

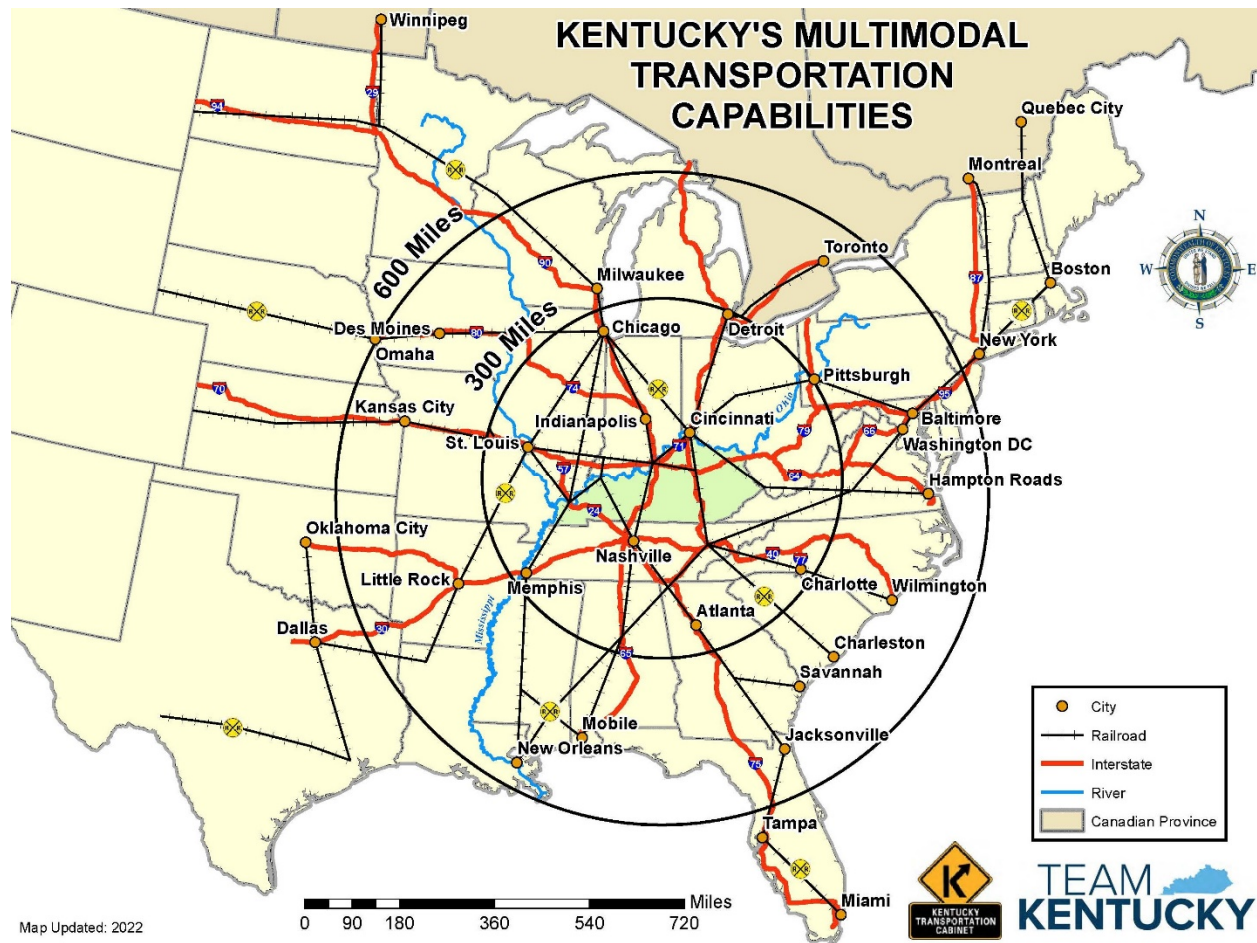
5. Key Industries and Supply Chains

Kentucky's major industries and their respective supply chains are vital drivers of Kentucky's economy. Supply chains are the pathways on which raw materials and production component parts move from their original sources to a production facility, warehouse, retail outlet, and end consumer. Kentucky industries rely on an efficient freight transportation system to meet these needs. This analysis will identify infrastructure crucial to Kentucky's economic future, including critical intermodal connectivity points. Often, these points are where most efficiency is gained or lost during transport. The analysis comprising this section was constructed using existing information and expertise including the KYTC Major Freight Users Inventory (MFUI), Freight Analysis Framework (FAF), and analysis completed by the Institute of Trade and Transportation Studies (ITTS).

5.1. History

Kentucky's economy has always been closely intertwined with its freight transportation system, beginning with the steamboat in the 1800's. While this provided many opportunities for riverside settlements, it left inland towns largely unconnected. During the Industrial Revolution, short line railroads began to connect many of these smaller communities, which provided major economic development opportunities for Kentucky. The success of the railroads allowed for the rapid expansion of the coal industry. A century later, Kentucky is strategically located less than one-and-a-half day's truck drive from most of the nation's eastern and central manufacturing centers, as shown in **Figure 5-1**. While Kentucky's geography provides many economic advantages, it also presents challenges with mountainous terrain, karst areas, and areas prone to flooding.

