

4 CURRENT CONDITIONS

The efficient, reliable, and safe movement of freight depends on a transportation system that is properly maintained and in good physical condition. The condition of the transportation system in Kentucky is the result of a variety of factors such as transportation funding availability, including the private sector's investments, system demand, economic conditions, and the quality and timing of operations and maintenance.

This chapter describes the current condition of the Kentucky freight system by mode – highways, waterways, rail, pipelines, and airports. The condition includes the state of the freight infrastructure, system performance, and/or safety.

4.1 HIGHWAYS

Kentucky has an extensive network of interstates and major highways that support 275 million tons of truck-borne freight annually. This includes two of the nation's busiest north-south interstate corridors (I-75 and I-65), connecting industries across North America from Canada to Mexico. Kentucky also contains a large portion of I-64, which is a major east-west corridor stretching from Norfolk, Va. to St. Louis, Mo.³⁰

4.1.1 Congestion/Bottlenecks

Freight bottlenecks occur at physical 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 2005, FHWA completed a report called an “An Initial Assessment of Freight Bottlenecks on Highways.” The study revealed that freight bottlenecks cause upwards of 243 million truck hours of delay annually. The direct cost of the bottlenecks were approximately \$8 billion (2005 \$) annually.

4.1.1.1 Congestion/Bottleneck Reports

The American Transportation Research Institute (ATRI) and FHWA have partnered since 2002 to collect and process truck Global Positioning System (GPS) probe data to analyze freight movement and bottlenecks in the U.S. Since then, ATRI has published an annual list of the 100 worst freight bottlenecks. In 2015, the report listed I-65 at I-64/I-71 interchange (Louisville) as the fourth worst freight bottleneck in the country. Less than a mile north of the Kentucky and Ohio state line is the I-71 and I-75 interchange (Cincinnati), and this interchange is listed as the seventh worst freight bottleneck.³¹

³⁰ <http://www.thinkkentucky.com/kyedc/pdfs/kytrannw.pdf>, Accessed on March 16, 2016.

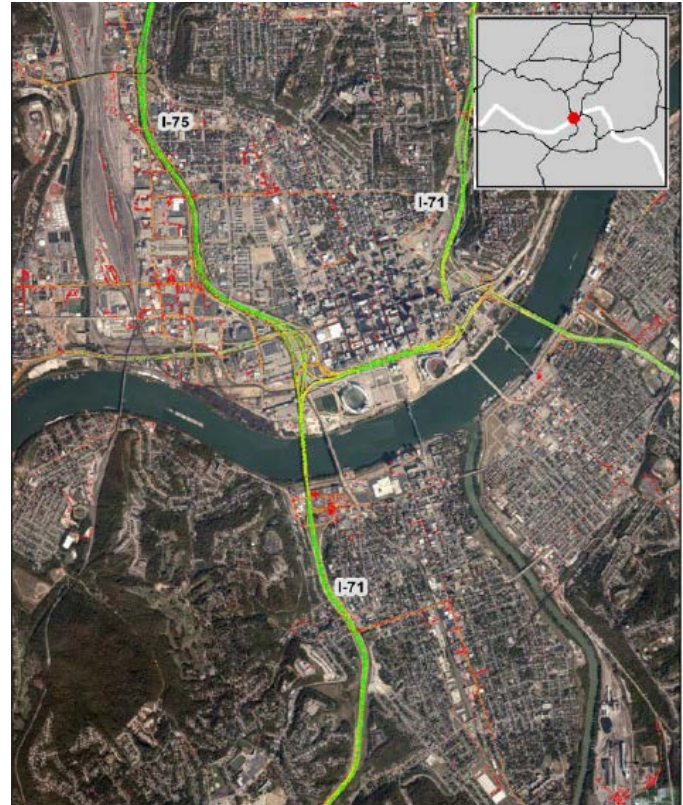
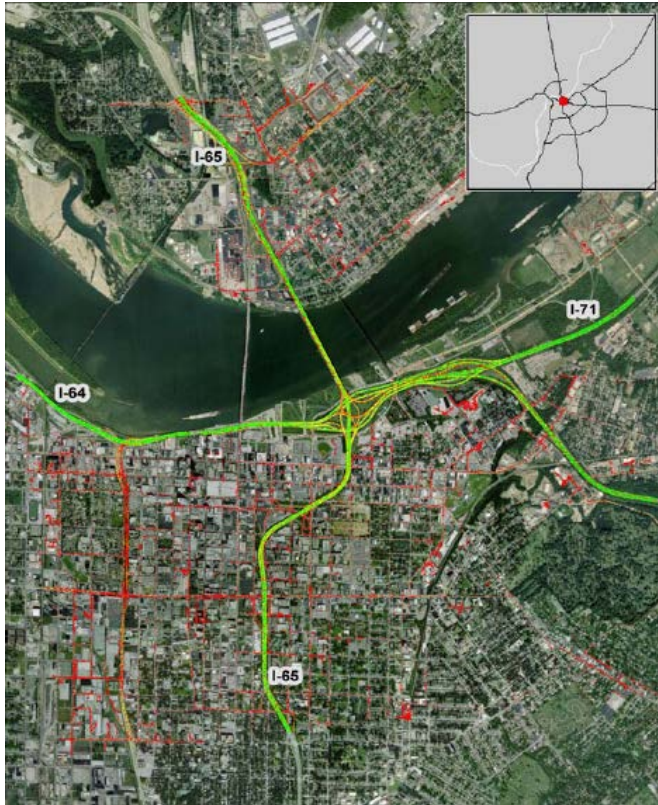
³¹ ATRI, *Congestion Impact Analysis of Freight-Significant Highway Locations*, 2015

Although in Ohio, this bottleneck has significant implications for northern Kentucky freight. Both interchanges are shown in **Figure 4-1**.

Figure 4-1: ATRI Freight Bottlenecks

I-65 at I-64/I-71 Interchange (Louisville)

I-71 at I-75 Interchange (Cincinnati)



Source: American Transportation Research Institute, 2015

In 2015, the American Highway Users Alliance published their “Unclogging America’s Arteries 2015” report that detailed passenger and freight bottlenecks. This report identified the nation’s top 50 bottlenecks, along with other zones of congestion in the U.S. Among the other zones of congestion they evaluated were I-64 at I-65 between N. Preston Street and N. Clay Street (North of Louisville Slugger Field) and I-65 at US 150, both in Louisville. I-64 at I-65 between N. Preston Street and N. Clay Street has estimated delays of 102,700 hours annually, while I-65 at US 150 has estimated delays of 241,540 hours annually.

The issue of staging trucks for supply and distribution/delivery logistics is a critical issue in Kentucky’s manufacturing and agriculture areas. Drivers are using interstate ramps, commercial/retail parking lots, and other areas to park and wait for their time to report to distribution hub locations for loading and unloading. This is creating safety concerns on interstates, conflicts with passenger vehicles, increased congestion at intersections adjacent to truck parking areas, and increased emissions and noise from idling trucks to local communities.

