4. Current Conditions

The efficient, reliable, and safe movement of freight relies on a properly maintained transportation system that functions well within anticipated periods of high demand. The condition of Kentucky's transportation system is the result of a variety of factors such as public-sector transportation funding availability, private sector infrastructure investments, system demand, economic conditions, and the quality and timing of capacity and operational improvements and regular maintenance.

This section describes the current condition of the Kentucky freight system by mode – highways, waterways, rail, pipelines, and airports. The conditions include the current state of the freight infrastructure, system performance, and safety.

4.1. Highways

Kentucky has an extensive network of interstates and major highways that support 364 million tons[23] of truck-borne freight annually. This includes two of the nation's busiest north-south interstate corridors (I-75 and I-65), connecting U.S. industries from Canada to Mexico. Kentucky is also home to almost 200 miles of I-64, a major east-west corridor stretching from Norfolk, VA, to St. Louis, MO.

4.1.1. Congestion/Bottlenecks

Freight bottlenecks occur at locations (usually bridges, interchanges, railroad crossings, lane reductions, etc.) where the free flow of goods is disrupted. There are two general types of freight bottlenecks:

- **Recurring:** Peak hour congestion that occurs each day along a segment of highway
- **Non-recurring:** Unpredictable bottlenecks that are likely to occur at specific locations, such as construction zones, crashes, extreme weather conditions, etc.

In May 2021, the American Road & Transportation Builders Association (ARTBA) released a study titled "Throttled: The Economic Costs of Freight Bottlenecks"[24], which estimated that freight bottlenecks cause approximately 659 million truck hours of delay nationwide and a cost loss of $42 billion (2019 $) annually.

4.1.1.1 Congestion/Bottleneck Reports

Since 2002, the American Transportation Research Institute (ATRI) and FHWA have partnered to collect and analyze truck Global Positioning System (GPS) probe data to assess freight movements and bottlenecks in the U.S. Since then, ATRI has published an annual list of the 100 worst freight bottlenecks in the country. In 2022, the report listed the Brent Spence Bridge (owned and maintained by KYTC) as the second worst freight bottleneck in the U.S. in 2021.[25] This bottleneck has significant implications for northern Kentucky freight, particularly in moving goods to/from the Cincinnati/Northern Kentucky

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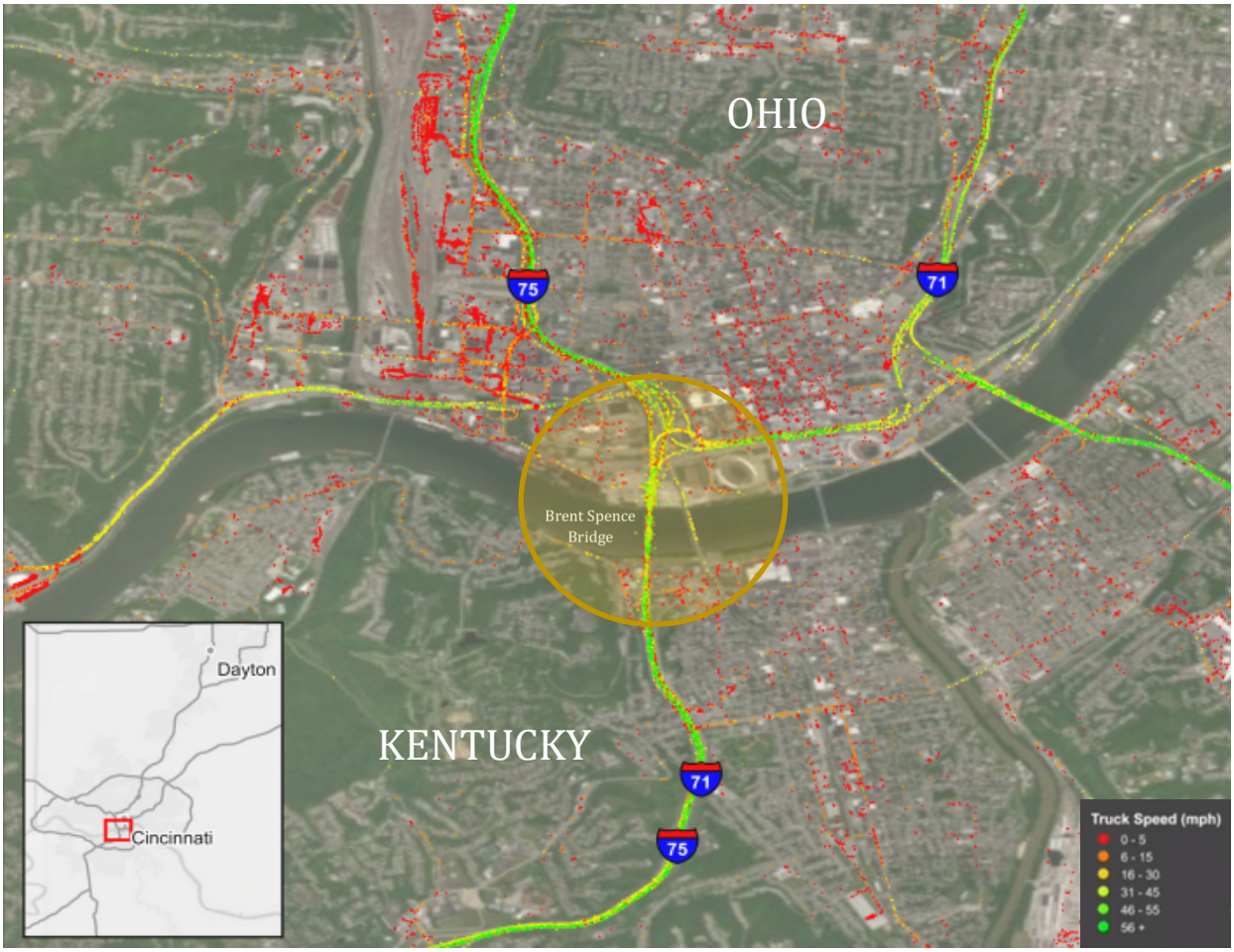
[23] Freight Analysis Framework, using the sum of tonnage for Kentucky as an origin and tonnage for Kentucky as a destination.
[24] American Road & Transportation Builders Association. *Freight Bottlenecks a $42 Billion Hidden Cost on U.S. Economy, Federal Data Shows.* https://www.artba.org/2021/05/24/freight-bottlenecks-a-42-billion-hidden-cost-on-u-s-economy-federal-data-shows/. Accessed May 2022.
[25] American Transportation Research Institute (ATRI), *Top 100 Truck Bottlenecks,* Accessed February 2022.

International Airport (CVG) and surrounding large-scale warehousing and distribution hubs. The bottleneck congests traffic across the bridge into and out of Kentucky, as shown in **Figure 4-1**.

Figure 4-1. ATRI Freight Bottlenecks – Brent Spence Bridge



Source: American Transportation Research Institute, 2022 – animation found here.

The issue of staging trucks for supply and distribution/delivery logistics and required driver rest is a critical issue along Kentucky's highways and particularly near industrial and agriculture areas. Drivers are using interstate ramps, commercial/retail parking lots, and other areas to park and wait for their pick-up/drop-off time window to load and unload. This is creating safety concerns on interstates, conflicts with passenger vehicles, increased congestion at intersections and ramps adjacent to designated and over capacity truck parking areas, and increased emissions and noise from idling trucks to local communities. This also places an increased strain on law enforcement to monitor and enforce illegal parking practices.

4.1.1.2 KYTC Congestion/Bottleneck Analysis

This section presents KYTC's efforts to identify highway locations with the worst congestion using INRIX real-time traffic data. These locations were identified using truck travel time and delay and may be referred to as speed bottlenecks. The bottlenecks highlight where there are major freight mobility issues. The Cabinet recognizes there are many methods to identify, quantify, and rank highway congestion.

Identifying the Top Truck Speed Bottlenecks on Kentucky's Interstate System

In Kentucky, there are 1,138 unique Interstate segments in the 2021 INRIX data. These segments were ranked according to the following two criteria:

- **Lowest Truck Speed:** Average truck travel times on a segment were considered over five time periods: AM, Mid-Day, PM, overnight, and weekend days. The greatest 50th percentile of truck travel time over all five time periods was used to calculate the slowest truck speed on that segment to gauge reliability of travel on a segment with known length.
- **Average Delay:** This measure uses the lowest truck speed (first ranking criterion), compares it to the posted speed limit on a segment, and weighs the resulting speed differential by the length of the segment and the average daily truck traffic on that segment. The resulting measure is the average delay on that segment, ranked from largest to smallest delay for all 1,138 segments.

The final ranking of truck bottlenecks is derived from a combination of the two ranking criteria above, lowest truck speed and average delay, for different locations on the interstate system in Kentucky.

Many of the worst locations are located in Northern Kentucky or in the Louisville region due to the high truck volumes and increased congestion on the interstates in those areas as well as the presence of major river crossings and complex system interchanges. **Table 4-1** summarizes the locations of the top truck bottlenecks on the Kentucky interstate system in 2021.

