been used in Ohio for a wide variety of projects, ranging from the purchase of new diesel-powered trucks and yard switcher locomotives to the replacement of tugboat engines.

Figure D-2: Example Diesel Emission Reduction Grant Program Projects ($millions)

Mode	Sponsor	Description	DERG Funding	Total Funding
Highway	Ohio EPA	Purchase 37 new diesel-powered trucks to replace trucks from 1997-2000	$1.0	$4.3
Rail	Ohio Rail Development Commission	Purchase a yard switcher locomotive engine to replace a 60-year-old 40-ton locomotive	$0.2	$0.4
Maritime	Belmont County Port Authority	Replace two tugboat engines from 1973 with new diesel engines	$0.4	$0.5

Source: CPCS analysis of Ohio ELLIS Project Data

Jobs & Commerce Economic Development Program

The Jobs & Commerce Economic Development (JCED) Program provided over $1.6 million in funding in the past period. This funding was leveraged to provide over $37 million in total funding. Thus, among the freight projects receiving JCED funding, just over 4 percent of the projects' total costs were funded using this source. The remaining 96 percent of project costs were from other sources. Figure D-3 provides a summary of this information.

This same pattern is true in the future period, with over 4 percent of total funding leveraged coming from the JCED Program. However, expected funding from JCED in the future period significantly lags the past period. This is likely the result of future funding procurement still being in process.

In both the past and future periods, highway projects received the bulk of JCED Program funding. In the past period, nearly 91 percent of JCED funding went to highway projects, with the remaining 9 percent or so funneled to rail projects.

Figure D-3: Jobs & Commerce Economic Development Program Funding ($millions)

Mode	2017-2021		2022-2026	
	Funding	Percent of Total	Funding	Percent of Total
Highway	$1.5	90.7%	$0.3	100.0%
Rail	$0.2	9.3%	$0	0.0%
Maritime	$0	0.0%	$0	0.0%
Freight Total	$1.6	100.0%	$0.3	100.0%
Amount Leveraged	**$37.1**	**4.4% from program**	**$7.9**	**4.5% from program**

Source: CPCS analysis of Ohio ELLIS Project Data

Between the past and future periods, 93 projects received funding from the JCED Program. Figure D-4 provides three examples of projects funded with Jobs & Commerce funds, two highway and one rail. As the examples show, the JCED Program has been used in Ohio for a wide variety of projects, ranging from the installation of roundabouts to road narrowing to railroad overpass construction.

Figure D-4: Example Jobs & Commerce Economic Development Program Projects ($millions)

Mode	Sponsor	Description	Jobs & Commerce Funding	Total Funding
Highway	District 2 Planning	Construct two roundabouts at US-20A/SR-295 and at US-20A/Whitehouse-Spence Road	$0.3	$4.2
Highway	City of Toledo	Full depth reclamation and narrowing from 5 to 3 lanes roads that circled the now razed North Towne Square Mall, making room for future industrial development	$0.5	$3.4
Rail	District 6 Planning	Construct railroad overpass for SR 309 over CSX railroad spur east of US 23	$0.2	$15.5

Source: CPCS analysis of Ohio ELLIS Project Data

Maritime and Freight Program

The Maritime Assistance Program (MAP) was created by the passage of HB 166 in the Ohio Legislature in 2019. The program provides grants to port authorities for approved maritime projects.

The MAP has provided funding in three rounds totaling over $47 million in grant funding, and leveraging over $200 million in maritime system improvements. Figure D-5 provides a summary of this funding information.

Figure D-5: Maritime and Freight Program Funding ($millions)

Mode	2017-2021		2022-2026	
	Funding	Percent of Total	Funding	Percent of Total
Highway	$0	0.0%	$0	0.0%
Rail	$0	0.0%	$0	0.0%
Maritime	$23.0	100.0%	$22.6	100.0%
Freight Total	$23.0	100.0%	$22.6	100.0%
Amount Leveraged	**$63.2**	**36.4% from program**	**$138.1**	**16.4% from program**

Source: Ohio Maritime Assistance Program Awards; ODOT

Figure D-6 lists the 23 maritime projects funded with MAP funds. MAP funds have been used for a variety of projects, ranging from the construction of an ore conveyance tunnel to dock reconstruction to the acquisition of new port equipment. The significant improvements made to Ohio's maritime assets between 2019 and 2021 highlight just how critical this grant program is for Ohio's maritime infrastructure. In order to maintain and improve the economic competitiveness of Ohio's maritime system, it is crucial that funding to this program continue.