4.1.1.2 KYTC Congestion/Bottleneck Analysis

This section presents KYTC's efforts to identify highway locations with the worst congestion using the truck data from the National Performance Measure Research Data Set (NPMRDS). These locations, identified using truck travel time data, may also be referred to as speed bottlenecks and they are considered to represent freight mobility issues. The Cabinet recognizes there are many methods to identify, quantify, and rank highway congestion. For the sample methodology discussed below, KYTC used only the 2015 NPMRDS.

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

In Kentucky, 537 unique interstate segments were in the 2015 NPMRDS. Only truck speeds during weekdays were considered, using 24 hourly averages of speeds for all of 2015. Using this criteria, 310 interstate segments or 58% of interstate segments never dipped below 55 miles per hour for any hour of the day. A closer review examined the hour of day when interstate segments recorded their lowest speed. The 5:00 pm to 6:00 pm period revealed the most slow speeds for the Kentucky interstate system.

The following criteria were used to further identify the locations with low truck speeds:

- Locations with slowest hourly speed (1 hour)
- Locations with slowest average daily speed (24 hours)
- Locations with greatest frequency of average hourly speed being less than 25 miles per hour

Locations and times of day meeting at least two of the three criteria above were identified as the worst for observed truck speed on the interstate system in Kentucky. As expected from the 2015 data, most of the worst locations were located in Jefferson County. During this time, the projects to construct two new Ohio River bridges and reconstruction of multiple interstates put a strain on traffic in and around Louisville. Similarly, I-65 in Hart and Hardin Counties was reconstructed in 2015 with a major widening of several miles from four lanes to six lanes. KYTC anticipates the NPMRDS data for 2017 will show a major improvement to congestion in the Louisville area and in Hart County. **Table 4-1** summarizes the locations of the top truck speed bottlenecks on the Kentucky interstate system.

Table 4-1: Locations of the Top Truck Speed Bottlenecks on the Kentucky Interstate System

County	Route	Direction	Begin MP	End MP	Length
Jefferson	I-71	Non Cardinal	0.000	1.919	1.919
Jefferson	I-65	Non Cardinal	135.320	135.480	0.160
Jefferson	I-65	Cardinal	132.850	136.633	3.783
Jefferson	I-64	Non Cardinal	0.000	0.776	0.776
Jefferson	I-64	Non Cardinal	5.660	7.580	1.920
Jefferson	I-64	Cardinal	4.190	5.732	1.542
Campbell	I-471	Non Cardinal	0.004	0.380	0.376
Campbell	I-471	Cardinal	0.000	0.029	0.029
Jefferson	I-265	Non Cardinal	34.750	38.080	3.330

Jefferson	I-264	Cardinal	22.350	23.240	0.890
Franklin	I-64	Cardinal	46.310	48.000	1.690
Franklin	I-64	Non Cardinal	47.560	52.840	5.280
Simpson	I-65	Cardinal	2.350	6.170	3.820
Hart	I-65	Non Cardinal	64.340	70.450	6.110
Hart	I-65	Cardinal	57.880	74.600	16.720
Hart	I-65	Cardinal	78.660	80.660	2.000
Hart	I-65	Non Cardinal	90.660	92.900	2.240
Hardin	I-65	Cardinal	91.330	91.590	0.260
Hardin	I-65	Cardinal	94.380	102.980	8.600
Lyon	I-69	Cardinal	68.280	68.350	0.070
Madison	I-75	Non Cardinal	61.740	75.390	13.650
Madison	I-75	Non Cardinal	94.540	97.700	3.160
Grant	I-75	Cardinal	154.390	158.740	4.350
Grant	I-75	Non Cardinal	158.460	166.220	7.760

Identifying the Top Truck Speed Bottlenecks on Kentucky's Non-Interstate National Highway System

In Kentucky, exactly 1,000 unique segments of non-interstate National Highway System (NHS) are identified in the 2015 NPMRDS. The peak frequency of minimum speed being less than or equal to 30% of the average daily speed occurred during the day time hours. The most records occurred during the 8:00 AM to 9:00 AM hour. During this peak hour, the 85th Percentile speed (system-wide) was 60 miles per hour.

To identify the top truck speed bottleneck locations on Kentucky's non-interstate NHS System, the following criteria were applied:

- Posted speed limit greater than 35 miles per hour
- Average Daily Traffic greater than 5,000 vehicles
- NPMRDS segment lengths greater than 0.5 mile
- Travel time delay per mile greater than 1.5 minutes
- Omit locations with average daily speed greater than posted speed

Table 4-2 summarizes the locations of the top truck speed bottlenecks on the Kentucky non-interstate portion of the National Highway System. Almost all of identified locations are in Kentucky's three largest MPOs.

Table 4-2: Locations of the Top Truck Speed Bottlenecks on the Kentucky NHS System

County	Route	Direction	Begin MP	End MP	Length
Boone	KY 237	Cardinal	4.690	6.341	1.651
Boone	US 42	Cardinal	12.700	14.083	1.383
Fayette	US 25	Non Cardinal	10.780	12.069	1.289

Fayette	US 25	Cardinal	10.850	12.076	1.226
Fayette	US 27	Cardinal	2.900	3.461	0.561
Fayette	US 27	Cardinal	6.490	8.461	1.971
Fayette	US 27	Non Cardinal	6.490	8.454	1.964
Fayette	US 68	Non Cardinal	4.310	5.673	1.363
Fayette	US 68	Cardinal	1.670	5.668	3.998
Jefferson	KY 1747	Non Cardinal	11.020	11.640	0.620
Jefferson	KY 1747	Cardinal	4.860	7.243	2.383
Jefferson	KY 1747	Cardinal	12.000	13.465	1.465
Jefferson	KY 22	Cardinal	3.700	4.275	0.575
Jefferson	KY 913	Cardinal	0.800	1.418	0.618
Jefferson	US 31W	Cardinal	7.590	8.296	0.706
Jefferson	US 60	Non Cardinal	5.470	6.392	0.922
Jefferson	US 60	Non Cardinal	7.860	9.668	1.808
Kenton	KY 17	Non Cardinal	18.500	19.572	1.072
Kenton	KY 17	Cardinal	18.700	19.562	0.862
Madison	US 25	Non Cardinal	20.130	25.213	5.083
McCracken	US 45	Cardinal	8.130	9.190	1.060
McCracken	US 60	Non Cardinal	16.320	17.535	1.215
McCracken	US 60	Cardinal	16.320	17.535	1.215
Trigg	US 68	Non Cardinal	20.780	24.261	3.481
Warren	US 31 W	Non Cardinal	14.660	15.716	1.056

The state employs several strategies to address freight mobility issues caused by bottlenecks. KYTC analyzes the NPMRDS data to identify bottlenecks and these bottlenecks are monitored for change. The more severe congestion locations are considered in the highway project planning process. Recent projects, including the reconstruction of the multi-interstate interchange in Louisville, KY (discussed in Section 4.1.1.1) and the commitment to widening I-65 and I-75 to at least six lanes for their entire length in Kentucky, are examples of strategies the state has used to address freight mobility issues caused by congestion. Additional strategies are discussed in Chapter 7.