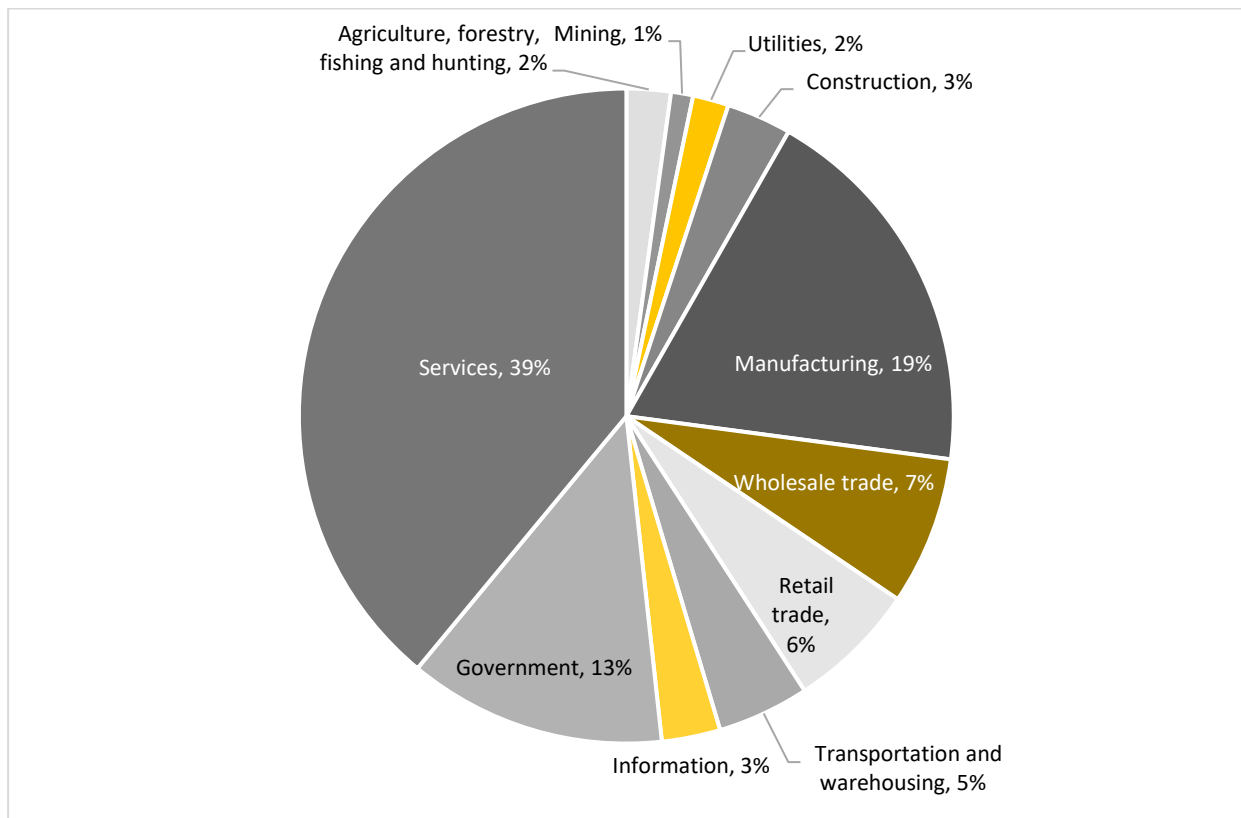
Figure 5-1. Kentucky's Multimodal Transportation Capabilities



Source: Kentucky Transportation Cabinet, 2022.

The commonwealth's industries, which have shifted in recent decades, are key players in freight transportation. In the 1990s, manufacturing became Kentucky's major industry. Key manufacturing industries include chemical and automotive. In present day, major employment generators are in the transportation equipment and automotive parts industries. In 2011, the services sector (which includes healthcare) exceeded manufacturing as a largest share of the overall Kentucky economy. In terms of employees, UPS has been Kentucky's largest employer since 2005, when it expanded its Louisville air cargo hub.

Figure 5-2 illustrates the industry share of Kentucky's economy by gross domestic product (GDP). Although coal is one of the top commodities transported by weight, mining only accounts for 1 percent of the total economic activity (in terms of GDP). In 2020, FAF's total tonnage for coal in Kentucky is 8.7 percent. With the ongoing trend of powerplant transition from coal to other fuels, coal is expected to play less of a role in the Commonwealth's economy and will likely lead to a continued decrease in rail and waterway traffic required to transport coal through and out of Kentucky, and an overall shift in the mix of commodities on the freight transportation system.

Figure 5-2. Industry Share of Kentucky Economy (GDP)⁴¹

Source: Bureau of Economic Analysis, 2020.

⁴¹ Bureau of Economic Analysis, 2020 State Gross Domestic Product by NAICS Code, <https://www.bea.gov/data/gdp/gdp-state>, Accessed November 2021.

5.2. Transportation Framework for Supply Chain Decisions

The factors utilized by site selectors when strategically locating new developments include the availability and capacity of the freight transportation system to move raw materials, manufacturing materials, and finished goods along the supply chain. For example, the location of a manufacturing or distribution center will be (in part) based on the presence of current or expected transportation infrastructure to meet these supply chain needs. An overall understanding of the role transportation plays in supply chain decision-making will support KYTC's planning efforts and strategic investment in the freight system.

As part of a National Cooperative Freight Research Program (NCFRP, Report #14) project, supply chain managers developed an overall framework for the selection of various routes and modes to carry freight throughout the product development process (**Table 5-1**). The criteria are balanced against the specific needs of the supply chain, and the best route, mode, or combination of modes is selected.

Table 5-1. Criteria for Analyzing Transportation in Supply Chain Decisions⁴²

Criteria	Definition
Time	The time required for the movement of materials within the supply chain. This normally includes moving raw materials to production and then through a distribution network to the ultimate customer.
Network Reliability	The degree of predictability that the stated transportation time will be adhered to during shipping. Reliability is very different than predictable delays such as rush hour congestion. Unlike recurring congestion, this is measurement of risk that the shipment will be impeded by an unexpected delay.
Cost	The cost of transportation cannot produce or hinder the overall price competitiveness of the final product. Cost, along with time and reliability, provides the three major factors of the framework.
Capacity	Evaluation of the selected route/mode(s) capacity to move additional product if necessary.
Safety	The ability of a route/mode(s) to provide a level of confidence that shipped goods will be delivered in good condition.
Availability	Overall availability and accessibility of the route/mode(s). Companies must ensure that shipments are available to both the shipper and the receiver. They also must ensure that if a supply chain manager wishes to ship more goods, there would be available means to transport.

⁴² Rhodes, Suzann. *NCFRP Report 14: Guidebook for Understanding Urban Goods Movement*, 2012, Pages 6-16.