Table 4-1. Locations of the 2021 Top Truck Bottlenecks on the Kentucky Interstate System

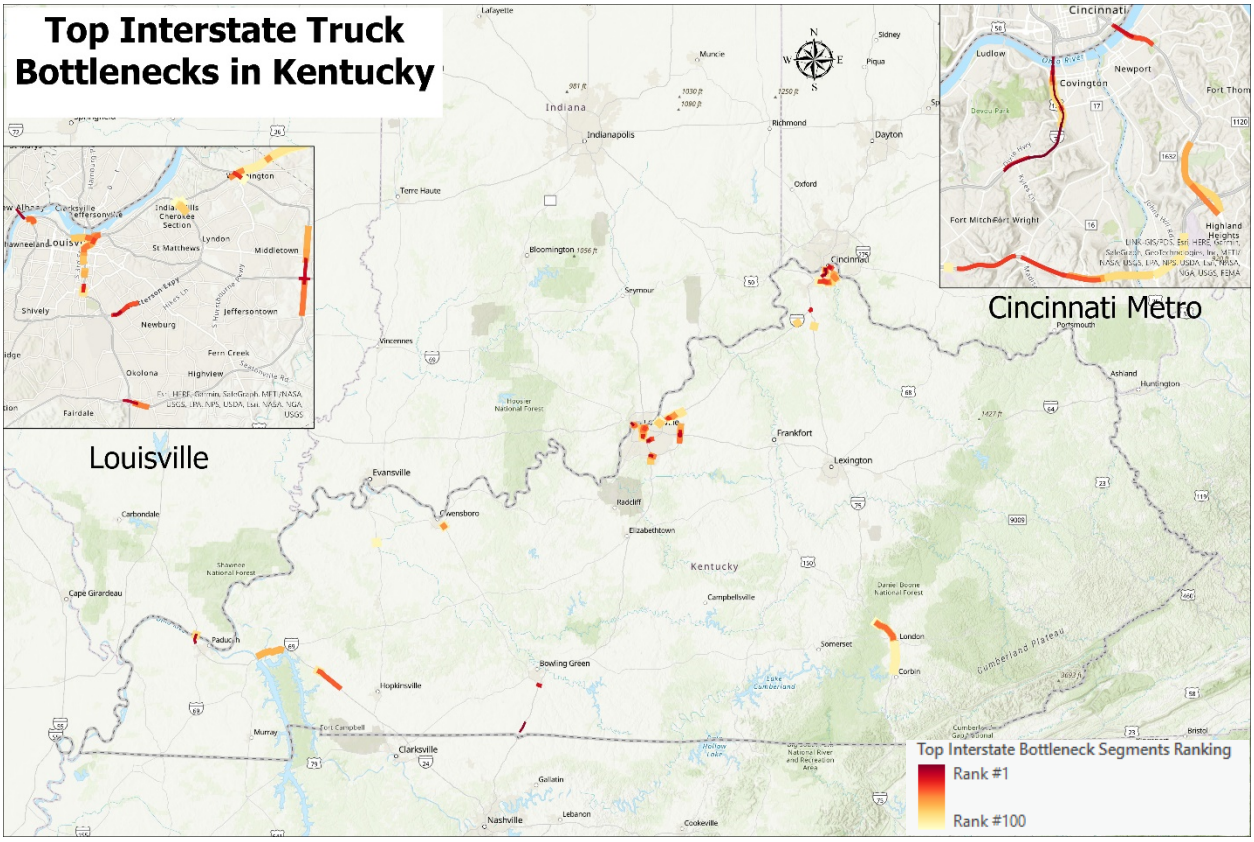
Rank	County	Route	Location	Average Truck ADT	Miles
1	Kenton	I-71	Brent Spence Bridge	23,706	6.43
2	Simpson	I-65	South of I-65/KY-100	12,760	3.49
3	Jefferson	I-64	Sherman Minton Bridge	7,124	1.36
4	Campbell	I-471	Bridge over the Ohio River	9,592	1.63
5	Jefferson	I-265	I-265/I-64 Interchange	10,622	8.79
6	Jefferson	I-264	East of I-65/Watterson Expy Interchange	11,253	1.94
7	McCracken	I-24	Bridge at the Kentucky/Illinois State Line	6,969	2.85
8	Jefferson	I-65	South of I-65/I-64 Interchange	15,034	1.93
9	Kenton	I-275	West of I-471/I-275 Interchange	11,610	5.77
10	Jefferson	I-71	I-71/I-265 Interchange	11,555	8.78
11	Laurel	I-75	North of I-75/KY-80 Interchange	9,269	16.12
12	Jefferson	I-265	East of I-65/I-265 Interchange	14,212	1.45
13	Warren	I-165	I-65/I-165 Interchange	5,039	1.38
14	Daviess	I-165	I-165/US-60-BYP Exit 70	3,044	0.15
15	Jefferson	I-264	I-71/Watterson Expy Interchange	6,769	1.08
16	Webster	I-65	Webster/Henderson County Line	3,141	0.02
17	Laurel	I-75	South of I-75/KY-192 Interchange	10,473	17.59
18	Trigg	I-24	North of I-24/US-68 Interchange	5,281	9.74
19	Campbell	I-471	I-471/I-275 Interchange	13,144	2.51

Rank	County	Route	Location	Average Truck ADT	Miles
20	Grant	I-75	KY-491/Exit 166	10,553	0.01
21	Lyon	I-24	West of I-24/US-62 Interchange	9,514	8.15
22	Jefferson	I-64	I-65/I-64 Interchange	24,191	2.03
23	Boone	I-71	I-71/I-75 Interchange	13,093	0.87
24	Boone	I-71	Boone/Gallatin CL	13,093	0.03
25	Jefferson	I-65	Jefferson/Bullitt County Line	22,168	0.05

Source: Kentucky Transportation Cabinet, INRIX, 2021.

Figure 4-2 shows the locations of these top truck bottlenecks in Kentucky. The higher-ranking bottlenecks show those with a combination of low truck speed and increased average delay,

Figure 4-2. Top Interstate Truck Bottlenecks—Low Truck Speed/High Average Delay



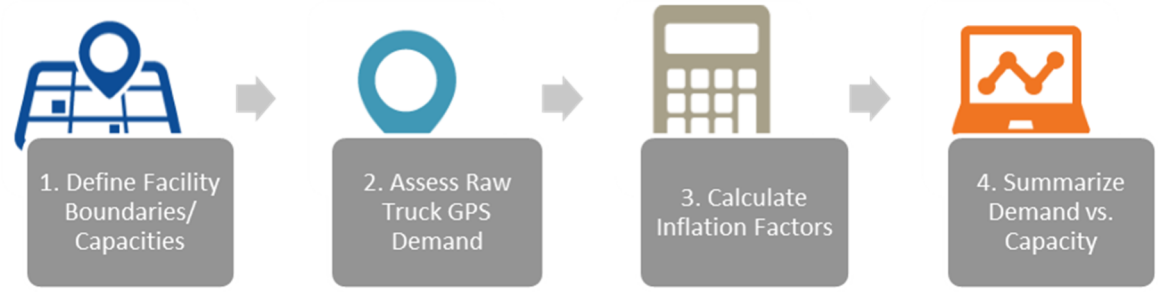
Source: Kentucky Transportation Cabinet, INRIX, 2021.

The state employs several strategies to address freight bottleneck mobility issues. KYTC analyzes the INRIX data to identify and monitor bottlenecks. The more severe congestion locations are considered in the highway project planning process. Example upgrade projects that are planned and/or underway to improve freight movement include the Brent Spence Bridge and Approach Improvements (including a new companion bridge); ongoing widening of I-265 and I-71 and improvements to the I-64/I-265 interchange; widening of I-75 to six lanes through the state.

4.1.1.3 Truck Parking

KYTC recently completed a statewide Truck Parking Assessment and Action Plan. The main objective of this study was to identify and assess truck parking supply and demand on major freight corridors. The analysis approach consisted of a four-step process as shown in **Figure 4-3**.

Figure 4-3. Truck Parking Supply Dataset Development Process



A summary of key findings include:

- Every weekday night, there are approximately 9,000 trucks parked for more than 4 hours.
- There are 7,196 truck parking spots in Kentucky.
- The night with the highest demand for truck parking is Wednesday.
- 82 percent of truck parking spots (5,900) are provided by private sector truck stops.
- 18 percent of parking by KYTC is located at KYTC-owned rest areas and weigh stations.

The locations of existing unmet truck parking demand locations are described in Section 2.2.2 of this plan.

4.1.2. State of Good Repair

Kentucky's roads and bridges receive several condition-based ratings by KYTC that can aid in determining the quality of service being provided to the public. Maintaining a state of good repair is a priority for KYTC, and the Cabinet is currently successful in achieving this priority.

4.1.2.1 Maintenance Rating Program (MRP) Report

The first rating criterion comes from the Maintenance Rating Program (MRP) Report, which is an annual survey of roads conducted by the KYTC Division of Maintenance. This rating is based on a 100-point scale, with a target score of 80. Between 300 and 400 roadway segments, 500 feet in length, are randomly selected in each KYTC district among four road categories: (1) interstates, (2) other NHS roads, (3) state primary and secondary roads, and (4) rural secondary roads.[26] Grades are assigned in several categories, including rideability, potholes, striping, and guide signs. An overall weighted score is assigned to each type of road in each of the 12 highway districts and statewide. Statewide maintenance ratings by roadway type according to the FY 20 Maintenance Rating Program (MRP) Report are shown in **Table 4-2**. The average grades for each roadway type are over the targeted score of 80.

[26] Kentucky Transportation Cabinet, 2020 Maintenance Rating Program Report.

Table 4-2. KYTC Maintenance Statewide Scores

Classification	Score	Grade
Interstates	92.4	A
National Highway System	90.0	B
State Primary and Secondary	81.7	B
Rural Secondary	78.0	C
All Roads	**81.4**	**B**

Source: Kentucky Transportation Cabinet, FY 20 Maintenance Rating Program (MRP) Report.

4.1.2.2 Pavement Conditions

Measures of pavement condition can also provide some insight into service quality. KYTC rates pavement conditions in the commonwealth by classifying pavements in good, fair, or poor condition. The scale used to determine what constitutes good, fair, or poor condition is adjusted based on traffic volume. Thus, routes with higher volumes are expected to be maintained in better condition than routes with lower traffic volumes. Statewide pavement conditions based on 2020 data are presented in **Table 4-3**. There are 25,314 lane-miles of rural secondary roads that were untested for this year.