4.1.1.3 Jason's Law and Truck Parking

Jason's Law put a spotlight on the need to improve truck parking nationally. Safe, legal, and available truck parking is an issue for truck and car drivers, shippers, manufacturers, enforcement, and KYTC. There is a significant cost to construct new parking facilities. A disconnect seems to exist between perceived need and actual need for truck parking.

KYTC participates in the FHWA – Kentucky Division's annual Evaluation Report of the Kentucky Commercial Vehicle Size and Weight Program, which includes an in depth review of facilities (including availability of truck parking), equipment, resources, policies, procedures, and goals and implementation of the State Enforcement Plan. The 2016 report, which covered the 2015 Commercial Vehicle Size and Weight Program, identified seven weigh stations as offering additional services above the average weigh station, including long-term parking for commercial vehicles. The availability of truck parking and many

other weigh station conditions are catalogued in the report and it is then a valuable tool in Division of Planning, Division of Maintenance, Commercial Vehicle Enforcement, and Kentucky State Police, among others.

KYTC participated in two truck parking studies in 2015, which were commissioned to identify truck parking facilities and demand in Kentucky. These studies are the Jason's Law Truck Parking Survey with FHWA and a truck parking capacity and demand study with the Kentucky Transportation Center (KTC) at the University of Kentucky.

According to FHWA, the Jason's Law Truck Parking report reviewed "public and private truck parking studies and efforts over the past 20 years, as well as a significant amount of research, analysis, and survey input from States and truck parking stakeholders, to provide an updated understanding of the magnitude of truck parking issues and a means for States and MPOs to evaluate truck parking in a consistent way moving forward. FHWA worked with States to collect as much information as possible through a variety of State resources. However, FHWA did not require States to conduct detailed truck parking research if information was not available. Noting that the information States could provide varied in detail, it [was] the goal of this work to provide a system of metrics that can be used consistently in the future to provide an assessment of truck parking, which will better inform the dialogue on the issue and focus on needed investments."³²

The study conducted by KTC, which was a snapshot of conditions on five interstates (I-65, I-75, I-24, I-64, and I-71), "examined information on parking demand, identified locations in for potential safety issues, and focused on potential countermeasures to reduce the number of commercial vehicle crashes where driver fatigue was a contributing factor." The methodology included "daytime and nighttime surveys to determine how frequently commercial vehicles used parking facilities on interstates in Kentucky" as well as an analysis of crash data to determine the relationship of commercial vehicle driver fatigue and roadway shoulder parking to crashes. A summary of observations and recommendations from this study is as follows:

- Of the 4,715 parking spaces surveyed during the day, 2,143 were in use (45 percent)
- of the 7,844 parking spaces surveyed during nighttime hours, 6,803 were in use (87 percent)
- from 2010 to 2013, 848 crashes were related to commercial vehicles being parked on roadway shoulders or involved commercial vehicle drivers suffering from fatigue
- 239 crashes were related to commercial truck parking
- Two-thirds of all crashes included in the analysis occurred on I-75, I-65, I-64, and I-71
- Crash cluster locations appeared directly related to proximity and usage rate of parking facilities
- Parking facilities with use rates at or above 90 percent would be candidates for expanding the number of parking spaces or for developing new sites to accommodate more parking.

According to the report, recommendations to address truck parking demand and safety in Kentucky include using public and private parking areas to increase capacity and using ITS to improve awareness

³² FHWA Office of Freight Management and Operations. https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/index.htm. Accessed July 2017.

of, and therefore use of, truck parking facilities. A copy of the report may be accessed at <http://ktc.ad.uky.edu/commercial-truck-parking/>.

KYTC is using these reports and others, as well as taking input from Division of Planning, Division of Maintenance, Commercial Vehicle Enforcement, Kentucky State Police, Kentucky Trucking Association, and MPOs, among others, to determine the best locations to better serve trucking parking needs. This effort, as well as KYTC's participation in the Regional Truck Parking Information and Management System (TPIMS), discussed in Chapter 2, help the state address one of the freight industry's more prominent freight mobility issues: truck parking. The following chart lists the state-owned facilities noted by Kentucky Commercial Vehicle Enforcement officers in December 2016 as having truck parking capacity issues. The Kentucky Trucking Association and the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) provided input regarding urgency of need, with "H" representing "High", "M" representing "Medium", and "L" representing Low.

OKI	KTA	Exit	Route	County	Site
	M	92	I-24	Christian	Welcome Center
	H	60	I-64	Woodford	EB Rest Area
	H	60	I-64	Woodford	WB Rest Area
	L	0	I-65	Simpson	Welcome Center
	L	60	I-65	Hart	NB Rest Area
	M	113	I-65	Bullitt	SB Welcome Center
	H	13	I-71	Oldham	NB Rest Area
	H	13	I-71	Oldham	SB Rest Area
H	HM	177	I-75	Boone	NB Rest Area
H	LM	177	I-75	Boone	SB Welcome Center
	M	76	WK	Ohio	Rest Area In Median

Note: "WK" refers to the Western Kentucky Parkway

The following chart lists the state-owned facilities that are currently unopen and under consideration for truck-only parking. The Kentucky Trucking Association provided input regarding urgency of need using the same lettering system as in the previous chart.

KTA	County	Route	Mile Point	Ownership	Surface Type
L	Lyon	I-24 WB	34.600	KYTC	Pavement
L	Lyon	I-24 EB	54.000	KYTC	Pavement
L	Lyon	I-24 WB	54.000	KYTC	Pavement
M	Warren	I-65 NB	39.221	KYTC	Reclaimed
M	Warren	I-65 SB	29.907	KYTC	Reclaimed
M	Hart	I-65 SB	55.165	KYTC	Semi-Reclaimed
H	Hardin	I-65 NB	81.036	KYTC	Reclaimed
H	Hardin	I-65 SB	81.999	KYTC	Reclaimed
H	Hardin	I-65 NB	89.310	KYTC	Reclaimed
H	Shelby	I-64 WB	38.126	KYTC	Reclaimed
H	Shelby	I-64 EB	28.251	KYTC	Reclaimed
H	Henry	I-71 SB	35.522	KYTC	Reclaimed/Pavement

H	Carroll	I-71 NB	51.500	KYTC	Pavement
H	Carroll	I-71 SB	51.400	KYTC	Pavement
H/M	Montgomery	I-64 WB	107.652	KYTC	Pavement
H/M	Rowan	I-64 EB	148.000	KYTC	Reclaimed

In April 2017, KYTC held a meeting of the Kentucky Freight Advisory Committee for Transportation (KFACT) in conjunction with the 2017 Kentucky Regional Freight Conference. Almost all of the presentations and discussions at the KFACT meeting, as well as those at Thursday's Regional Freight Conference, had a common thread - the need for planners from the private and public sectors to consider the shift in commerce from business-to-business to business-to-consumer. The landscape is being shaped by and will continue to be shaped by e-commerce and connected commercial vehicle technology. This will have a significant impact on future public investment in commercial truck parking.