Figure D-6: Maritime and Freight Program Projects ($millions)

Mode	Sponsor	Description	MAP Funding	Match Funding	Total Funding
Round One					
Maritime	Cleveland Port Authority	The project will expand the existing ore conveyance tunnel and update the mechanical and electrical infrastructure.	$1.6	$3.2	$4.8
Maritime	Cleveland Port Authority	The project will reconstruct and upgrade two docks, install structural pavement to accommodate heavy cargo, raise and reconstruct the deteriorated ship to rail spur, and complete a fiber-optic communication loop.	$6.3	$11.0	$18.5
Maritime	Columbiana County Port Authority	The Parsons Terminal project will include a dock pad extension with full depth heavy cargo concrete to increase capacity for loading and unloading river barges along with transloading equipment.	$0.4	$0.4	$0.9
Maritime	Columbiana County Port Authority	The S.H. Bell project will extend and repair the dock wall with full depth heavy cargo concrete, sheet pile and refacing for expanded loading and unloading river barges.	$1.0	$1.0	$2.0

Mode	Sponsor	Description	MAP Funding	Match Funding	Total Funding
Maritime	Toledo-Lucas County Port Authority	This project will reconstruct and upgrade the existing Facility-1 dock face,	$4.0	$4.5	$14.0
Maritime	Toledo-Lucas County Port Authority	This project will provide funding for the Toledo-Lucas County port authority to purchase an additional heavy lift mobile harbor crane.	$5.5	-	All funding from MAP
Round Two					
Maritime	Cleveland Cuyahoga County Port Authority	The project provides funding to construct a permanent U.S. Customs and Border Protection (USCBP) Cargo Facility within the Port Authority's General Cargo Terminal to maintain and increase a diversified mix of cargo, specifically containerized cargo.	$0.6	$0.6	$1.2
Maritime	Cleveland Cuyahoga County Port Authority	This award provides additional funding to expand upon the first round selection for the ore tunnel extension.	$0.6	$3.2	$10.4
Maritime	Cleveland Cuyahoga County Port Authority	This project will construct the next lift of permanent retention berms on the surfaces of CDF 12 to accommodate forecasted dredge sediment, resurface the existing roadway network and haul routes, harden the sluiceway spillway structures, adjust elevations of critical water management infrastructure, and increase the site's ability to hold more dredge process water.	$0.6	$0.6	$1.2
Maritime	Columbiana County Port Authority	This project will purchase transloading equipment to move cargo between truck/rail/ Ohio River barges and construction of additional covered storage space.	$0.3	$0.3	$0.6
Maritime	Monroe County Port Authority	This project will construct an industrial access road and repair/replace existing barge mooring cells in the Ohio River.	$1.5	$1.5	$3.0
Maritime	The Toledo-Lucas County Port Authority	This award provides funding for the purchase of a heavy-lift forklift to increase capacity for finished steel products and oversized cargo.	$0.2	$0.2	$0.5
Maritime	The Toledo-Lucas County Port Authority	This project will build an industrial road for the shipyards mobile crane and repair retaining walls at the Toledo Shipyard.	$0.33	$0.33	$0.67
Round Three					
Maritime	Cleveland Cuyahoga County Port Authority	The Irishtown Bend stabilization and rehabilitation project along the navigation channel of the Cuyahoga River.	$5.0	$44.8	$49.8