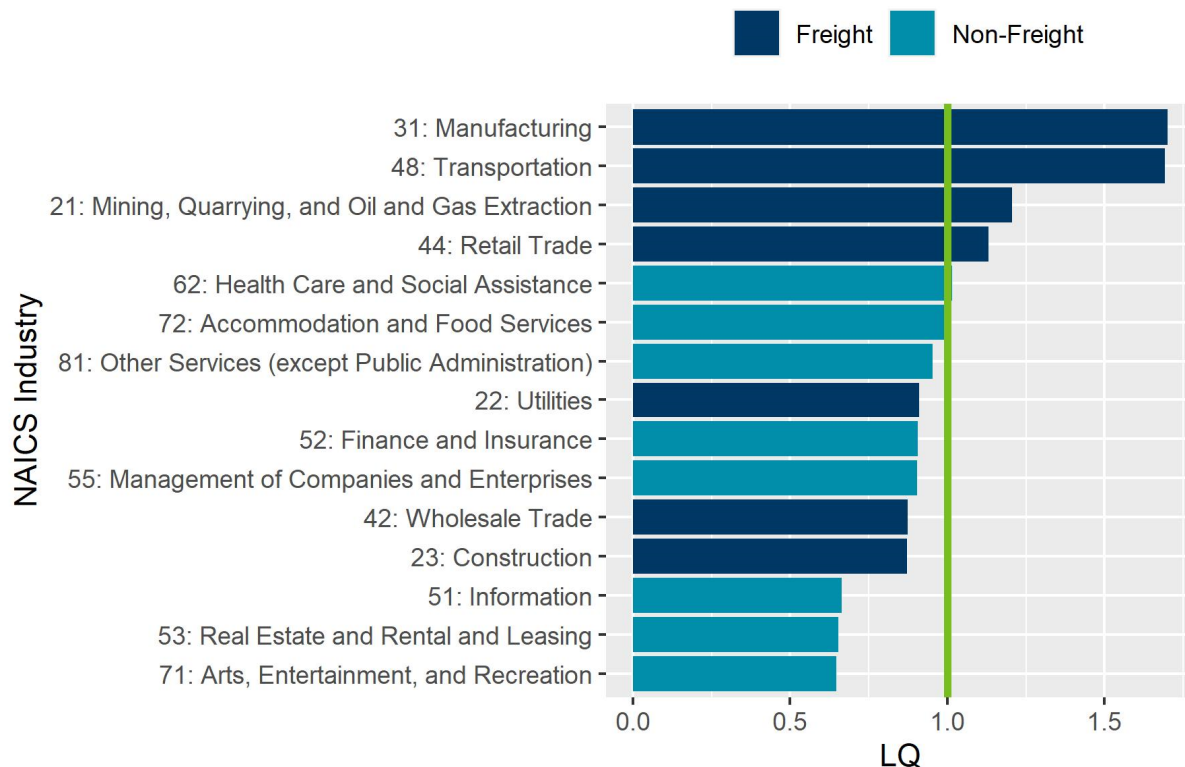
The importance of each freight-related industry to the state's economy can be evaluated through the degree of specialization of that specific industry compared to the national degree of specialization. This evaluation can be measured using a location quotient (LQ) approach, where:

$$LQ = \frac{\frac{\text{Industry Emp. in KY}}{\text{Total Emp. in KY}}}{\frac{\text{Industry Emp. in US}}{\text{Total Emp. in US}}}$$

A location quotient of 1.0 means that Kentucky has exactly as much employment for that industry as would be expected based on the national employment. A location quotient of 2.0 would indicate that Kentucky has twice the expected level of employment for that industry. Economists assume that industries with a location quotient over 1.0 serve an export market (to other regions or countries).

Kentucky location quotients by NAICS industries are shown in **Figure 5-3** for freight and non-freight industries. The location quotients for each NAICS industry were calculated using 2019 County Business Patterns (CBP) data⁴³. The industries with location quotients above 1.0 are Manufacturing (NAICS Code 31), Transportation (NAICS Code 48), Mining (NAICS Code 21), and Retail Trade (NAICS Code 44), and they are all freight-related industries that are more specialized relative to US employment. Manufacturing and Transportation have approximately 1.7 times as many jobs as expected.

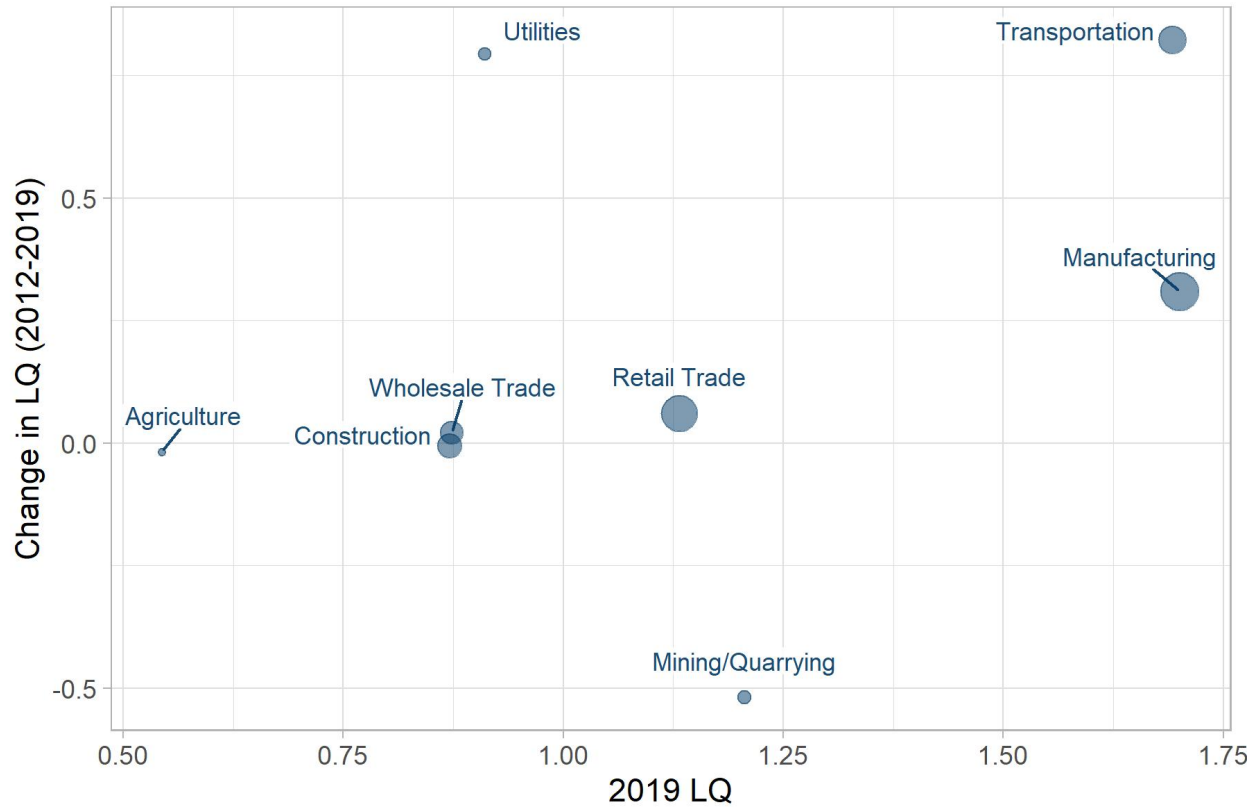
Figure 5-3. Kentucky Location Quotient by NAICS Industries (2019)



⁴³ U.S. Census Bureau, County Business Patterns: 2019, <https://www.census.gov/data/datasets/2019/econ/cbp/2019-cbp.html>.