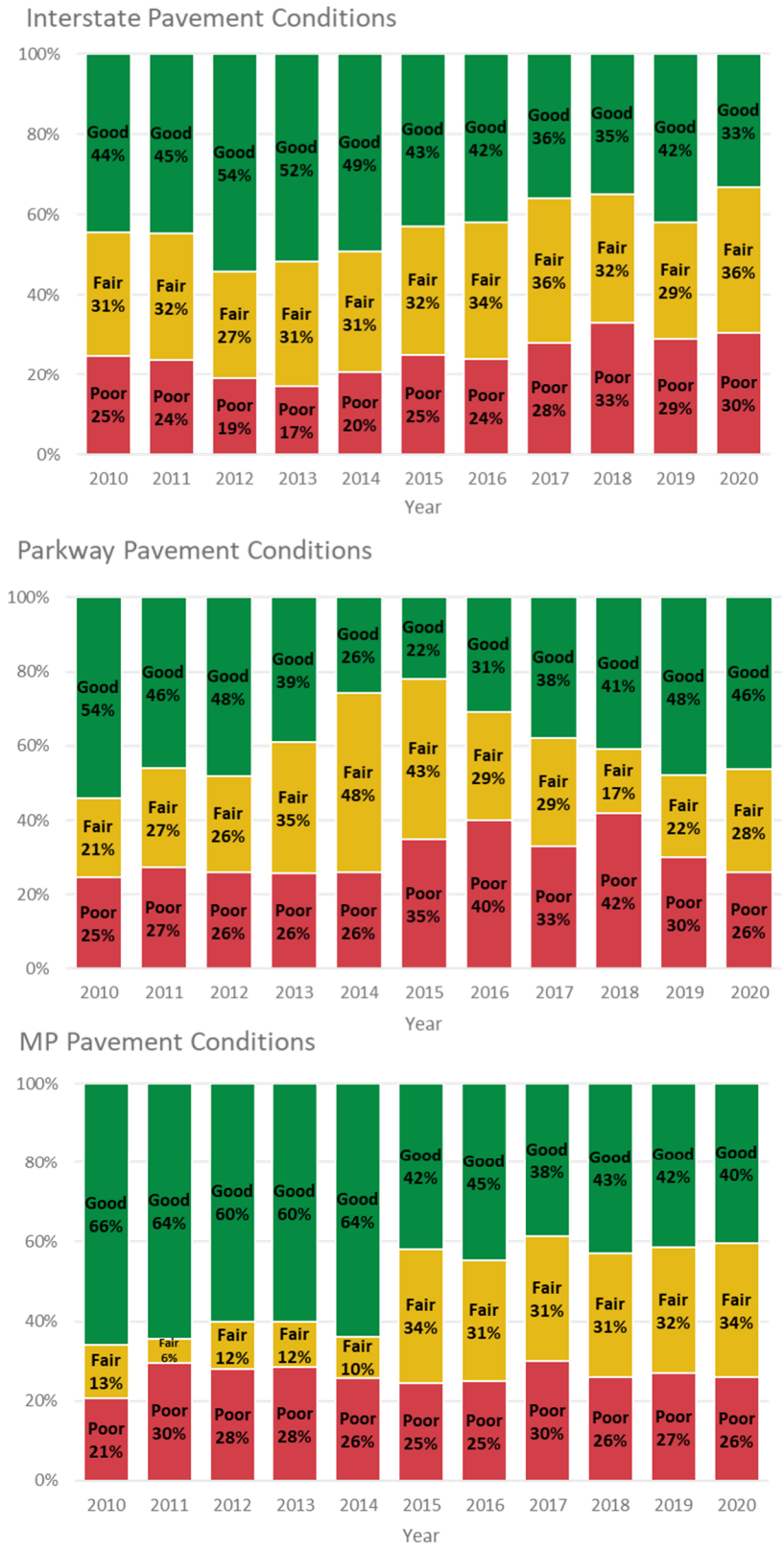
Table 4-3. Statewide Pavement Conditions Data per State Primary Road System (2020)

Network	Lane-Miles Good	% Good	Lane-Miles Fair	% Fair	Lane-Miles Poor	% Poor
Interstates	1,550	33%	1,695	36%	1,424	30%
Parkways	817	46%	489	27%	461	26%
Maintenance Rating Program Segments (MP)	12,996	40%	10,867	34%	8,384	26%
Department of Highway Subtotal	**15,363**	**40%**	**13,051**	**34%**	**10,269**	**27%**
Rural Secondary	N/A	N/A	N/A	N/A	N/A	N/A

Source: Kentucky Transportation Cabinet, Transportation Asset Management Plan (TAMP), 2022.

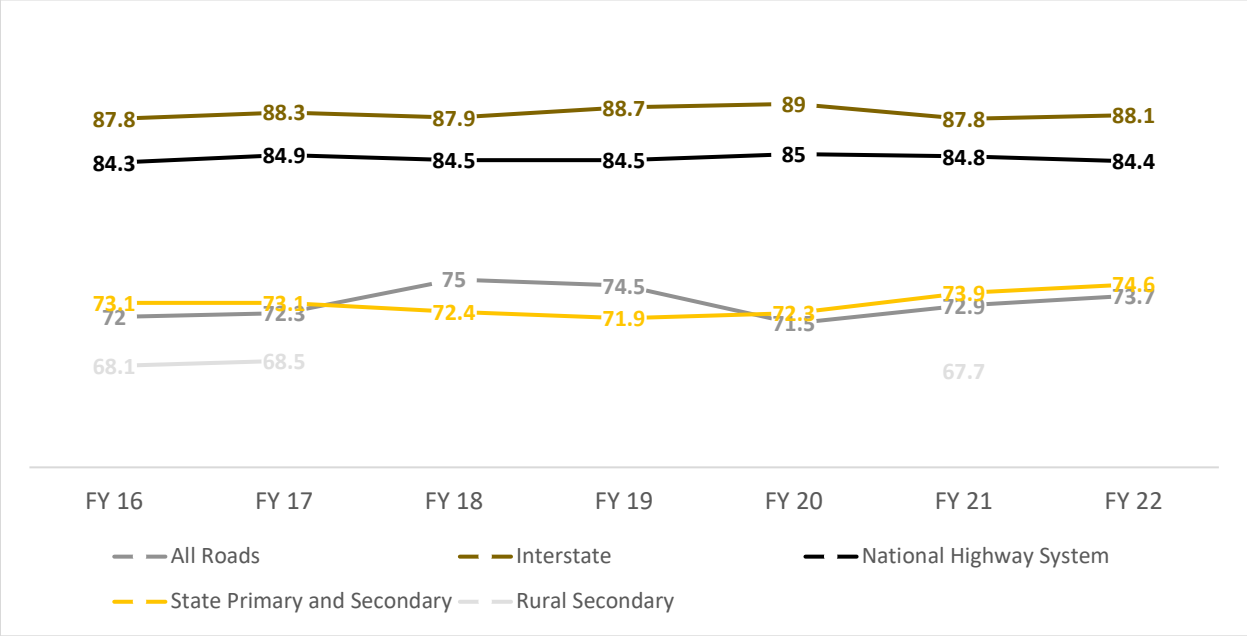
Figure 4-4 provides historic trends for pavement conditions for Interstates, Parkways, and the MP system. Pavement is also graded using the International Roughness Index (IRI), which measures the roughness of pavements. This index provides rideability scores. Statewide rideability scores for all roads and by road type —including Interstate, Parkway, and Rural Secondary, as well as segments selected for the Maintenance Rating Program (MP) —are presented in **Figure 4-5** for FY 2016 through FY 2022. Rideability scores for Rural Secondary are "Blank" for FY 2018 through FY 2020 and for FY 2022 as IRI data was not collected for Rural Secondary routes during these years. Scores below 70 are considered unacceptable.

Figure 4-4. Historic Trends for Interstate, Parkway, and MP Pavement Conditions



Source: Kentucky Transportation Cabinet, Transportation Asset Management Plan (TAMP), 2022.

Figure 4-5. Statewide Rideability Scores for All Roads and by Road Type



Source: Kentucky Transportation Cabinet, FYs Maintenance Rating Program (MRP) Reports.

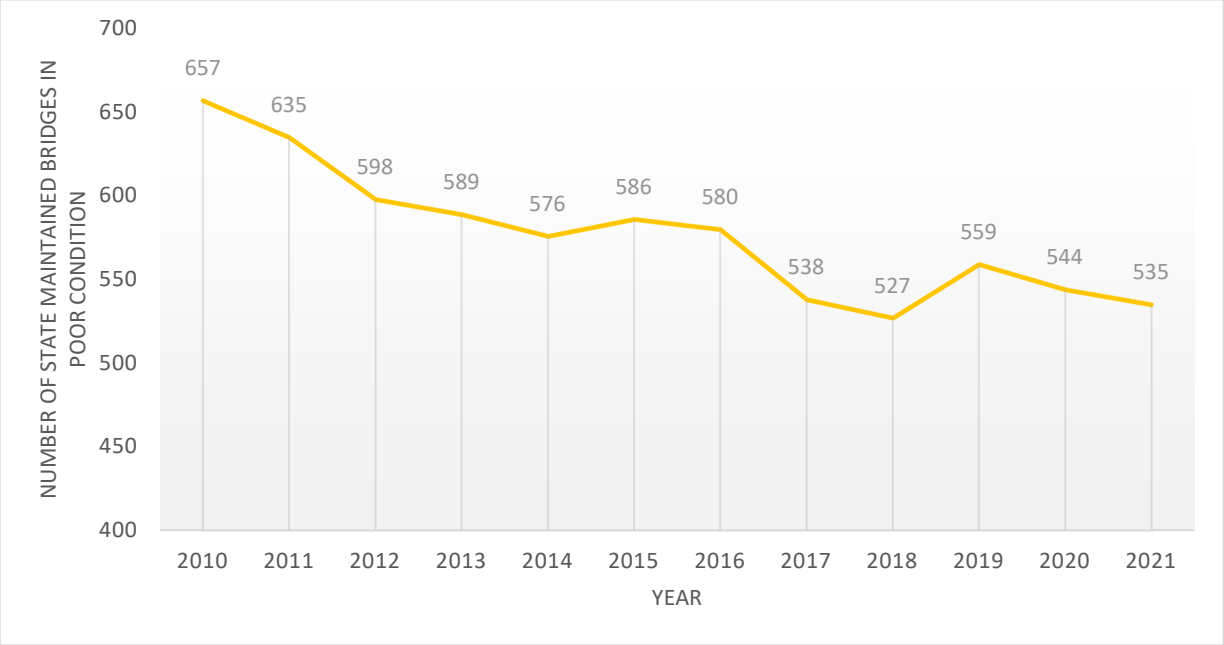
The figure indicates that scores for all roads improved from FY 17 to FY 18, then fell slightly behind through FY 20, and are improving again through FY 22. Interstates followed by highways in the NHS have the highest rating in terms of rideability, with relatively steady variability. Rural Secondary roads have the lowest rideability scores for the years where IRI data was available.