Mode	Sponsor	Description	MAP Funding	Match Funding	Total Funding
Maritime	Cleveland Cuyahoga County Port Authority	Rehabilitation of Docks 26W and 24 add alternatives.	$1.0	$12.4	$20.9
Maritime	Cleveland Cuyahoga County Port Authority	U.S. Customs and Border Protection (USCBP) Facility for increased containerized cargo	$0.9	$0.9	$1.8
Maritime	Cleveland Cuyahoga County Port Authority	Dock 20N paved containerized cargo dock laydown space for increased storage area.	$1.7	$1.7	$3.4
Maritime	Cleveland Cuyahoga County Port Authority	CHEERS Project will ensure there is sufficient dredge disposal capacity for the USACE; Planning & Design	$2.0	$2.0	$4.0
Maritime	Columbiana County Port Authority	Quality Liquid Feeds – JLG 600 AJ man lift and a FCG40K6 8,000 lb. cushion tire forklift to accurately gauge inventory in the storage tanks and offload products from the river barges. Also purchase of a 460V, 16' hoist lift with a 4,000 lb. capacity.	$0.4	$0.4	$0.8
			$0.6	$0.6	$1.2
Maritime	Columbiana County Port Authority	Pier 48 Stevedoring LLC equipment purchase skid steer	$0.06	$0.06	$0.12
Maritime	Monroe County Port Authority	Construction of a bulkhead at Powhatan #7 Funding split $4M Mooring cells on the river $1M Real Estate Acquisition	$5.0	$24.0	$29.0
Maritime	The Toledo-Lucas County Port Authority	$3 million Acquisition and installation of a bulk material conveyor system to service warehouse A-1 at the Port's General Cargo Facility.	$3.0	$3.0	$3.0
Maritime	The Toledo-Lucas County Port Authority	$4 million in MAP funds requested will cover exceptional inflationary costs associated with construction funded by MARAD PIDG and MAP Round# 1 funds for the dock wall reconstruction and liquid bulk transload project.	$4.0	$4.0	$24.0

Source: Ohio Maritime Assistance Program Awards; ODOT

National Highway Freight Program

The National Highway Freight Program (NHFP) provided over $180 million in funding in the past period. This funding was leveraged to provide about $1.1 billion in total funding. Thus, among the freight projects receiving NHFP funding, nearly 16 percent of the projects' total costs were funded using this source. The remaining 81 percent or so of project costs were from other sources. Figure D-7 provides a summary of this information.

Highway projects received the bulk of NHFP funding. In the past period, over 94 percent of funding went to highway projects, with the remaining 5.7 percent or so funneled to rail projects.

Figure D-7: National Highway Freight Program Funding ($millions)

Mode	2017-2021	
	Funding	Percent of Total
Highway	$170.6	94.3%
Rail	$10.2	5.7%
Maritime	$0	0.0%
Freight Total	$180.8	100.0%
Amount Leveraged	**$1,135.9**	**15.9% from program**

Source: CPCS analysis of Ohio ELLIS Project Data

Figure D-8 lists all 15 projects funded with the National Highway Freight Program. There are five on highways and 10 on railroads. NHFP funds have been used for a wide range of projects, from rail line rehabilitation to interchange redesign to roadway reconstruction. Although almost half of the nine projects were on railroads, these projects received significantly less funding than projects on highways. The rail project receiving the largest amount of NHFP funding was awarded just over $6 million. Meanwhile, the highway project receiving the largest amount of NHFP funding was awarded almost $106 million.

Figure D-8: National Highway Freight Program Projects (2017-2021) ($millions)

Mode	Project Name	Sponsor	Description	NHFP Funding	Total Funding
Highway	HAM IR 75 12.60	ODOT Sponsoring Agency	The project is the phases 1 & 2 of the HAM-75 corridor projects. Phase 1 includes reconstructing the interstate between Shepherd Lane and Glendale-Milford Rd. Phase 2 is the construction of the local roadway connection between Shepherd and Glendale-Milford.	$61.0	$188.4
Highway	CLA IR 70/SR 72 10.55/6.50	ODOT Sponsoring Agency	The work includes rehabilitation of lanes and construction of new lanes on IR70 between the US68 and SR72 interchanges.	$45.3	$61.7
Highway /Rail	MAR SR 309 19.59	District 6 Planning	The works consist of constructing railroad overpass for SR 309 over CSX railroad spur east of US 23. It also includes slight realignment of SR 309 and service road.	$6.4	$15.5
Highway	CUY IR 480 18.42 L&R Deck	ODOT Sponsoring Agency	Located in Cuyahoga County, the project includes the replacement of the decks on the IR480 bridges over the Cuyahoga River Valley in Valley View and Independence. Work will include constructing a new structure between the existing bridges.	$34.0	$617.3
Rail	AUG US 33 16.69	ORDC	The project involves the removal and relocation of the existing railroad spur servicing Ametek Plastics, Inc. from its crossing of US-33 located east of Cemetery Road to the north side of US-33 within the road right of way and on a similar alignment to US-33.	$0.2	$2.2
Highway	FRA IR 71 17.46 (Proj 3B)	District 6 Planning	The project works include the reconstruction and widening of IR 71 from Broad St. to Long St., as well as the reconstruction and widening of the Broad St. bridge over IR 71. The project also builds Lester Dr. and Elijah Pierce Ave between Broad St. and Long St. and eliminates two existing ramps.	$30.3	$62.8