Figure 5-4 highlights the change in location quotients for the freight-related industries between 2012 and 2019. Transportation (NAICS Code 48) and Utilities (NAICS Code 22) have experienced the highest levels of growth in terms of location quotients from 2012 to 2019, and Mining (NAICS Code 21) has experienced the largest reduction in location quotient during this period.

Figure 5-4. Kentucky Change in Location Quotients (2012 to 2019)



5.3. Kentucky Freight Corridors

The data driven identification of key corridors for Kentucky's freight system is needed to guide policy and investment decisions that impact the largest and most important freight users in the commonwealth. This identification was completed utilizing the KYTC Major Freight Users Inventory and FAF.

The Freight Analysis Framework (FAF) integrates data from a variety of sources to create a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation. With data from the 2017 Commodity Flow Survey and additional sources, FAF version 5 (FAF5) provides estimates for tonnage, value, and domestic ton-miles by region of origin and destination, commodity type, and mode for 2017, and forecasts through 2050. Also included are state-to-state flows for these years plus 1997, 2002, and 2007, and 2012, summary statistics, and flows by truck assigned to the highway network for 2017 and 2050.⁴⁴

5.3.1. Exports

In 2010, the commonwealth created the Kentucky Export Initiative⁴⁵ with the goal to increase international exports, which will ultimately lead to job growth. Since its creation, exports have grown from just over \$19 billion in 2010 to nearly \$25 billion in 2020, outpacing all previous years' exportation levels. These activities have created over 150,000 jobs. **Table 5-2** demonstrates the top ten international export categories for Kentucky in terms of weight and value.

Table 5-2. Kentucky International Exports, 2017

Ranked by Weight		Kiloton	Ranked by Value		Millions \$ (2017 \$)
1	Mixed freight	1032.97	1	Machinery	\$12,087.12
2	Motorized vehicles	557.32	2	Motorized vehicles	\$5,627.02
3	Plastics/rubber	435.61	3	Electronics	\$1,731.55
4	Base metals	360.60	4	Pharmaceuticals	\$1,658.82
5	Wood prods.	313.98	5	Plastics/rubber	\$1,455.75
6	Nonmetal min. prods.	305.76	6	Base metals	\$1,339.25
7	Coal	287.48	7	Precision instruments	\$1,230.64
8	Chemical prods.	199.84	8	Chemical prods.	\$1,184.31
9	Alcoholic beverages	166.12	9	Articles-base metal	\$1,064.45
10	Waste/scrap	165.35	10	Furniture	\$678.73

Source FHWA FAF5.

⁴⁴ Federal Highway Administration, Freight Analysis Framework Version 5.2, <https://faf.ornl.gov/faf5/>, Accessed February 2022.

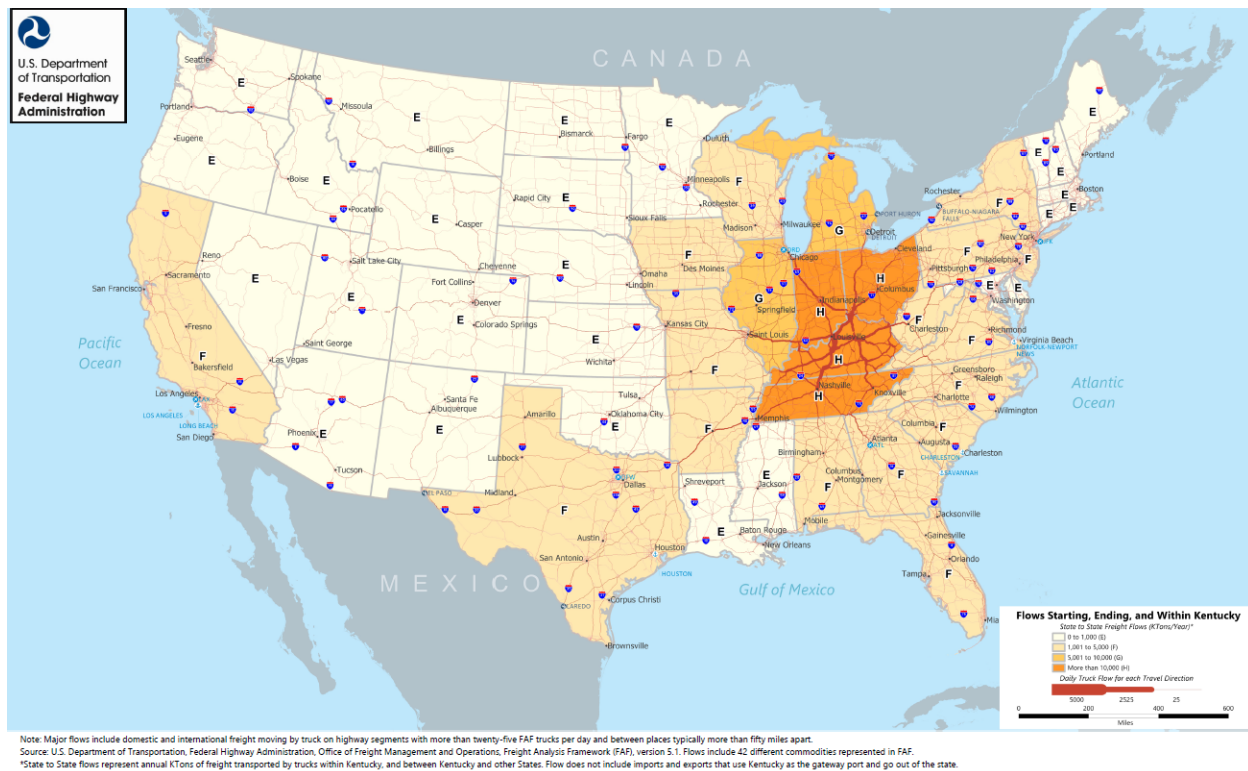
⁴⁵ Kentucky Export Initiative, <http://www.kyexports.com/>, Accessed February 2022.

While the various exports are transported by air, truck, water, and rail, this document focuses on the exports on the highway network. These intermodal links are critical to the rapidly growing export market in Kentucky. According to the FAF network analysis and illustrated in **Figure 5-5**, I-75, I-71, I-64, and I-69 are critical highway links for Kentucky exports to Canada and Mexico.