KYTC continues to monitor pavement conditions and address issues that arise as a result of normal traffic conditions. In addition, KYTC pays special attention to roadways that are impacted by oversize/overweight loads such as too and from coal mines, agricultural areas, etc. Additional inspection and more robust pavement treatments are considered based on the outcome of those inspections.

4.1.2.3 Bridge Rating

Kentucky's bridges are also rated annually by KYTC and reported to FHWA. The number of state-maintained bridges in poor condition is displayed in **Figure 4-6**. The figure shows a decrease in the number of bridges in poor condition from 657 in 2010 to 535 in 2021. The number of bridges in poor condition did increase from 2014 through 2015, as well as 2018 to 2019. Based on FHWA's 2021 National Bridge Inventory Data, 6.9 percent of Kentucky's bridges are classified as structurally deficient, with one of the key elements of a bridge being in poor or worse condition. Of these 990 structurally deficient bridges, 27 percent are located on the Interstate system. These bridges may restrict the size and weight of trucks crossing the structure and create load restrictions on major and frequently traveled truck routes. The locations of the most traveled structurally deficient bridges in Kentucky are shown in **Table 4-4**. All of them cross urban interstates and support more than 60,000 daily vehicle crossings.

Figure 4-6. Number of State Maintained Bridges in Poor Condition, 2021.



Source: National Bridge Inventory, 2021.

Table 4-4. Topmost Traveled (all Vehicles) Structurally Deficient Bridges in Kentucky in 2021[27]

County	Year Built	Daily Vehicle Crossings	Type of Bridge	Location
Jefferson	1988	166,770	Urban Interstate	I-65 over Grade Ln
Jefferson	1988	166,770	Urban Interstate	I-65 over Standiford Ln
Jefferson	1959	119,880	Urban Interstate	I-65 over E Kentucky & S Brook St
Jefferson	1957	119,880	Urban Interstate	I-65 over Hill, CSX RR & Burnett
Jefferson	1972	110,389	Urban Interstate	I-64 over 3rd, 5th, Rvr Rd, Belvedere
Jefferson	1965	90,900	Urban Interstate	I-64 over CSX, 1st, Floyd, Preston, River
Jefferson	1974	79,872	Urban Interstate	I-264 EB over Ramp (31W NB to I-264 WB)
Jefferson	1976	72,032	Urban Interstate	I-64 over Old P and L RR (7-13 St)
Jefferson	1984	71,930	Urban Interstate	I-265 over Avoca-Quarry Rd
Jefferson	1969	65,180	Urban Interstate	I-64 Ramp over N Western Pkwy (Ky 3064)

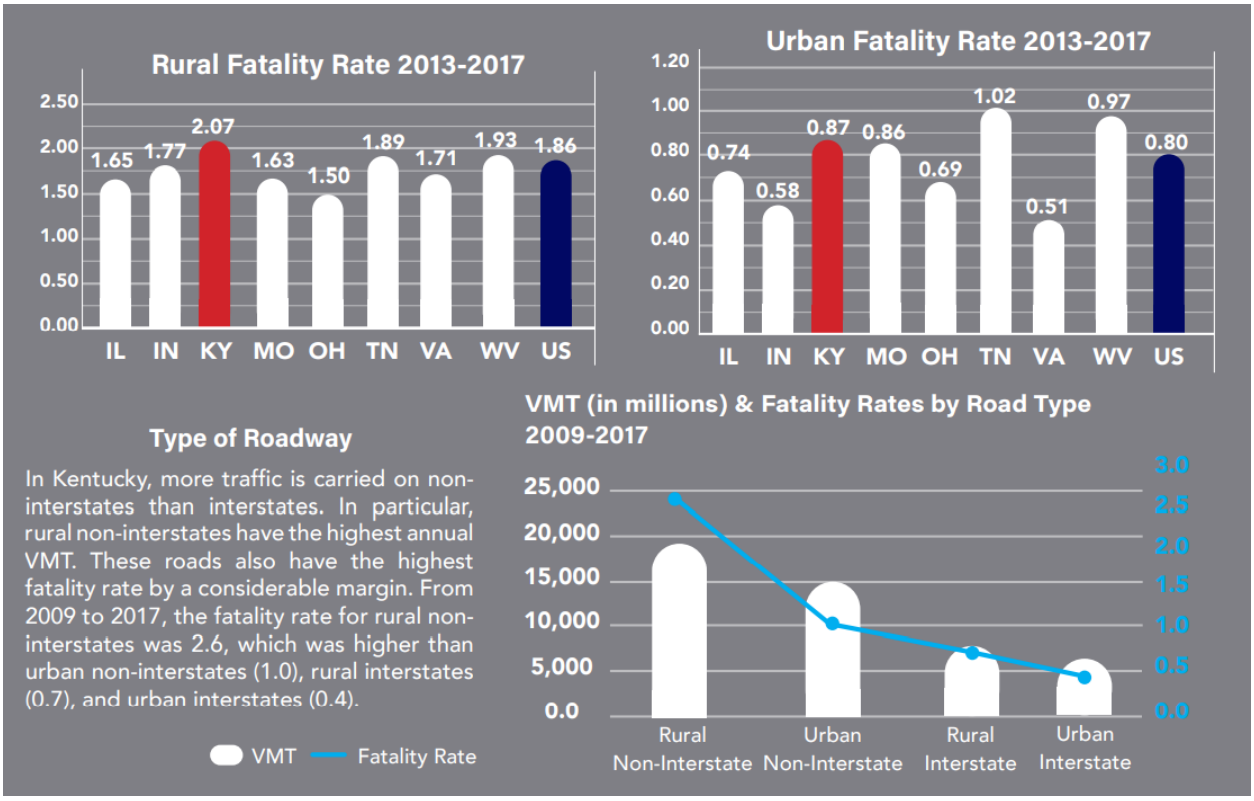
Source: National Bridge Inventory, 2022.

[27] American Road & Transportation Builders Association, 2022 Bridge Profile, *https://artbabridgereport.org/reports/state/KY.pdf*, Accessed May 2022.

4.1.3. Highway Safety

Kentucky currently ranks poorly for fatality rate per hundred million vehicle miles traveled (VMT) as compared to adjacent states and to the U.S. From 2013 to 2017, the rural fatality rate was nearly two and a half times higher than the urban fatality rate. This is significant because more than half of the driving in Kentucky takes place in rural areas, and rural areas experience more crash fatalities involving large trucks than urban areas. **Figure 4-7** illustrates the crash fatality rates for Kentucky, adjacent states, and the U.S. over the same time period, Kentucky had the 12th worst rural fatality rate in the U.S. and ranked worst among all bordering states.

Figure 4-7. Fatality Rate Comparison – All Vehicles



Source: Kentucky Transportation Cabinet, Strategic Highway Safety Plan 2020-2024[28].

4.1.4. Freight Level of Service

KYTC's Freight Level of Service (LOS) template is available for use at the project review level. The Freight LOS provides an inventory of the freight components to be considered at the project level to determine how a project impacts freight movement and whether the project properly addresses the needs of the freight users on the route. The Freight LOS is divided into three sections as follows:

- Assessment of freight movement operating conditions

[28] Kentucky Transportation Cabinet, Strategic Highway Safety Plan 2020-2024, *https://transportation.ky.gov/HighwaySafety/Documents/2020%20SHSP%20SAFE%20KY%20Highway%20Safety%20Plan%20Final%205-20.pdf#search=fatality%20rate*, Accessed November 2021.

- Truck comfort index
- Freight service index

The assessment of freight movement operating conditions uses existing information including proximity to freight routes, bridge weight limits, and road weight rating, among other existing conditions. The truck comfort index uses existing and observed information to present specific project site data, including speed limit, average daily traffic, commercial vehicle crash history, volume to capacity ratio, road geometry, and pavement conditions, among other data. KYTC can supplement the review by including average daily truck traffic and actual truck speeds, among other inputs. The freight service index combines data with on-site observations, including proximity to truck parking, seasonal or consistent commercial vehicle traffic, proximity to the National Network, presence in a bottleneck area of influence, and existence of roadside truck parking, bike lanes, or lane drops, among other observations. The information in the KYTC Freight LOS report is taken from many different sources and on-site observations that provide a snapshot of the freight service conditions, or lack thereof, for the project review team.

4.2. Inland Waterways

With nearly 1,662 navigable miles of which 1,020 are commercially navigable, and 10 public port authorities, Kentucky also provides year-round waterborne commerce. The Ohio River forms Kentucky's entire northern border and is a major tributary of the Mississippi River System. Western Kentucky sits at the confluence of the Ohio and Mississippi rivers, marking the transition between the Upper and Lower Mississippi River. The entire inland waterway system provides a waterway link to Canada via the Great Lakes and to Mexican and South American markets via the deep-water ports of New Orleans, LA, and Mobile, AL. Kentucky also connects the Ohio River to numerous southern cities such as Nashville, TN, via the Cumberland River; Knoxville and Chattanooga, TN, via the Tennessee River; and Mobile, AL, via the Tennessee-Tombigbee Waterway.

4.2.1. Waterway Conditions

The lock and dam system was designed to control the river levels to maintain a minimum channel on the rivers for more reliable navigation. For instance, the Ohio River requires a minimum depth of 9 feet. Five commercially navigable rivers in Kentucky have one or more locks and dams, as shown in **Table 4-5**. The USACE has jurisdiction over all these locks and dams except for those on the Kentucky River, which are owned and maintained by the Kentucky River Authority.