Mode	Project Name	Sponsor	Description	NHFP Funding	Total Funding
Rail	CIND Tie & Surface 2019	ORDC	The project contains rail line rehabilitation work, such as tie replacement, surfacing gauging, and crossing surface renewal. Approved in 3/20/2019, the project is located on CIND Main Line between mileposts 0 – 20.	$0.4	$1.3
Rail	RJ Corman Cleveland Lines 2018	ORDC	Work includes tie replacement, surfacing, joint welding, bridge deck work, and crossing reconstruction at S First St and Crown, Mt. Pleasant, and Baertown Roads. Project area includes MP 101-105 on the RJC Cleveland Line, bridge 72.4, and crossings at MP 108.3, 76.4, 77.4, and 77.8.	$0.2	$0.7
Rail	Camp Chase Railway Rehab	ORDC	Track rehabilitation and grade crossing surface replacement on Camp Chase Railway. The project is located in Franklin County and is sponsored by MORPC.	$0.2	$0.4
Rail	IORY Springfield Brdge Undercuts	ORDC	The project is in Clark County and includes undercutting to increase vertical clearance at three structures in Springfield on the IORY. Project includes excavation, track reconstruction, turnout replacement, and retaining wall construction.	$0.3	$2.3
Rail	Omal Yard Expansion	ORDC	The rail yard rehabilitation project includes tie replacement, surfacing, joint welding, and rail installation on Central Maine and Quebec Railway Omal Line.	$0.1	$0.2
Rail	CRISI IORY Delta	ORDC	The project includes rehabilitation of the Delta Rail Yard in Delta, Ohio/Fulton County.	$0.3	$7.9
Rail	ASRY Yard Expansion & Rail Test	ORDC	Work includes installation of 3000 feet on new track, installation of 7 turnouts, and related work to expand the Mansfield Yard. Additional work expected involves ultrasonic Rail Flaw Detection (RFD) on 23 miles of track between milepost 64 and milepost 87 and replacement of defective rail.	$0.7	$1.5
Rail	OSCR Aluchem Rehab	ORDC	The project is the rail line rehabilitation of the Aluchem Lead. Work includes track improvements, such as tie replacement, refurbishment of turnouts, rail replacement, and other improvements.	$0.4	$0.6
Rail	CCR Mahoning Sub Rehabilitation	ORDC	The project is the rehabilitation of rail infrastructure along the railroad's Mahoning Subdivision in Cuyahoga County. The work includes crosstie replacement, ballast installation, surfacing, rail replacement, and ancillary work on main and side tracks over 12 miles.	$1.5	$2.0
Rail	Medina Track Improvements	ORDC	The project includes grading, drainage improvements, tie replacement, ballast installation along the rail line owned by the City of Medina, and the replacement of the grade crossing surface on Liberty Street.	$0.2	$0.3

Source: CPCS analysis of Ohio ELLIS Project Data

ORDC Rail Development Fund

The ORDC Rail Development Fund provided $175,000 in funding in the past period. This funding was leveraged to provide almost $888,000 in total funding. Thus, among the freight projects receiving Rail Transportation Planning funding, nearly 20 percent of the projects' total costs were funded using this source. The remaining 80 percent or so of project costs leveraged other funding sources. Figure D-9 provides a summary of this funding information.

There are currently no projects receiving ORDC Rail Development Funds listed under the future period. This is likely to change over the next few years as additional funding decisions/project selections are made.

Rail projects received all of the ORDC Rail Development Funding. In fact, only one project received funding from this source. This project is listed in Figure D-10.