5.3.2. National Flows

Kentucky serves as a major junction for the nation's freight network. **Figure 5-5** and **Figure 5-6** demonstrate base year flows (2017) and forecasted flows in 2040⁴⁶. It is important to recognize the multijurisdictional nature of freight. Freight that travels in Kentucky travels throughout the eastern half of the U.S. and has key linkages to ports on the west coast.

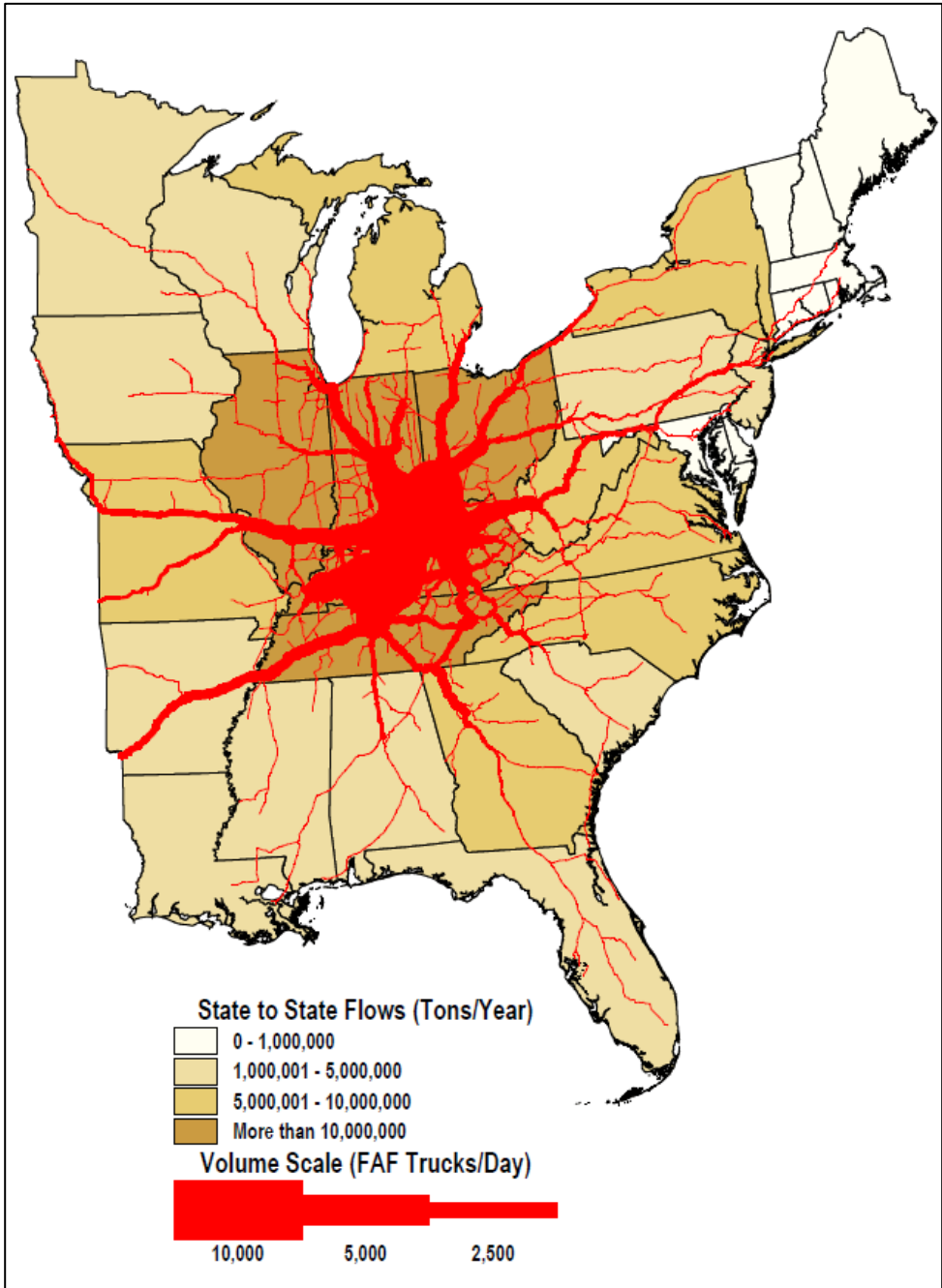
Figure 5-5. Major Flow by Truck To, From and Within Kentucky (2017)



Source: FHWA, Accessed August 2022.

⁴⁶ For base year 2007. The national map of major flow by truck to, from, and within Kentucky forecasted for 2050 with base year 2017 has not been released yet by FHWA as of August 2022.

Figure 5-6. Major Flow by Truck To, From and Within Kentucky (2040)⁴⁷



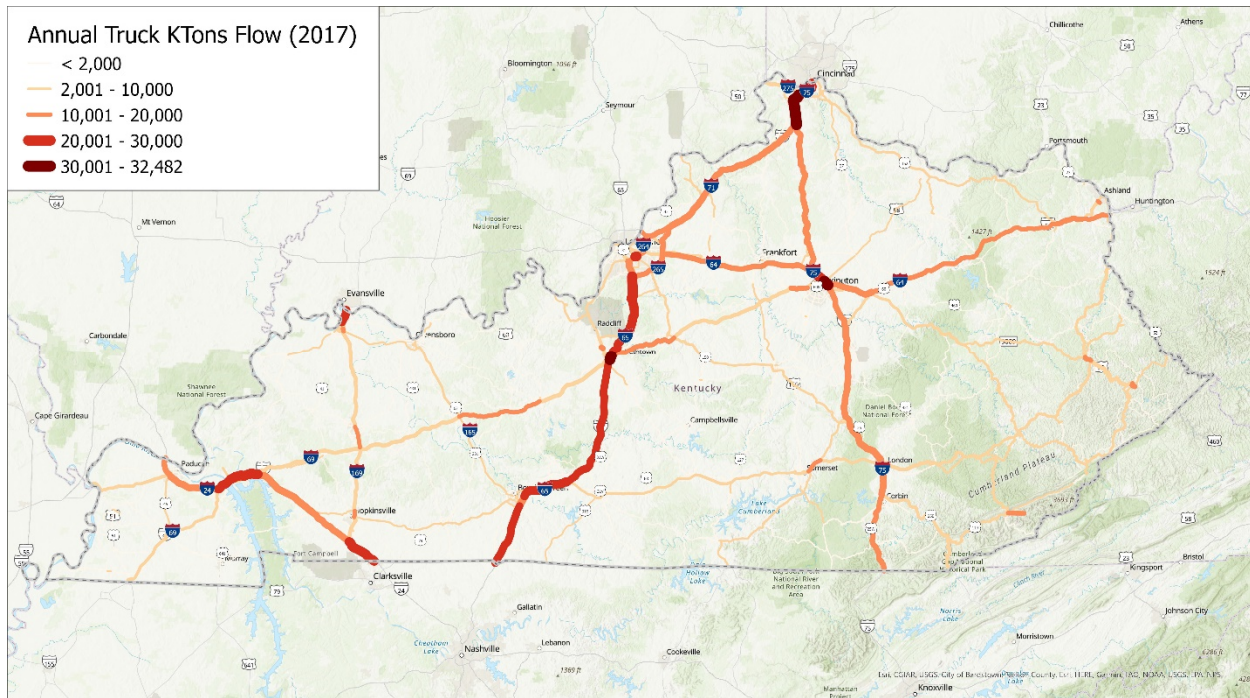
Source: FHWA, Accessed August 2022.