Table 4-5. Kentucky Locks and Dams

USACE District/Authority	River	River Mile Point	Lock & Dam	Main Lock Chamber	Auxiliary Lock Chamber
Huntington District	Ohio	341	Greenup Locks & Dam	1,200'	600'
Huntington District	Ohio	436	Captain Anthony Mehldahl Locks & Dam	1,200'	600'
Louisville District	Ohio	531	Markland Locks & Dam	1,200'	600'
Louisville District	Ohio	604	McAlpine Locks & Dam	1,200'	1,200'
Louisville District	Ohio	720	Cannelton Locks & Dam	1,200'	600'
Louisville District	Ohio	776	Newburg Locks & Dam	1,200'	600'

USACE District/Authority	River	River Mile Point	Lock & Dam	Main Lock Chamber	Auxiliary Lock Chamber
Louisville District	Ohio	846	John T. Myers Locks & Dam	1,200'	600'*
Louisville District	Ohio	918	Smithland Locks & Dam	1,200'	1,200'
Louisville District	Ohio	964	Olmstead Locks & Dam	1,200'	1,200'
Louisville District	Green	9	Green River Locks & Dam No. 1	600'	None
Louisville District	Green	63	Green River Locks & Dam No. 2	600'	None
Nashville District	Cumberland	30	Barkley Locks & Dam	800'	None
Nashville District	Tennessee	22	Kentucky Locks & Dam	600'**	None**
KY River Authority	Kentucky	4	Lock 1	145'	None
KY River Authority	Kentucky	31	Lock 2	145'	None
KY River Authority	Kentucky	42	Lock 3	145'	None
KY River Authority	Kentucky	65	Lock 4	145'	None

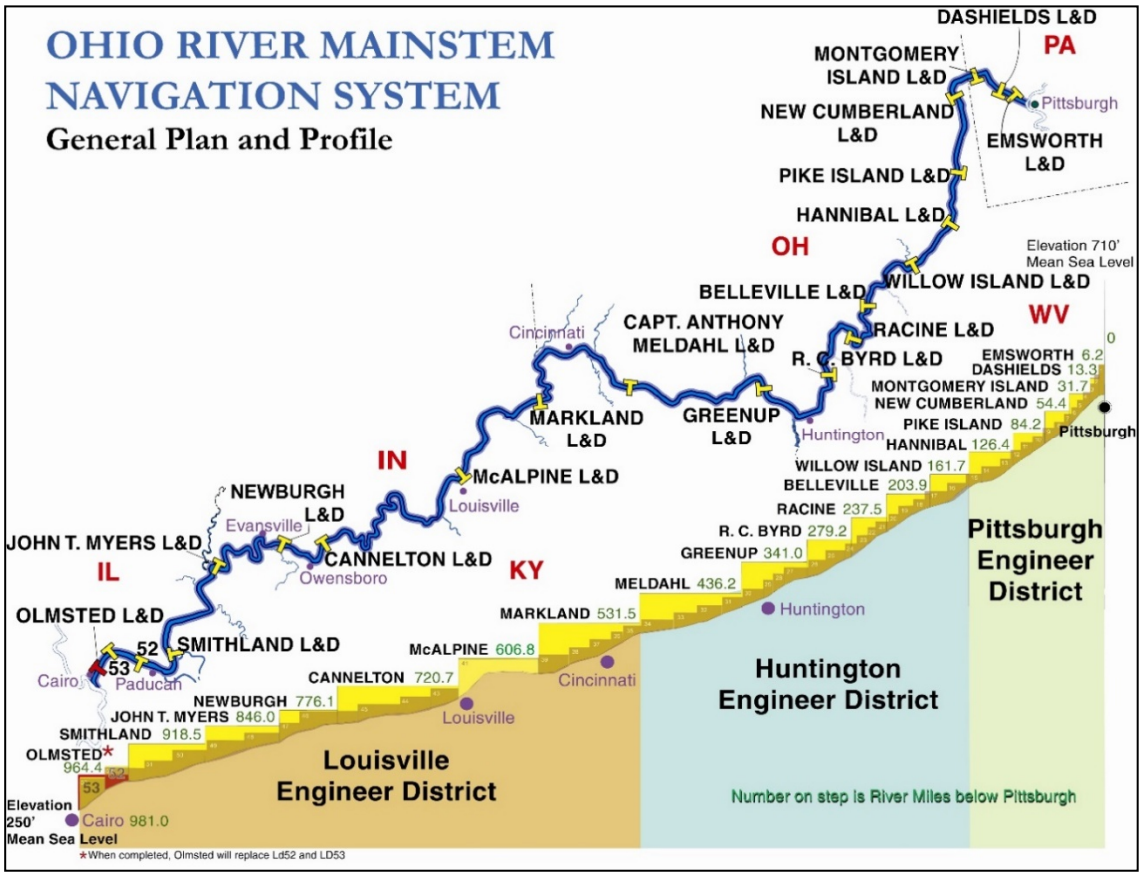
Source: Kentucky Transportation Cabinet, 2022.
**Authorized to expand 600' auxiliary chamber to 1,200', funding not yet obligated.*
***Currently only 600' lock chamber in operation. New 1,200' main lock chamber under construction. Upon completion projected for 2029, lock will have 1,200' main and 600' auxiliary lock chambers.*

The locks and dams on the Ohio River are illustrated in **Figure 4-8**. The majority of these locks and dams were constructed in the 1950s and 1960s. Locks and Dams 52 and 53 were put into operation in 1928 and 1929 respectively. To eliminate aging structures and reduce congestion on the Ohio River, their demolition and replacement by Olmsted Locks and Dam was authorized in 1988. The landside demolition of Locks and Dams 52 (Mile 939) and 53 (Mile 963) was finished in 2021, and their complete demolition is expected by the end of 2022. The construction for the replacement Olmsted Lock and Dam megaproject was completed in August 2018, and became operational by October 2018, greatly reducing tow and barge delays through one of the busiest U.S. inland waterways.

The Kentucky lock addition project is currently taking place on the Tennessee River in western Kentucky. The existing 600-ft Lock currently has one of the longest delay times of any lock in the inland waterway system. Upon completion, the construction of this new 1,200-ft lock is expected to essentially eliminate these delays, thus allowing for additional tonnage and value of commercial cargo and goods to pass through Kentucky Lock. The total project completion date is targeted for the year 2030 as of 2022.[29]

[29] U.S. Army Corps of Engineers, Kentucky Lock Addition Project, *https://www.lrn.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/2939894/kentucky-lock-addition-project/msclkid/kentucky-lock-addition-project/*, Accessed April 2022.

Figure 4-8. Ohio River Locks and Dams

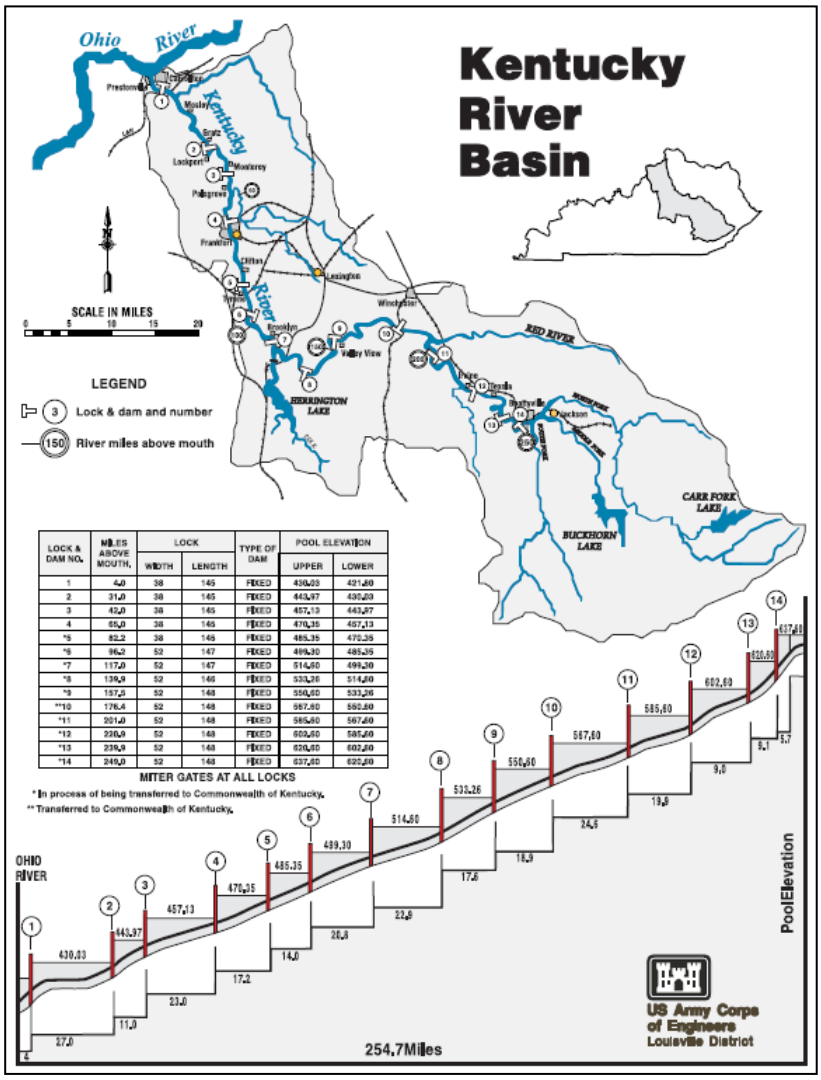


Source: U.S. Army Corps of Engineers, 2022.

The USACE Louisville District operates the two locks and dams on the Green River, with Lock and Dam No.1 located near Henderson and No.2 near Calhoun. Both locks and dams were constructed in the 1950s. The only Cumberland River lock and dam in Kentucky is operated by the USACE Nashville District. Constructed in the 1960s, this lock and dam is located near Grand Rivers in Livingston County. The USACE Nashville District also operates the only Tennessee River lock and dam in Kentucky. This lock and dam are located 20 miles east of Paducah.

Figure 4-9 shows the locks and dams on the Kentucky River. All the locks and dams were originally owned by the USACE but have been transferred over to the Kentucky River Authority. Locks and dams 1 through 4 were originally constructed in the 1830s and 1840s. In 1882, the dams were rebuilt, and since then they have been maintained through repairs and some reconstruction.