4.1.2 State of Good Repair

Kentucky's roads and bridges receive several condition-based ratings assigned by KYTC that can aid in determining the quality of service being provided to the general public. Maintaining the existing system to a state of good repair is a priority for KYTC.

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.³³ 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 for year 2015 by roadway type are shown in **Table 4-3**. The average grades for each roadway type are over the targeted score of 80.

Table 4-3: FY 2015 KYTC Maintenance Statewide Scores

Classification	Score	Grade
Interstates	90.5	A
National Highway System	91.0	A
State Primary and Secondary	84.0	B
Rural Secondary	80.6	B
All Roads	83.7	B

Source: 2015 Kentucky Transportation Cabinet, Maintenance Rating Program 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

³³ Kentucky Transportation Cabinet, 2015 Maintenance Rating Program Report

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 from 2013 are presented in **Table 4-4**.

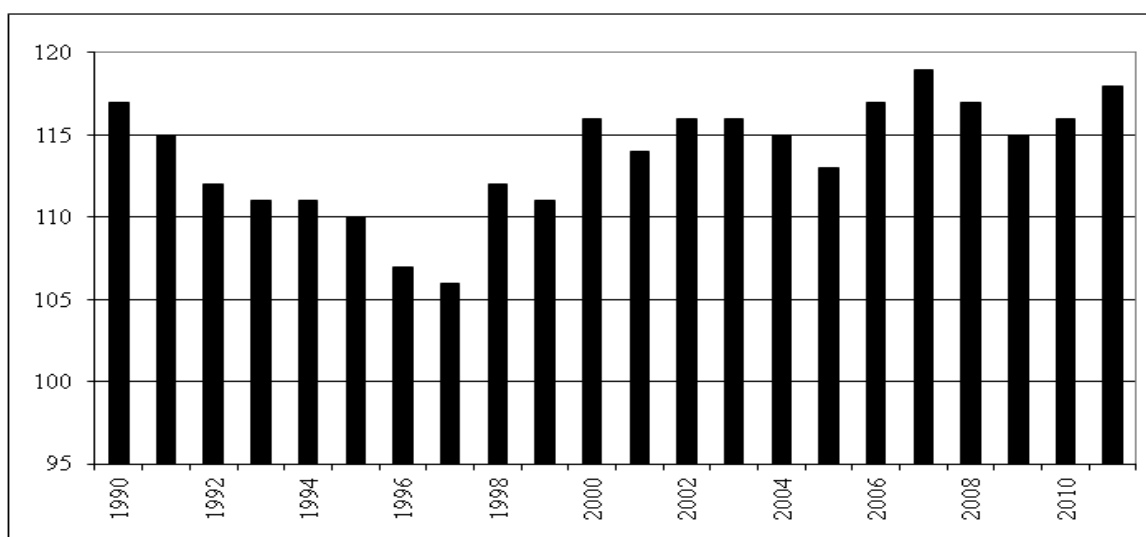
Table 4-4: Statewide Pavement Conditions by State Primary Road System, 2013

System	Centerline Miles	% Good	% Fair	% Poor
Interstates	801	54%	27%	19%
Parkways	619	48%	26%	26%
State Primary, Secondary, and Supplemental	13,376	60%	12%	28%
Rural Secondary	12,763	53%	38%	9%
All Routes	27,559	57%	25%	19%

Source: 2014 Kentucky Transportation Cabinet, Long Range State Transportation Plan

Pavement is also graded using the International Roughness Index (IRI), which measures the roughness of pavements. This index provides rideability scores. Lower scores are indicative of improvement in this measure. A pavement score greater than 170 is considered an unacceptable ride quality. Statewide scores for all roads are presented in **Figure 4-2**.

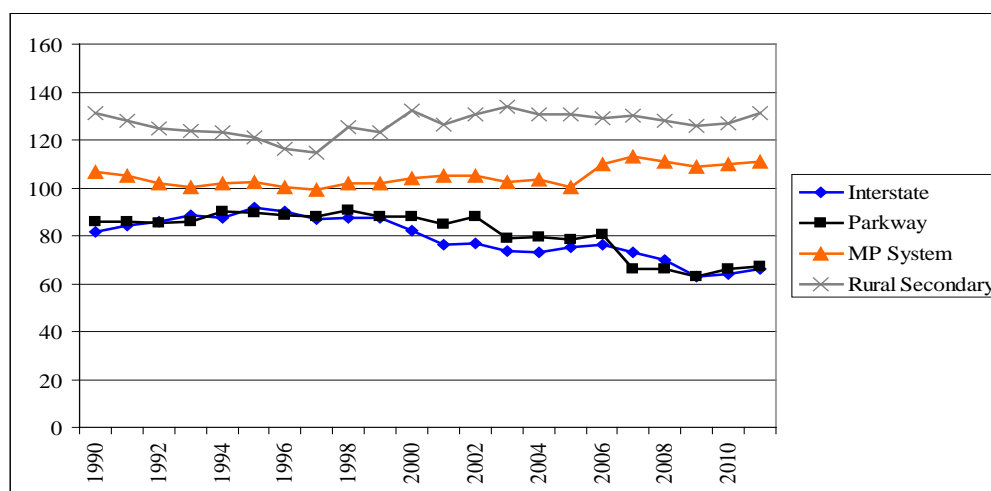
Figure 4-2: Statewide Rideability Scores



Source: Kentucky Transportation Cabinet

The figure indicates that scores improved from 1990 through 1997, then fell behind in later years, although there is variability between improvements and declines. Rideability recorded its worst measure in 2007, which was followed by 2 years of improvement until 2009.

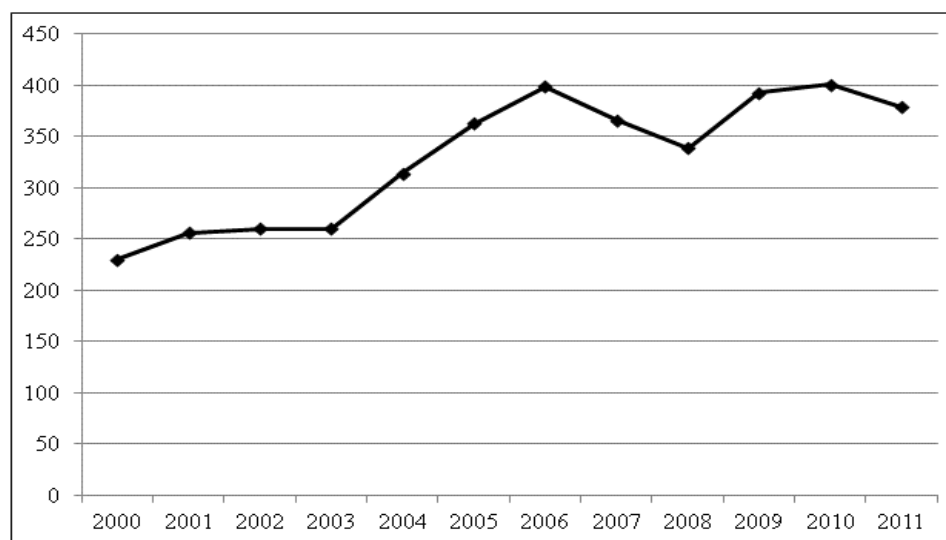
Rideability scores by road type—including interstate, parkway, maintenance program (MP), and rural secondary—are presented in **Figure 4-3**. Again, lower scores are good in this measure. As seen in the MRP scores, rural secondary roads fared the worst in terms of rideability as well, while interstates and parkways were rated the best.