Figure D-9: ORDC Development Fund ($thousands)

Mode	2017-2021		2022-2026
	Funding	Percent of Total	
Highway	$0	0.0%	TBD
Rail	$175.0	100.0%	
Maritime	$0	0.0%	
Freight Total	$175.0	100.0%	
Amount Leveraged	**$887.9**	**19.7% from program**	

Source: CPCS analysis of Ohio ELLIS Project Data

Figure D-10: ORDC Rail Development Fund Project ($thousands)

Mode	Sponsor	Description	Rail Transportation Planning Funding	Total Funding
Rail	Ohio Rail Development Commission	Track and railbed maintenance on Jackson Rail Line right-of-way, including removing and replacing rail ties, ballast improvements, and drainage improvements	$175.0	$887.9

Source: CPCS analysis of Ohio ELLIS Project Data

Rail Crossing Safety

The Rail Crossing Safety funding source provided over $75 million in funding in the past period. This funding was leveraged to provide over $117 million in total funding. Thus, among the freight projects receiving Rail Crossing Safety funding, over 64 percent of the projects' total costs were funded using this source. The remaining 36 percent or so of project costs were covered by leveraging other funding sources. Figure D-11 provides a summary of this information.

In the future period, almost $56 million in funding is expected from Rail Crossing Safety. This funding will be leveraged to provide over $77 million in total funding. Thus, about 72 percent of expected funding on these projects is covered by the Rail Crossing Safety funding source. These future period figures are similar to those from the past period and will likely look more similar as funding is finalized.

Rail projects received the bulk of Rail Crossing Safety funding. Indeed, in the past period, rail received 99.8 percent of this funding. The remaining 0.2 percent went to highway projects.

Figure D-11: Rail Crossing Safety Funding ($millions)

Mode	2017-2021		2022-2026	
	Funding	Percent of Total	Funding	Percent of Total
Highway	$0.2	0.2%	$0	0.0%
Rail	$75.1	99.8%	$55.7	100.0%
Maritime	$0	0%	$0	0.0%
Freight Total	$75.3	100%	$55.7	100.0%
Amount Leveraged	**$117.2**	**64.2% from program**	**$77.5**	**71.9% from program**

Source: CPCS analysis of Ohio ELLIS Project Data

Between the past and future periods, 439 projects received funding from the Rail Crossing Safety funding source. Figure D-12 provides three examples of projects funded with Rail Crossing Safety funds, two rail and one highway. As the examples show, the Rail Crossing Safety funding source has been used in Ohio for a wide variety of projects, ranging from rail grade separation to bridge replacement to the installation of active warning devices.

Figure D-12: Example Rail Crossing Safety Projects ($millions)

Mode	Sponsor	Description	Rail Crossing Safety Funding	Total Funding
Rail	City of Akron	CSX rail grade separation	$0.25	$10.4
Highway	District 11 Planning	Bridge replacement with new single span steel beam structure	$0.20	$6.5
Rail	Ohio Rail Development Commission	Installation of flashing lights and roadway gates at grade crossing	$0.06	$0.2

Source: CPCS analysis of Ohio ELLIS Project Data

Other Assistance

The Other Assistance funding category provided just over $44,000 in funding in the past period. This funding was leveraged to provide over $5 million in total funding. Thus, among the freight projects receiving Other Assistance funding, almost 1 percent of the projects' total costs were funded using this source. The remaining 99 percent or so of project costs were covered by leveraging other funding sources. Figure D-13 provides a summary of this information.

In the future period, over $540,000 in funding is expected from the Other Assistance category. This funding will be leveraged to provide over $5.4 million in total funding. Thus, 10 percent of expected funding on these projects is covered by the Other Assistance funding category. Interestingly, these numbers are higher than those in the past period.

Rail projects received the bulk of Other Assistance funding. Indeed, in the past period, rail projects were awarded over 85 percent of this funding. The remaining 15 percent or so went to highway projects.