Figure 4-9. Kentucky River Locks and Dams



LOCK & DAM NO.	MILES ABOVE MOUTH,	LOCK		TYPE OF DAM	POOL ELEVATION	
		WIDTH	LENGTH		UPPER	LOWER
1	4,0	38	145	FIXED	430,03	421,80
2	31,0	38	145	FIXED	443,97	430,03
3	42,0	38	145	FIXED	457,13	443,97
4	65,0	38	145	FIXED	470,35	457,13
*5	82,2	38	145	FIXED	485,35	470,35
*6	96,2	52	147	FIXED	499,30	485,35
*7	117,0	52	147	FIXED	514,50	499,30
*8	139,9	52	146	FIXED	533,26	514,50
*9	157,5	52	148	FIXED	550,50	533,26
**10	176,4	52	148	FIXED	567,60	550,50
**11	201,0	52	148	FIXED	585,60	567,60
**12	220,6	52	148	FIXED	602,60	585,60
**13	239,6	52	148	FIXED	620,80	602,60
**14	249,0	52	148	FIXED	637,80	620,80

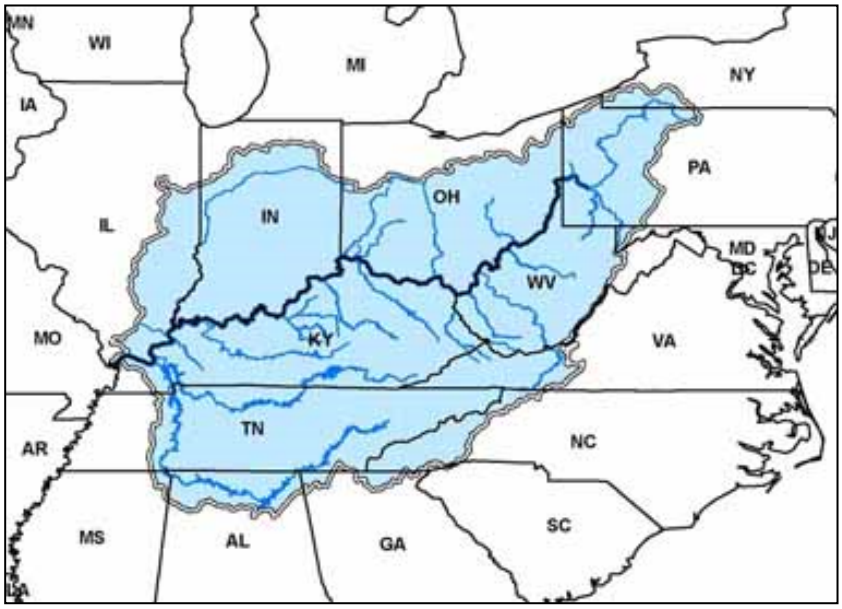
Source: U.S. Army Corps of Engineers. 2022

4.2.2. Waterway Performance

Vast quantities of agricultural and industrial commodities are shipped through Kentucky's waterways. For example, from 2000 to 2010, barges on the Ohio River carried a yearly average of 234 million short tons of commodities on all navigable rivers within the basin. The Ohio River Basin is shown in **Figure 4-10**. Coal, petroleum products, aggregates, agricultural products, construction raw materials, and chemicals are some of the predominant commodities carried by barge on the Ohio River. The Ohio River locks can handle forecasted levels of coal and grain exports; however, the age of the lock and dam

infrastructure affects reliability, which in turn influences the competitiveness of coal and grain exports.[30]

Figure 4-10. Ohio River Basin



Source: The Ohio River - All things fishing on the Ohio River, TheOhioRiver.com, 2022

4.2.3. Waterway Safety

Maritime accidents are common in Kentucky, with so much activity taking place on the multiple river systems flowing through the state. The responsibility for marine incident safety investigations is shared between the National Transportation Safety Board (NTSB) and the United States Coast Guard (USCG). Therefore, a comprehensive picture of marine incidents is difficult to obtain. The adoption of double hulled barges and the infrequent interaction with other modes allows for fewer incidents. According to NTSB, there are five maritime incidents that happened in Kentucky since 2010.[31]

4.2.4. Riverport Conditions and Performance

In July 2022, KYTC completed the Kentucky Riverports, Highway and Rail Freight Study in partnership with the Kentucky Cabinet for Economic Development (CED). It is designed to help the state analyze its riverports and help to find better ways to support waterborne commerce and to further economic growth across the Commonwealth. The study follows up on the 2008 Kentucky Riverport Improvement Project which included a synopsis of information that discussed the existing conditions for each of Kentucky's public riverports such as location, site, facilities, and services offered. The study focused on

[30] U.S. Army Corps of Engineers, Inland Waterways and Export Opportunities, *http://www.lrd.usace.army.mil/Portals/73/docs/Navigation/PCXIN/Inland_Waterways_and_Export_Opportunities-FINAL_2013-01-03.pdf*, Accessed May 2022.
[31] National Transportation Safety Board (NTSB), Common Investigation Fields Database, *https://data.ntsb.gov/carol-main-public/basic-search*, Accessed May 2022.

infrastructure needs and ultimately provided several industry recommendations, including the creation of the Kentucky Water Transportation Advisory Board.[32]

Kentucky's inland ports and terminals provide direct access to the agricultural markets of the Midwestern and North Central states, the industrial and consumer markets of the Northeast, and the distribution networks of the South. The Paducah region is considered a national hub for river shipping, as it is home to numerous barge companies, including Ingram Barge and Crounse Corporation, two of the largest barge operators in the U.S., which serve customers nationwide.

4.2.5. Riverport Planning Toolkit

KYTC created its first Riverport Planning Toolkit in 2018, which is a detailed document riverports can use to report their volume of freight, inventory of facilities, identify freight mobility issues, and share their ongoing maintenance and capital improvement needs. The report was modeled after the "Port Planning and Investment Toolkit" created by the USDOT Maritime Administration (MARAD). KYTC requested each riverport complete the form and will seek updates annually. The report provides KYTC with a snapshot of the services and activities currently present at the riverports but also allows KYTC an opportunity to learn about the needs at each riverport in the foreseeable future. More specifically, and much like the toolkit created by MARAD, this resource can be used to help Kentucky's riverports with the following tasks, among others:

- Evaluate port conditions
- Identify port facilities and services
- Identify freight mobility issues, whether caused by infrastructure or regulatory issues
- Plan capital improvement projects with a 20-year outlook
- Present actionable needs to administrators
- Engage state partners
- Locate and access available funding

The Kentucky Riverport Planning Toolkit is available for download. More information about the Port Planning and Investment Toolkit can be found on the USDOT Maritime Administration website.

4.3. Freight Rail

Kentucky's approximately 2,700 miles of railroad track carry a myriad of freight and provide connectivity to all points in the U.S. Class I track makes up approximately 2,185 miles of Kentucky's rail system and represents the most heavily traveled rail lines by revenue. Kentucky is traversed by CSXT's Chicago, IL to Nashville, TN and Detroit, MI to Atlanta, GA. mainlines, by NS's Cincinnati, OH to Atlanta, GA. and New Orleans, LA. mainlines, and by CN's Chicago, IL to New Orleans, LA. mainline. The Class I railroads are complemented by a network of regional and short line railroads that provide in-state connectivity. The Paducah & Louisville Railway is one example, providing east-west service in Kentucky and connecting with six other carriers at three locations within the state.

[32] Waterways Journal, Kentucky Study Analyzes State's Public Riverports, *https://digital.waterwaysjournal.net/Waterways-Journal-01202020-e-Edition/2/*, Accessed May 2022.

4.3.1. Track Condition Ratings

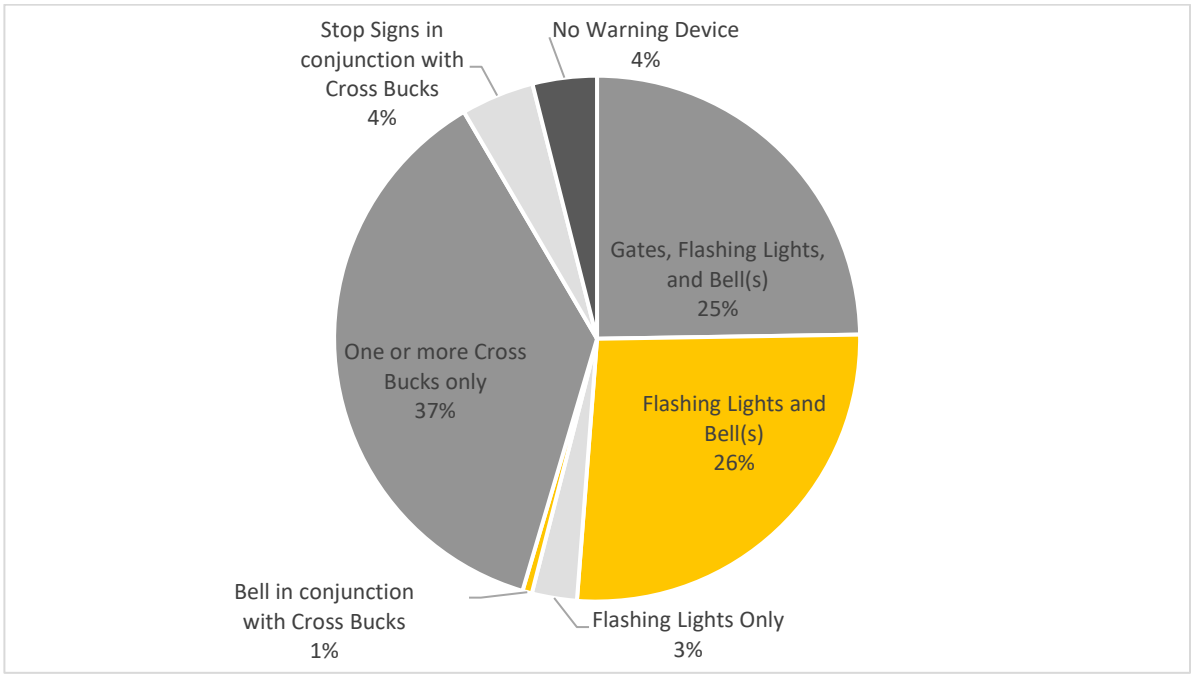
The FRA establishes track structure and track geometry requirements for the different classes of track, with maximum speeds designated for each class. As per FRA's Track Safety Standards found at 49 CFR Part 213 Section 213.9, the classes of track are Excepted Track and Class 1 through 6. The maximum allowable operating speeds for freight trains are 10, 25, 40, 60, 80, and 110mph for track Class 1 through 6 respectively.[33]

Track condition ratings set restrictions on rail operation speeds and weight capacity. Rail facilities in Kentucky are all owned by private companies. Consequently, information on specific privately owned track conditions is not shared with the Cabinet.