⁴⁷ For base year 2007. The national map of major flow by truck to, from, and within Kentucky forecasted for 2050 with base year 2017 has not been released yet by FHWA as of August 2022.

5.3.3. Statewide Flows

While national analysis is important to understand how the bigger freight picture works, statewide analysis is particularly important to KYTC's planning process. The routes identified as critical freight corridors are within KYTC's span of control and are a known part of the planning process. **Figure 5-7** and **Figure 5-8** demonstrate the base flow year in 2017 and forecasted flow in 2050.

Figure 5-7. Kentucky FAF Freight Tonnage (2017)

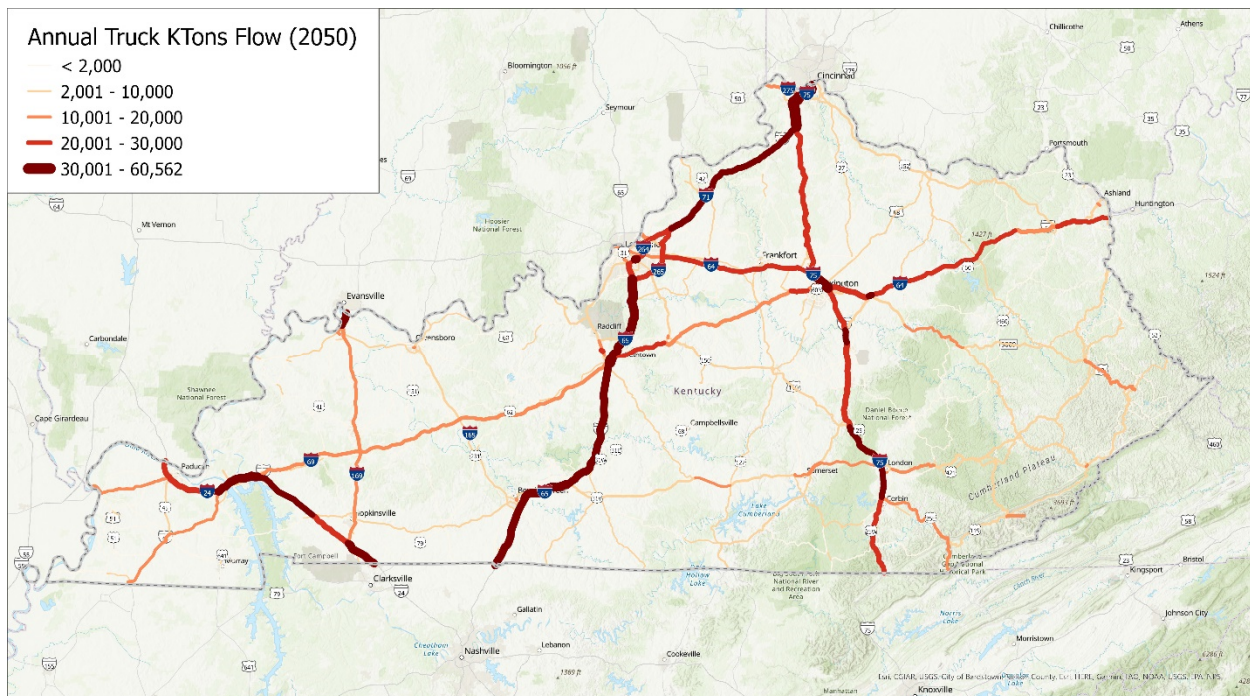


Source: FHWA, Accessed August 2022.

The 2050 freight forecast uncovers significant freight challenges for many roads throughout the commonwealth. Significant growth takes place on I-71/75 between the Brent Spence Bridge and the I-71/75 split (**Figure 4-1**). This corridor is particularly crucial for Kentucky's exports to Canada. Additionally, I-65 and I-64 see substantial growth. However, I-65 and I-75 see the highest tonnage on Kentucky's interstate highways. In addition, I-69 shows growth in highway tonnage, but the full impact may be several years away, as adjacent states complete their segments of I-69.

Freight growth is not limited to the Interstate Highway System. Significant growth takes place on the NHS and some principal arterials, reflecting economic growth in rural areas of Kentucky. This is important because, to maintain the supply chain and economic growth throughout the commonwealth, freight investment in Kentucky must be balanced between heavy volume interstate highways and NHS highways that service local freight generators.