Figure 4-3: Statewide Rideability Scores by Road Type

Source: Kentucky Transportation Cabinet

4.1.2.3 Bridge Rating

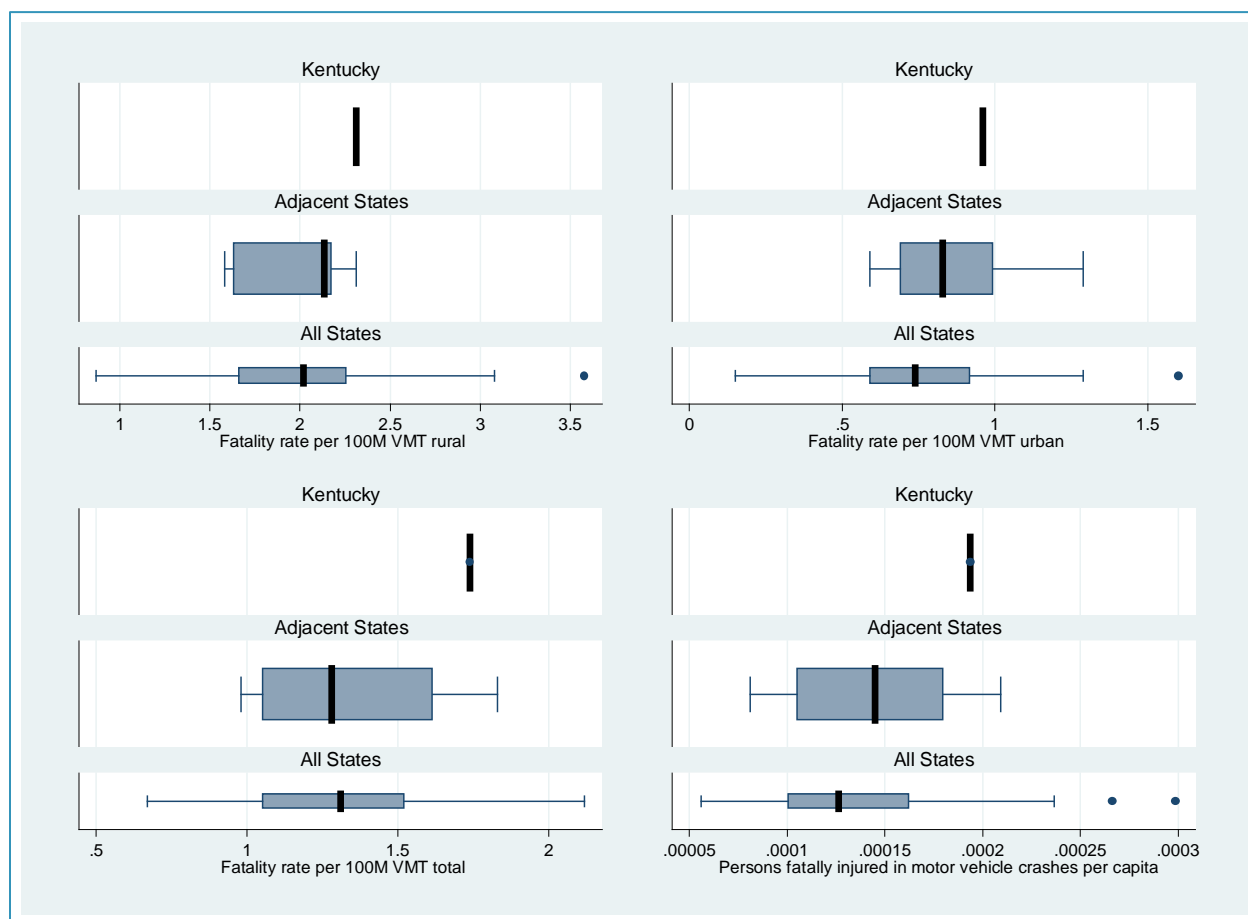
Kentucky's bridges are also rated annually by KYTC. The number of structurally deficient state maintained bridges is displayed in **Figure 4-4**. The figure shows an increase in the number of structurally deficient bridges from 230 in 2000 to 379 in 2011. The number of structurally deficient bridges did decrease from 2006 through 2008, as well as 2010 to 2011.