4.3.2. Rail Safety

KYTC is currently monitoring a total of 3,770 public crossings. These crossings are composed of 2,424 at-grade crossings which include 34 that are for pedestrian use and 1,346 grade-separated crossings, including 19 that are pedestrian. The inventory of public at-grade crossings lists 1,323 active crossings and 1,101 passive crossings in 2022. According to the FRA Office of Safety, there are 4,258 highway-rail at-grade crossings operating in Kentucky, including 2,172 public and 2,047 private crossings. KYTC's records of public highway-rail at-grade crossings, which are usually more current than the FRA's, indicate 2,424 public crossings in Kentucky, including 1,323 active crossings and 1,101 passive crossings. **Figure 4-11** shows the distribution of public crossing categories by warning devices in Kentucky.

Figure 4-11. Kentucky Railroad Crossings by Warning Device

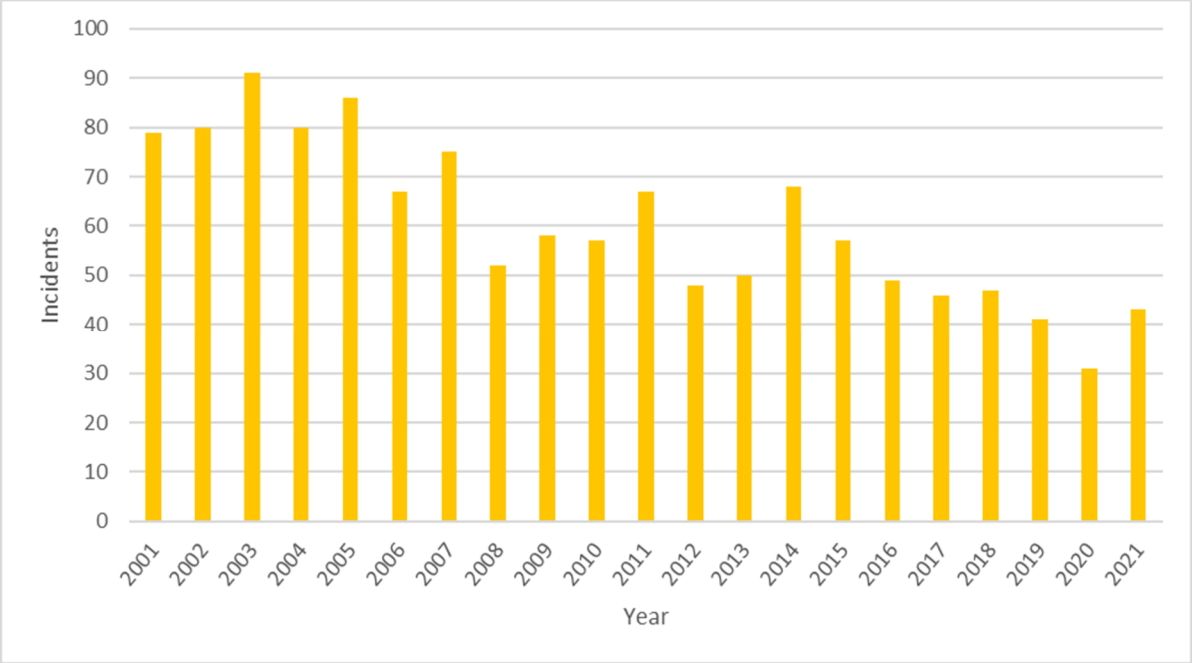


Source: State Action Plan for Highway-Rail Grade Crossings, 2022.

[33] Code of Federal Regulations, Title 49, Subtitle B, Chapter II, Part 213, Subpart A, Section 213.9. https://www.ecfr.gov/current/title-49/subtitle-B/chapter-II/part-213/subpart-A/section-213.9, Accessed May 2022.

Highway-rail at-grade crossing incidents have decreased overall in Kentucky since 2000. **Figure 4-12** shows the highway-rail at-grade crossing incidents from 2000 to 2019. A total of 43 highway-rail at-grade crossing accidents occurred in Kentucky in 2021, compared to 79 in 2001.

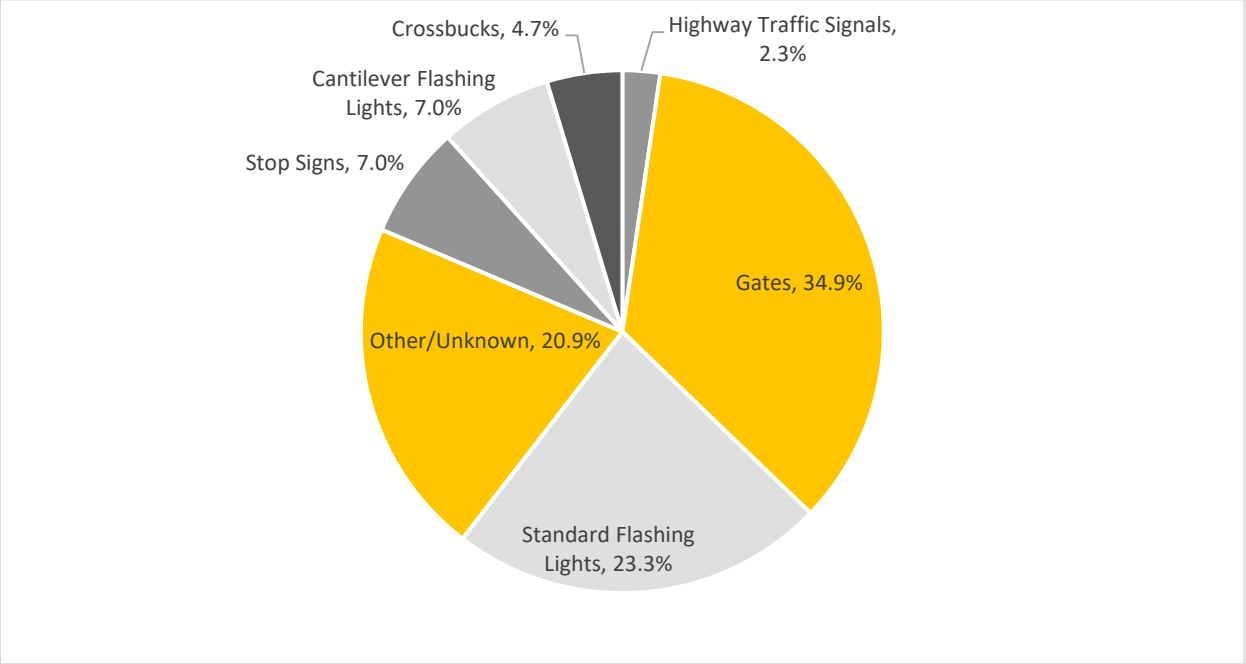
Figure 4-12. Kentucky Highway-Rail At-Grade Crossing Incidents, 2001-2021.



Source: Federal Railroad Administration Accident and Incident Reporting Data, 2022.

There were 43 highway-rail grade crossing incidents in Kentucky in 2021, four of which occurred at private crossings. **Figure 4-13** shows Kentucky public highway-rail at-grade crossing incidents for 2021 by warning devices. Crossbucks, flashing lights, stop signs, and gates account for nearly 94 percent of crossings at which incidents occurred. Crossings without warning devices or unknown account for the remaining 6 percent of incidents.

Figure 4-13. Kentucky Highway-Rail Crossing Incidents by Warning Device[34], 2021.



Source: Federal Railroad Administration Office of Safety, 2022.

FRA maintains statistics on the number of fatalities and injuries at highway-rail at-grade crossings and pedestrian trespass locations. In 2021, Kentucky ranked 27th and 28th in the U.S. respectively for injuries and fatalities at highway-rail at-grade crossing facilities. **Table 4-6** shows the fatality and injury incidents from 2016 to 2021.

Table 4-6. At-Grade Highway-Rail Crossing Injuries and Fatalities[35], 2016-2021

Year	Fatalities	Injuries
2017	3	19
2018	2	10
2019	3	7
2020	2	8
2021	2	6

Source: Federal Railroad Administration Office of Safety, 2022.

4.3.3. KYTC Railroad Annual Report

KYTC is required by KAR Title 603, Chapter 7, Section 090 to regularly update railroad data. This regulation requires that all freight railroads must submit the following information to the KYTC:

[34] Federal Railroad Administration, Highway-Rail Grade Crossing Accident Data, *https://data.transportation.gov/Railroads/Highway-Rail-Grade-Crossing-Accident-Data/7wn6-i5b9*, Accessed May 2022.
[35] Federal Railroad Administration, Highway-Rail Grade Crossing Accident Data, *https://data.transportation.gov/Railroads/Highway-Rail-Grade-Crossing-Accident-Data/7wn6-i5b9*, Accessed May 2022.

- Kentucky Railroad Annual Report (Form TC 59-102);
- Map of all active routes;
- Written notice of abandonments; and
- Reports of accidents resulting in a loss of life.

The annual report and map of all active routes are to be submitted to KYTC's Division of Planning on or before March 31st of each year. With the submitted information, KYTC has records available for rail location reference purposes, future updates of the Kentucky Statewide Rail Plan, and other planning efforts KYTC may pursue. For more information about KYTC's involvement with rail, the Kentucky Statewide Rail Plan can eb viewed on KYTC's website.

4.4. Pipeline

Approximately 41,000 miles of pipelines move natural gas, crude oil, refined petroleum products, and highly volatile liquids, flammable liquids, and toxic liquids throughout Kentucky. The commonwealth has one crude oil refinery that has an operating capacity of approximately 291,000 barrels per calendar day in 2022.[36] Most of Kentucky's natural gas comes from the Big Sandy field located in the eastern part of the commonwealth, which is the largest natural gas field in the Appalachian Basin.