Figure 5-8. Kentucky FAF Freight Tonnage (2050)

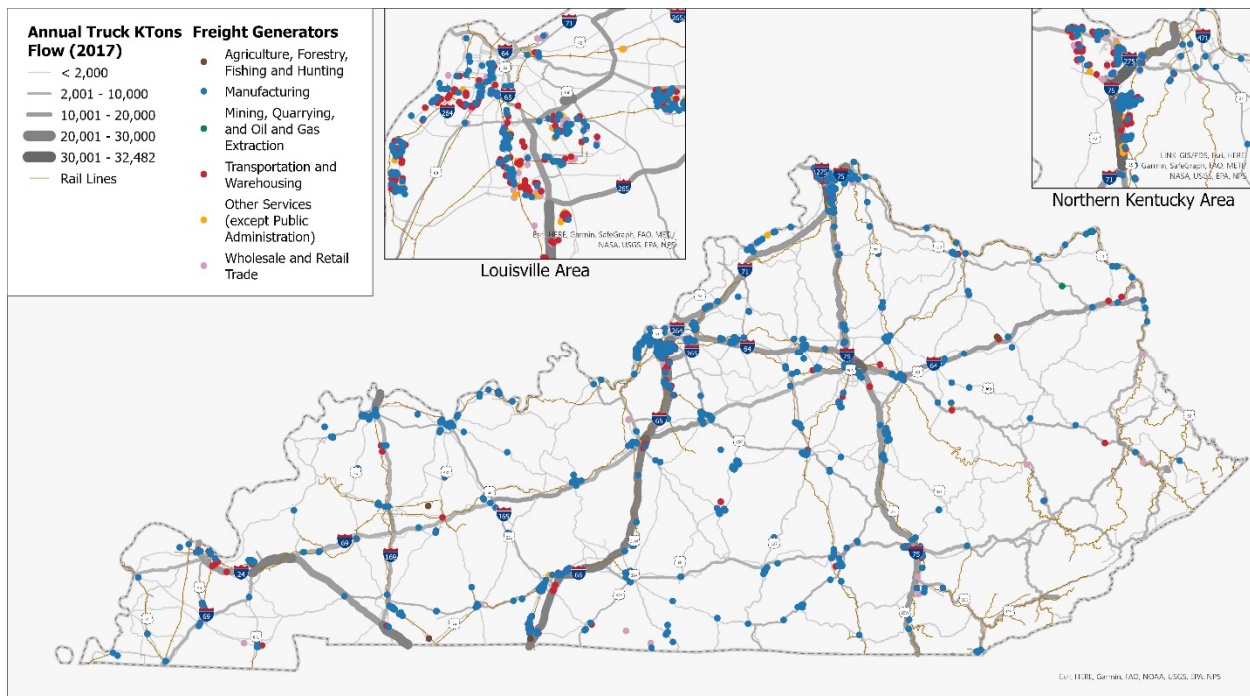


Source: FHWA, Accessed August 2022.

5.3.4. Kentucky Supply Chain

To retain and attract new economic development opportunities, one needs to understand how the supply chain and transportation system interact throughout Kentucky. Supply chains are the pathways that raw materials and production component parts move from their original sources to a production facility, warehouse, retail outlet, and the end consumer. There are significant data limitations when evaluating private companies' supply chains; simply stated, the chains are often proprietary information. However, KYTC developed a robust Major Freight Users Inventory that, when used in combination with statewide FAF freight flows, can begin to give transportation planners a look into the relationship between freight generators and the highway network. This analysis is illustrated in **Figure 5-9**.

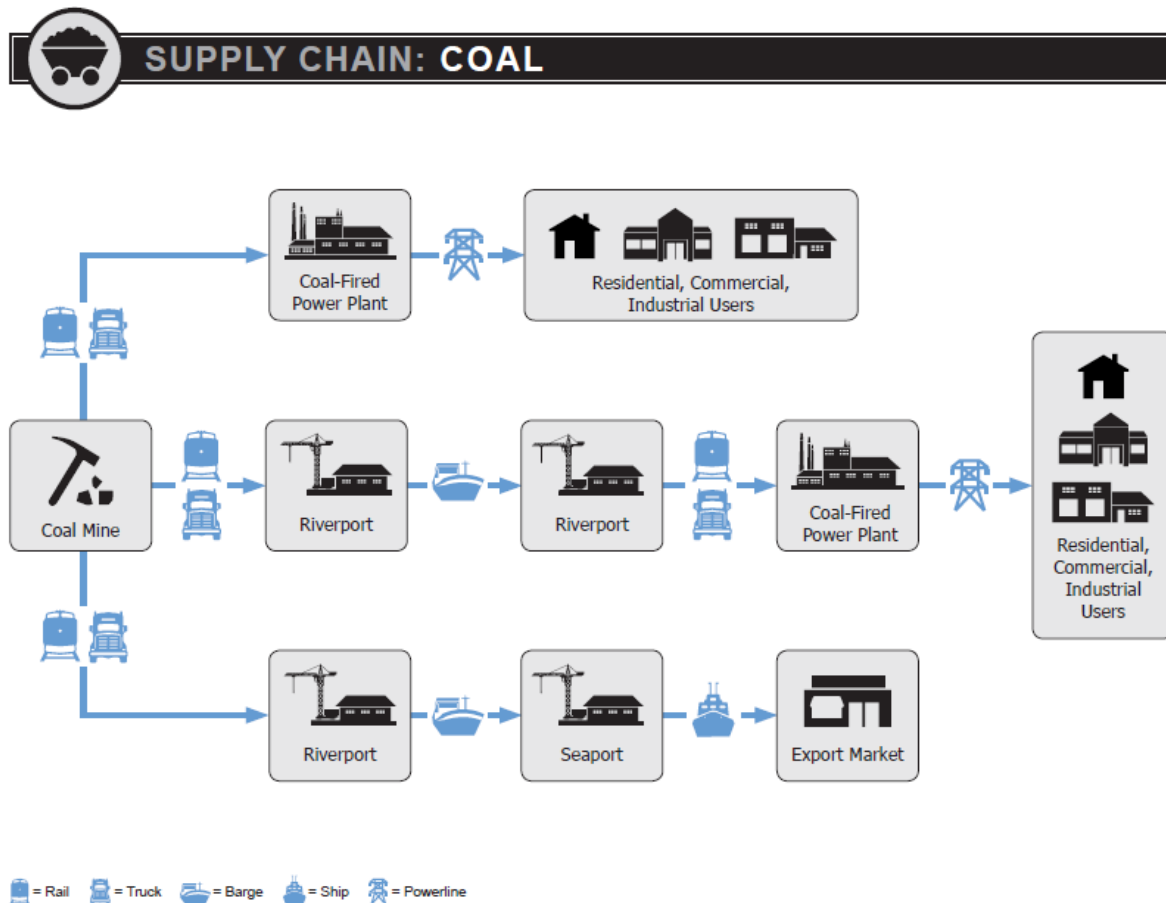
Figure 5-9. Kentucky Freight Generators and Highway Tonnage



Source: FHWA Data Date: 2017, KYTC Trip Generator Data: 2021.

Although coal is continuing to decline as a result of environmental effects at coal-fired power plants, it still remains a large contributor to the Kentucky economy. As illustrated in **Figure 5-10**, the coal supply chain involves different modes of transportation to move this natural resource from the coal mines to coal-fired power plants and the export market. Kentucky's multimodal freight network plays a critical role in this supply chain, as shown in the figure.