Figure 4-4: Number of Structurally-Deficient State Maintained Bridges

Source: Kentucky Transportation Cabinet

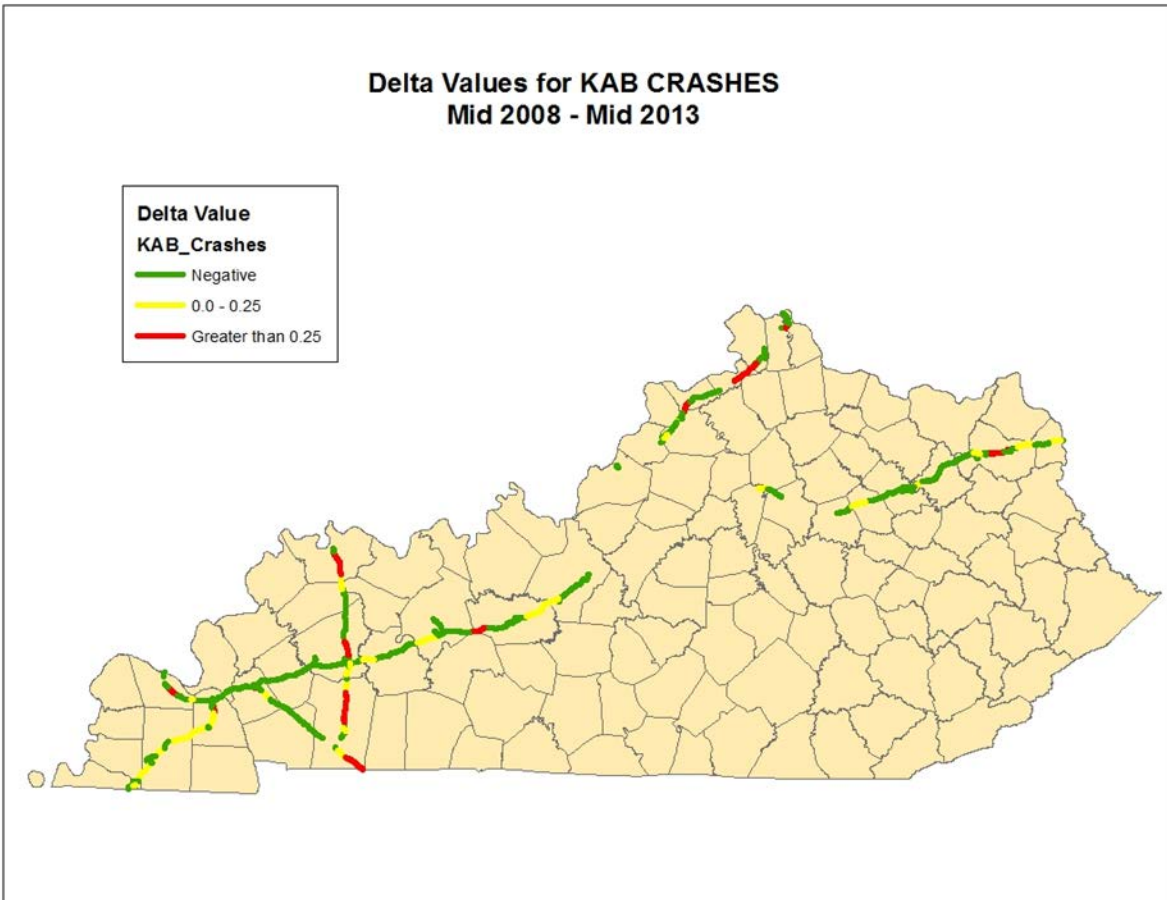
4.1.3 Highway Safety

Kentucky currently ranks high, as compared to other states, for both fatality rate per million vehicle miles traveled (VMT) and number of persons fatally injured in crashes per capita. In fact, both measures are in the top 75 percent for all states. **Figure 4-5** illustrates the crash fatality rates for Kentucky, adjacent states, and the U.S.

Figure 4-5: Fatality Rate Comparison – All Vehicles

Source: Kentucky Transportation Cabinet

Figure 4-6 illustrates commercial vehicle crashes with serious injury for a number of Kentucky interstates and U.S. highways from 2008 to 2013. This data helps to identify critical crash locations along Kentucky's roadway network. This figure uses KAB, an injury scale developed by the National Safety Council to measure the observed injury severity for any person involved, as determined by law enforcement at the scene of the crash. The acronym is derived from Fatal (K), Incapacitating Injury (A), and Non-Incapacitating Injury (B). A negative KAB means a reduction of overall crash severity, while a KAB of greater than 25 percent is a significant increase in overall crash severity. As illustrated in **Figure 4-6**, there are multiple sections of I-71, I-69, and US 41 with a KAB of greater than 25 percent.

Figure 4-6: Commercial Vehicle Crash Rates

Source: Kentucky Transportation Cabinet

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
- Truck comfort index
- Freight service index

The assessment of freight movement operating conditions uses existing information within and near project's location, 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, geometry, and pavement condition, 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 over 1,980 miles of commercially navigable waterways and 12 public port authorities, Kentucky also provides efficient year-round waterborne commerce. The Ohio River forms Kentucky's entire northern border and is a major tributary of the Mississippi River System, providing connectivity as far as Pittsburgh, Pa., Minneapolis, Minn., and Tulsa, Okla. Western Kentucky sits at the confluence of the Ohio and Mississippi rivers, marking the nominal 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 deepwater ports of New Orleans, La. and Mobile, Ala. Kentucky also connects the Ohio River to numerous southern cities such as Nashville, Tenn. via the Cumberland River; Knoxville and Chattanooga, Tenn. via the Tennessee River; and Mobile, Ala. via the Tennessee-Tombigbee Waterway.³⁴

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 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

River	No. of Locks and Dams*
Ohio	10
Kentucky	4
Green	2
Cumberland	1
Tennessee	1
Total	18

Source: 2015 Kentucky Modes Book, Kentucky Transportation Cabinet

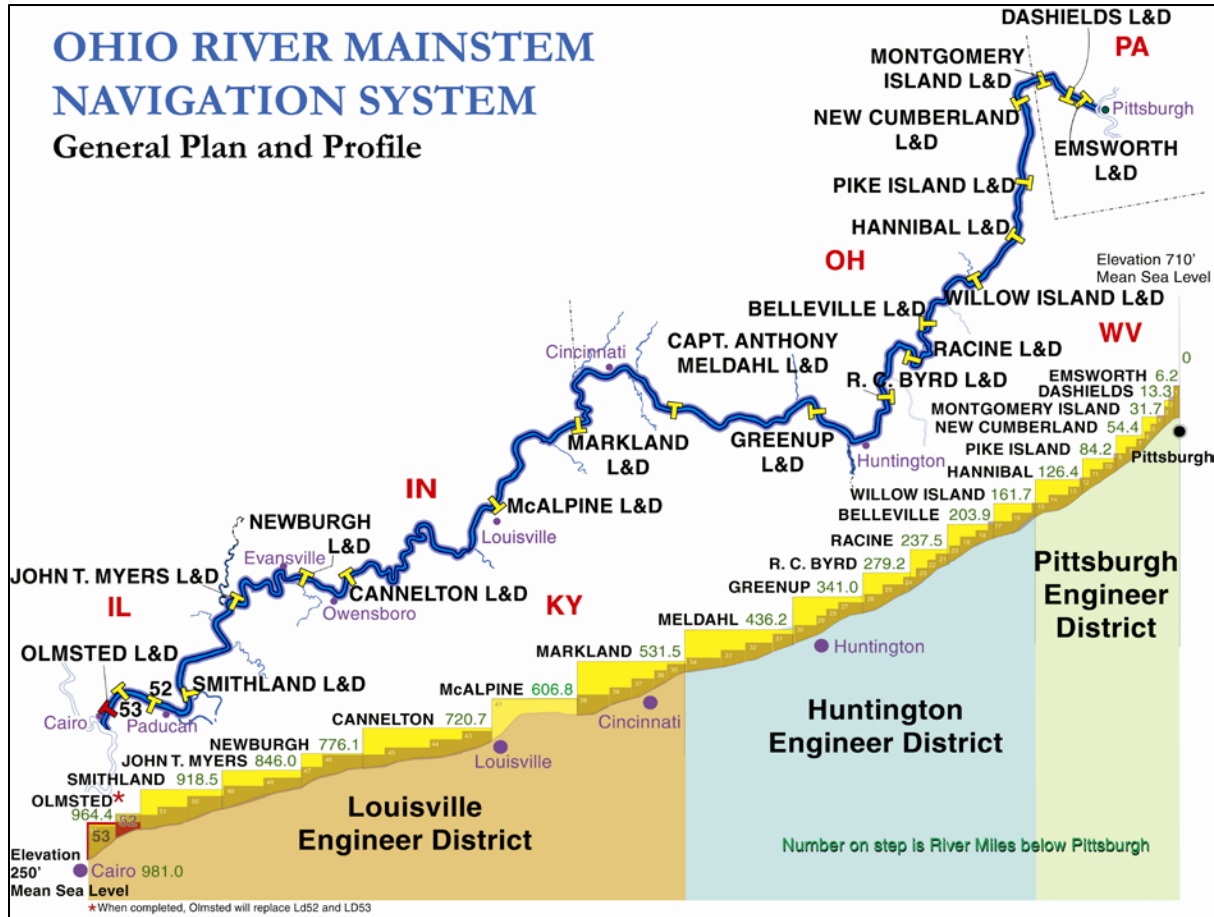
Notes: *The locks and dams that are open.