4.4.1. Pipeline Conditions

In Kentucky, ninety-eight percent of the pipelines transport natural gas. The total miles of natural gas transmission pipelines are among the highest of any state in the Southeast.

The Broad Run Expansion project by Tennessee Gas Pipeline (TGP) went in service in the second quarter of 2018. Currently, it provides an incremental 200,000 dekatherms per day of firm transportation capacity on the same capacity path.[37] This project involved the construction of two new compressor stations built in Madison County and the modification and replacement of two existing compressor stations in Powell and Boyd counties.[38]

The Rogersville Shale, which covers eastern Kentucky and parts of West Virginia, Ohio, Maryland, Pennsylvania, and New York, is a potential energy source of oil and gas (**Figure 4-14**). In January 2019, the state announced that the shale tested well on its Kentucky part.[39] In January 2020, the state of Kentucky launched a new study for the shale's potential with an estimated budged of $7.4 million to study the oil and gas potential located in Eastern Kentucky.[40] The Conasauga Shale Research Consortium (CSRC)'s horizontal research well will be drilled from the pilot hole of the Bruin Exploration 1 Young well, highlighted in red in **Figure 4-14.** If the Rogersville Shale becomes a usable energy source, this would result in future expansion of pipelines in Kentucky.

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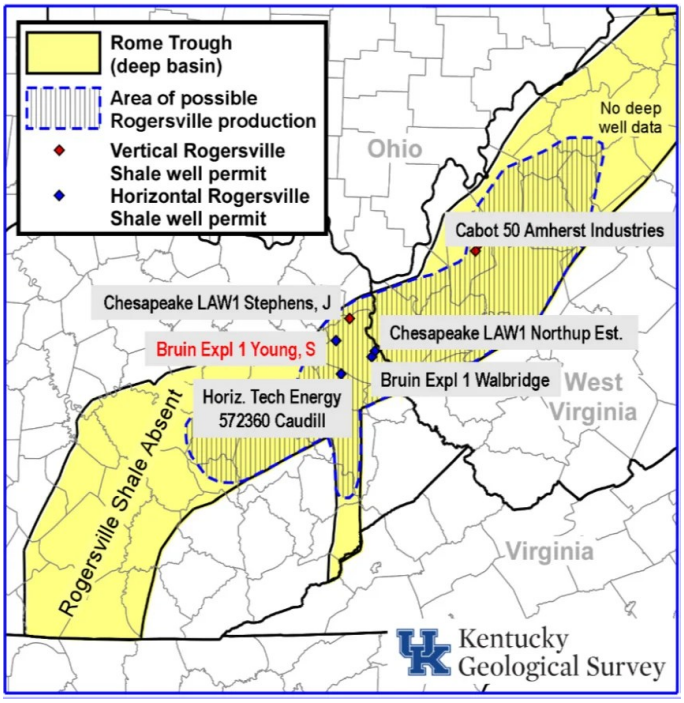
[36] U.S. Energy Information Administration, Kentucky State Energy Profile, *https://www.eia.gov/state/print.php?sid=KY*, Accessed August 2022.
[37] RBN Energy, Broad Run Expansion Project, *https://rbnenergy.com/node/5176*, Accessed May 2022.
[38] NS Energy, Broad Run Expansion Project, *https://www.nsenergybusiness.com/projects/broad-run-expansion-project/*, Accessed May 2022.
[39] Marcellus Drilling New, Rogersville Shale Test Wells in KY, WV Appear to be a Flop, January 7, 2019, *https://marcellusdrilling.com/2019/01/rogersville-shale-test-wells-in-ky-wv-appear-to-be-a-flop/*, Accessed May 2022.
[40] Marcellus Drilling News, Kentucky Launches New Study of Rogersville Shape Potential, January 2, 2020, *https://marcellusdrilling.com/2020/01/kentucky-launches-new-study-of-rogersville-shale-potential/*, Accessed May 2022.

Figure 4-14. Rogersville Shale

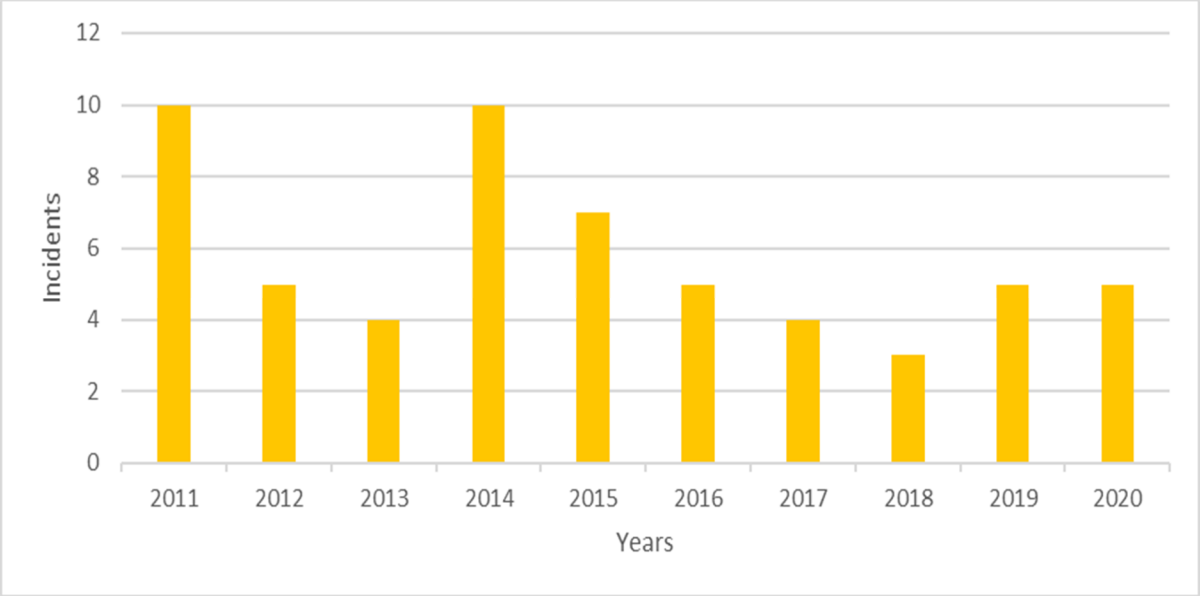


Source: University of Kentucky, 2020.

4.4.2. Pipeline Safety

Pipelines are considered the safest method for transporting energy products. However, when pipeline incidents occur, they can present considerable risks to the public and the environment. The USDOT's PHMSA is responsible for documenting and investigating pipeline incidents and accidents. **Figure 4-15** shows the pipeline incidents, including spills, injuries, and fatalities in Kentucky over the last 10 years. Most of these years experienced less than 10 incidents per year.

Figure 4-15. Kentucky Pipeline Incidents, 2011-2020.



Source: Pipeline and Hazardous Materials Safety Administration, 2021.

4.5. Air Cargo

Rounding out the five modes of transportation, Kentucky is also home to two major air cargo hubs. DHL and Amazon Air both operate major cargo hubs at Cincinnati/Northern Kentucky International Airport (CVG) in Hebron, while UPS operates 'Worldport' hub at Louisville Muhamad Ali International Airport (SDF). These hubs serve as sorting facilities that handle significant volumes of air cargo throughput, a small fraction of which originates in or is destined for Kentucky.

4.5.1. Airport Conditions

A variety of factors, including runway lengths, can impact air cargo service. Runway lengths determine the size of aircraft that can land at an airport. Cargo planes for domestic operations typically require a runway length of 8,000 feet, while international operations usually require a runway of 10,000 feet. As shown in **Table 4-7**, Cincinnati/Northern Kentucky International Airport and Louisville International Airport can handle cargo planes for both domestic and international operations.

Table 4-7. Kentucky Top Cargo Airports

ID	Airport Name	Number of Runways	Longest Runway Length (ft)
CVG	Cincinnati/Northern Kentucky International Airport	4	12,000
SDF	Louisville Muhammad Ali International Airport	3	11,887

Source: Federal Aviation Administration, 2021.

Other factors that can impact air cargo service include:

- **Runway Strength:** A heavy all-cargo jet requires a runway, taxiway, and ramp with sufficient load bearing capacity to handle its weight.
- **Ramp Area:** A sufficient amount of ramp area is necessary to park one or more aircraft and to provide space for equipment loading, cargo staging, and truck access.
- **Available Facilities or Land for Development:** Handling large amounts of specialized air cargo may require additional on-airport facilities. Land adjacent to runways and taxiways may be necessary to attract aviation-related air cargo shippers seeking to construct a cargo ramp, sort center, maintenance hangar, or factory.

As mentioned in *Air Cargo*, Cincinnati/Northern Kentucky International Airport and Louisville Muhammad Ali International Airport were ranked in the top 10 in North America and top 25 in the world in terms of total air cargo tonnage in 2020. Louisville Muhammad Ali International Airport handled over 2.9 million tons of total air cargo, with a North American ranking of 3rd and world ranking of 5th. Over 1.3 million tons of total air cargo was handled at Cincinnati/Northern Kentucky International Airport with a North American ranking of 7th and world ranking of 21st. The Amazon Air Hub began full operation at CVG in August 2021, which may increase total air cargo tonnage and affect the airport's ranking over the next few years as other development take place at the facility.

The performance of air traffic controllers and pilots is perhaps the most critical factor in the capacity of an airport. During the busy periods of an airport, air traffic controllers must manage the traffic demand, balancing arrivals, and departures to ensure efficient operation. For example, if the spacing between aircraft on final approach is not delivered consistently, then larger gaps will lead to increased delays and lower runway throughput.

4.5.2. Air Cargo Safety

The NTSB has the primary role of investigating every civil aviation accident in the U.S., and the FAA also provides input. Safety data for air cargo is difficult to differentiate from other commercial/passenger incidents for two reasons. First, a large portion of air cargo is transported in commercial passenger aircrafts rather than in dedicated air cargo freighters. Second, the NTSB does not differentiate between a passenger/commercial aircraft and a dedicated air cargo freighter.