Figure D-13: Other Assistance Funding ($thousands)

Mode	2017-2021		2022-2026	
	Funding	Percent of Total	Funding	Percent of Total
Highway	$6.5	14.8%	$0	0.0%
Rail	$37.5	85.2%	$542.3	100.0%
Maritime	$0	0%	$0	0.0%
Freight Total	$44.0	100%	$542.3	100.0%
Amount Leveraged	**$5,074.3**	**0.9% from program**	**$5,437.4**	**10.0% from program**

Source: CPCS analysis of Ohio ELLIS Project Data

Figure D-14 lists all five projects funded with Other Assistance funds in the past and future periods. There are four on railroads and one on a highway. Other Assistance funds have been used for a variety of projects, ranging from railroad relocation to active warning signal improvements closures to roadway resurfacing.

Figure D-14: Other Assistance Projects ($thousands)

Mode	Sponsor	Description	Other Assistance Funding	Total Funding
Rail	Ohio Rail Development Commission	Removal and relocation of the existing railroad spur servicing Ametek Plastics, Inc.	$37.5	$2,181.8
Rail	Ohio Rail Development Commission	Closure of two at-grade CSX crossings and warning device modifications	$227.3	$3,546.5
Rail	Ohio Rail Development Commission	Closure of CSX grade crossing	$203.5	$1,563.0
Rail	Ohio Rail Development Commission	Improvement to flashing lights and roadway gates at CSX grade crossing	$111.6	$328.0
Highway	ODOT Sponsoring Agency	Resurface existing roadway	$6.5	$2,892.5

Source: CPCS analysis of Ohio ELLIS Project Data

Appendix E Table of Figures

Appendix F Acronyms & Abbreviations

Acronym	Definition
AAM	Advanced Air Mobility
ADIP	Airport Data and Information Portal
AFRL	Air Force Research Laboratory
AO40	Access Ohio 2040
AO45	Access Ohio 2045
ASCE	American Society of Civil Engineers
ATRI	American Transportation Research Institute
ATSG	Air Transport Services Group
BIL	Bipartisan Infrastructure Law
CAR	OSU Center for Automotive Research
CAV	Connected and Autonomous Vehicles
CBP	US Customs and Border Protection
CLE	Cleveland Hopkins International Airport
CORBA	Central Ohio River Business Association
CRFC	Critical Rural Freight Connector
CUFC	Critical Urban Freight Connector
CVG	Cincinnati/Northern Kentucky International Airport
DEG	Diesel Emissions Reduction Grant
DMS	Dynamic Message Sign
DoD	US Department of Defense
DOT	Department of Transportation
DSRC	Dedicated Short Range Communication
EPA	US Environmental Protection Agency
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FAA	Federal Aviation Administration
FAC	Freight Advisory Committee
FAF	Freight Analysis Framework
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FTZ	Foreign Trade Zone
GDP	Gross Domestic Product
HOS	Hours of Service
HVL	Highly Volatile Liquids
IIJA	Infrastructure Investment and Jobs Act
ILN	Wilmington Air Park
JCED	Jobs and Commerce Economic Development
kW	Kilowatt

Acronym	Definition
LCK	Rickenbacker International Airport
MAP	Maritime Assistance Program
MAP-21	Moving Ahead for Progress in the 21st Century Act
MPO	Metropolitan Planning Organization
NASA	National Aeronautics and Space Administration
NFSP	National Freight Strategic Plan
NHFN	National Highway Freight Network
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
OBU	On Board Unit
ODOT	Ohio Department of Transportation
ORDC	Ohio Rail Development Commission
OSU	Ohio State University
PHFS	Primary Highway Freight System
PSR	Precision Scheduled Railroading
PTC	Positive Train Control
RFD	Rail Flaw Detection
RSIA	Rail Safety Improvement Act
RSU	Road Side Unit
RTPO	Regional Transportation Planning Organization
RUMA	Road User Maintenance Agreement
SFS	Strategic Freight System
SMART	Smart Mobility Advanced Research and Test
STRACNET	Strategic Rail Corridor Network
STRAHNET	Strategic Highway Corridor Network
SWOT	Strengths, Weaknesses, Threats, and Opportunities
TIMS	Transportation Information Management System
TPIMS	Truck Parking Information and Management System
TRAC	Transportation Review Advisory Committee
TRC	Transportation Research Center Inc.
TSMO	Transportation System Management and Operations
TTTR	Truck Travel Time Reliability
UAS	Unmanned Aircraft Systems
US	United States
USACE	US Army Corps of Engineers
US DOT	US Department of Transportation
VMT	Vehicle Miles Traveled