The locks and dams on the Ohio River are illustrated on **Figure 4-7**. Eight of the locks and dams in Kentucky are operated by the USACE Louisville District and the remaining two locks and dams are operated by the USACE Huntington District. The majority of these locks and dams were constructed in the 1950s and 1960s. The Locks and Dams 52 and 53 Replacement Project, known as the Olmsted Locks and Dams, is currently underway to replace two locks that were put into operation in 1928 and

³⁴ <http://www.thinkkentucky.com/kyedc/pdfs/kytrannw.pdf>

1929 respectively. This project is located on the Ohio River at mile marker 964. The project was authorized in 1988 and is scheduled to be operational by 2020. The purpose is to improve the reliability and efficiency of barge traffic.

Figure 4-7: Ohio River Locks and Dams



Source: U.S. Army Corps of Engineers

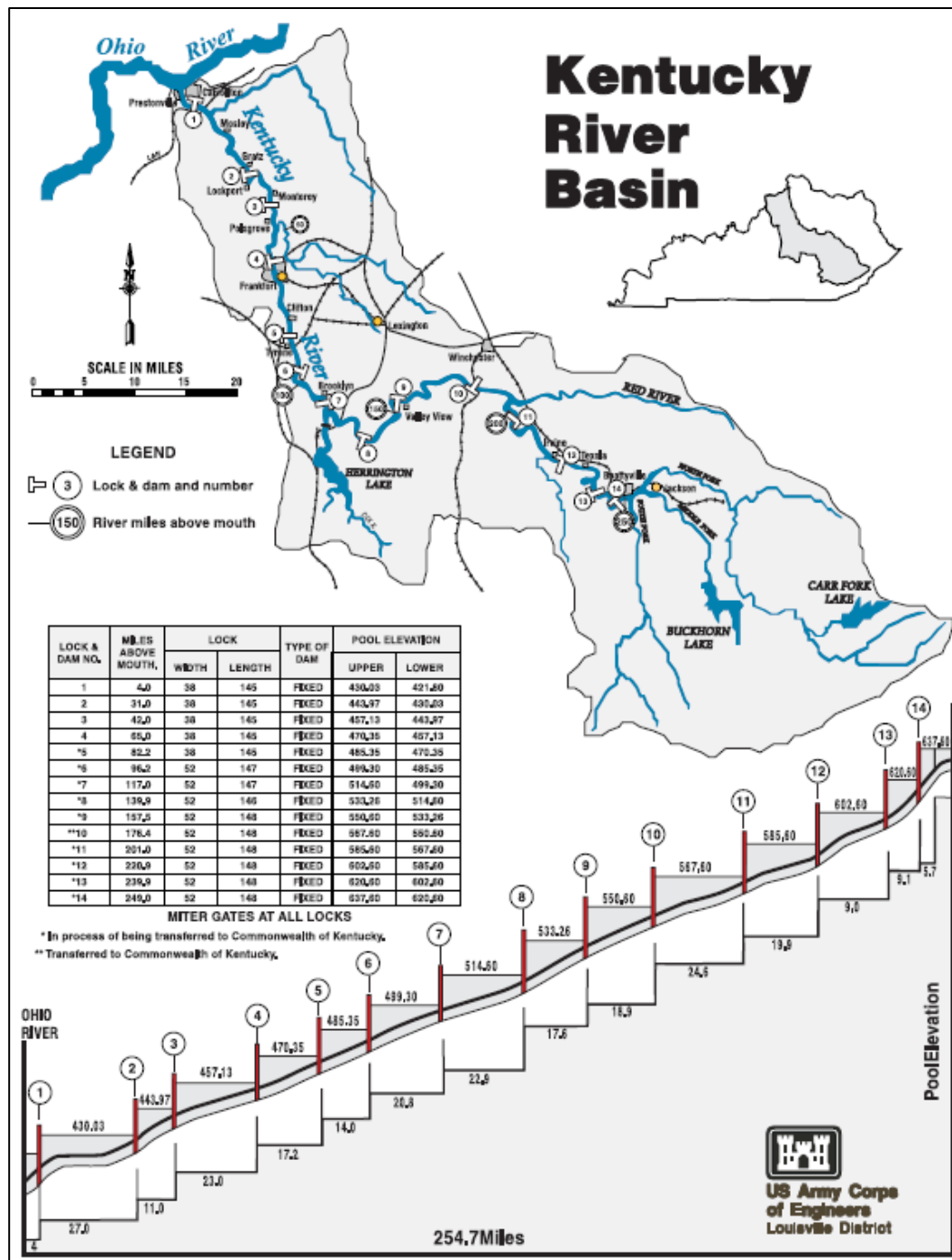
The USACE Louisville District operates the two locks and dams on the Green River. The Green River Locks and Dam No. 1 is located near Henderson. The Green River Locks and Dam No. 2 is located near Calhoun. Both locks and dams were constructed in the 1950s.

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.

The USACE Nashville District also operates the only Tennessee River lock and dam in Kentucky. This lock and dam is located 20 miles east of Paducah.

Figure 4-8 shows the locks and dams on the Kentucky River. Although there are a total of 14 locks and dams, locks and dams 1 through 4 are the only ones open for operation. 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 4-8: Kentucky River Locks and Dams



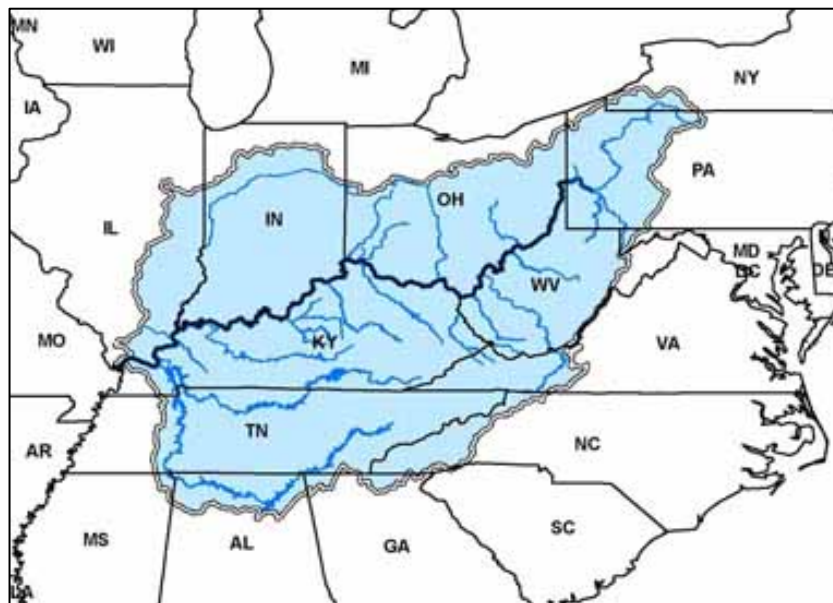
Source: U.S. Army Corps of Engineers

The majority of the locks and dams on the rivers in Kentucky are over 50 years old. Those constructed in the 1930s and 1940s are in need of major rehabilitation or replacement.