Figure 5-10. Kentucky Coal Industry Supply Chain



An overall understanding of the role transportation plays in supply chain decision-making will help to support KYTC's planning efforts and strategic investment in the freight system. As competition continues to grow to attract and retain business, these concepts will help Kentucky compete in the global marketplace.

5.3.5. Critical Connections and the First/Last Mile

As freight volumes grow, the ability of the multimodal freight system to be resilient and responsive to the freight community's needs will be increasingly important to Kentucky's economic future. Although KYTC is constitutionally limited on gas tax allocation and funding of modes other than roadways, it is important to maintain the vital connectivity points with other modes of transportation. The connection points are where most efficiency is gained or lost during freight travel. In Kentucky, these connection points are airports, rail, truck distribution centers, pipelines, and port facilities. The roads leading up to major connectivity points are designated NHS intermodal connectors by FHWA and KYTC. Kentucky's intermodal connectors are listed in **Table 5-3** and are updated biannually.

Intermodal connectors are often maintained by different entities and fall through the cracks in the planning and programming process. Investment in connectors is often in competition with other high-profile projects for ever decreasing transportation funding. Intermodal connectors often suffer

geometric issues, pavement lifecycle, and other challenges that create inefficiencies and reliability issues for freight users.

Table 5-3. Freight NHS Intermodal Connectors⁴⁸

Facility	Criteria	Connector description
Amtrak Station - Catlettsburg	AMTRAK Station	CS 2551 (15th St East in Ashland to Amtrak Station Entrance)
Amtrak Station - Fulton	AMTRAK Station	US 51 (South limits of Purchase Pkwy Interchange to Newton Rd.), Newton Rd (US 51 to Terminal Entrance)
Bells Lane Petroleum/Chemical Pipeline	Truck/Pipeline Terminal	KY 2056 from I-264 W to the Louisville-Ohio River Floodwall
Bells Lane Petroleum/Chemical Port	Port Terminal	KY 2056 - Louisville-Ohio Floodwall to I-264- Same as KY 6
Campground Rd Petroleum Pipeline	Truck/Pipeline Terminal	Campground Rd (Cane Run to Ralph), Kramers Ln (Cane Run to Campground), Ralph Ave (Cane Run to Campground Rd)
Campground Rd Petroleum Port	Port Terminal	Same as above
Cincinnati/N KY International Airport	Airport	KY 212 from I-275 S to the Airport Roadway System
CCI Energy Slones Branch Terminal	Truck/Rail Facility	KY 1441 (US 460 to Clark Elkhorn Tipple #1 Ent), KY 1789 (US 460 to KY 1441)
Greyhound Bus Station - Louisville	Intercity Bus Terminal	FS 8829 (Roy Wilkens to Ali Blvd), FS 8806 (Ali Blvd to Facility)
Ivel Coal Tipple	Truck/Rail Facility	County Rd 1020 - US 23 to Facility
Lexington Blue Grass Airport	Airport	Served by an existing NHS route (Man O War Blvd)
Louisville International Airport	Airport	Grade Ln (I-264 to UPS Feeder Truck Entrance), FS 8879 (I-264 to Facility)
Louisville/Ashland Oil/Chevron Dist. Center	Truck/Pipeline Terminal	KY 1681 - KY 4 Interchange to Facility
McCoy Elkhorn Coal Corp	Truck/Rail Facility	KY 194 - US 119 to Facility
Norfolk Southern Intermodal - Georgetown	Truck/Rail Facility	KY 620 - Facility to I-75 Interchange
Norfolk Southern Intermodal - Louisville	Truck/Rail Facility	Newburg Rd (I-264 to Bishop), Bishop Ln (Newburg to Jennings), Jennings Ln (Bishop to Facility)
Owensboro Riverport	Port Terminal	KY 331 (US 60 to Harbor Rd), Harbor Rd (KY 331 to Facility)
Apex Energy/Cambrian Coal Corp. Tipple	Truck/Rail Facility	KY 80 from US 460 to Facility
Truck to Barge Coal Dock Cluster, Boyd County	Port Terminal	KY 757 from US 23 near Lockwood to 2.3 Miles North

⁴⁸ Federal Highway Administration, National Highway System: Intermodal Connectors, http://www.fhwa.dot.gov/planning/national_highway_system/intermodal_connectors/kentucky.cfm, Accessed November 2021.

5.4. Kentucky Military Installations

The U.S. military has a significant presence in Kentucky. Military installations require efficient and reliable access to the freight transportation system for national defense purposes. The U.S. military depends on the Kentucky freight system to move cargo to not only support the installations, but also to deploy personnel and equipment for national defense. To meet this critical need, the Strategic Highway Network (STRAHNET) and the Strategic Rail Network (STRACNET) were developed by the Department of Defense (DoD) in coordination with FHWA.⁴⁹ The STRAHNET and STRACNET are networks of highways and rail lines, respectively, which provides the U.S. military access, continuity, and emergency capabilities for defense purposes. Kentucky's military installations and networks are shown in **Figure 5-11**.

The state's military installations serve as major freight generators, consumer markets and need connectivity to the freight transportation system. At Fort Campbell, the U.S. Army has its highest concentration of rotary-winged aircraft and its fifth largest concentration of soldiers in the U.S., approximately 30,000. The 101st Airborne Division (Air Assault) is renowned for its unique warfighting capabilities and storied history. Fort Knox is home to a wide diversity of Army units, to include combat, logistics, combat-support, operations, and administrative. Other key installations include the Blue Grass Army Depot and the Wendell H. Ford Regional Training Center (Kentucky National Guard). Also, the Kentucky National Guard has numerous Army and Air Guard units domiciled throughout the state including the 123rd Airlift Wing based in Louisville. Diverse and complex supply chains are necessary to efficiently and reliably provide logistics support to these military sites. Enormous amounts of fuel, food, ammunition, maintenance, equipment & materials, and medical supplies are critical to maintaining these units in a combat-ready posture. Transportation infrastructure to include highways, rail, inland waterways, and air are critical to supporting these supply chains and to support deployment of units.

⁴⁹ FHWA, Policy & Governmental Affairs, 2004 Conditions and Performance, Chapter 18, Strategic Highway Network (STRAHNET), <https://www.fhwa.dot.gov/policy/2004cpr/chap18.cfm>.

Figure 5-11. Kentucky Military Installations and Networks