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 4-9**. 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 have the ability to handle forecasted levels of coal and grain exports; however, the age of the lock and dam infrastructure affects reliability, which in turn has an effect on the competitiveness of coal and grain exports.³⁵

Figure 4-9: Ohio River Basin



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

4.2.3 Waterway Safety

The responsibility for marine incident safety investigations is shared between the National Traffic Safety Board (NTSB) and the 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.

4.2.4 Riverport Conditions and Performance

In 2008, KYTC completed the Kentucky Riverport Improvement Project, which included a synopsis of information for 11 of the 12 Kentucky public riverports. This synopsis discussed the existing conditions for each of these ports, such as location, site, facilities, and services offered. The Kentucky Riverport

³⁵ http://www.lrd.usace.army.mil/Portals/73/docs/Navigation/PCXIN/Inland_Waterways_and_Export_Opportunities-FINAL_2013-01-03.pdf

Improvement Project is located at <http://transportation.ky.gov/Riverports/Pages/Riverport-Studies.aspx> and includes a detailed account for the public riverports.

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. Of Kentucky's eight operating public riverports, Paducah 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.³⁶

4.2.5 Riverport Planning Toolkit

In late 2016, KYTC created its first Riverport Planning Toolkit, 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 at KYTC's Riverport Improvement website at <http://transportation.ky.gov/Riverports/Pages/KY-Riverport-Improvement-Program.aspx>. More information about the Port Planning and Investment Toolkit created by USDOT Maritime Administration can be found at <https://www.marad.dot.gov/ports/strongports/port-planning-and-investment-toolkit/>.

4.3 FREIGHT RAIL

Kentucky's approximately 3,200 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 2,300 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, Tenn. and Detroit, Mich. to Atlanta, Ga. mainlines, by NS's Cincinnati, Ohio 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

³⁶ <http://www.thinkkentucky.com/kyedc/pdfs/kytrannw.pdf>

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.

4.3.1 Track Condition Ratings

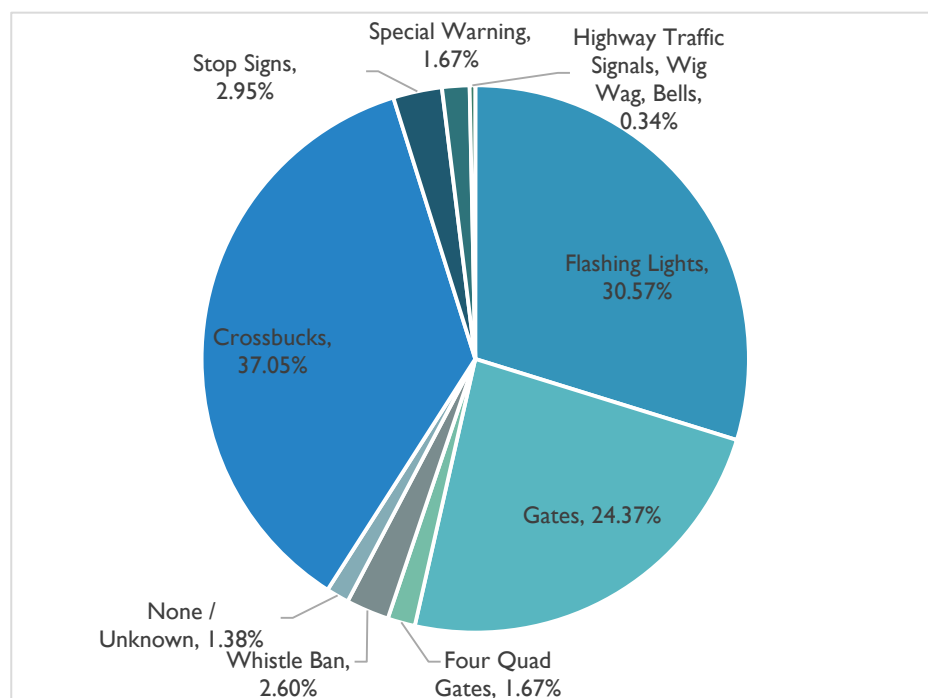
Track condition ratings set restrictions on rail operation speeds and weight capacity. Rail facilities in Kentucky are owned by private companies. Consequently, information on specific privately owned track conditions are not shared with the Cabinet.

4.3.2 Rail Safety

According to the FRA Office of Safety, there are 4,707 highway-rail at-grade crossings operating in Kentucky, including 2,293 public and 2,414 private crossings. This is equivalent to more than 1.1 crossings per route-mile of track. KYTC's records of public highway-rail at-grade crossings, which are usually more current than the FRA's, indicate 2,088 public crossings in Kentucky.

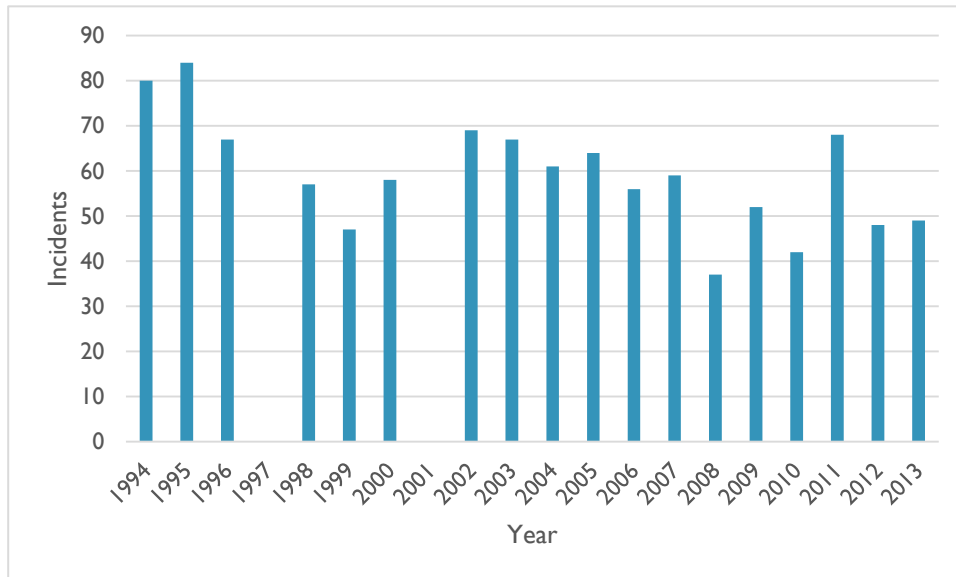
According to KYTC data, just over 1 percent of the public highway-rail at-grade crossings in Kentucky have either no warning devices or the type of protection is unknown. **Figure 4-10** shows the distribution of public highway-rail at-grade crossings types by warning devices in Kentucky in 2013.

Figure 4-10: Kentucky Highway-Rail At-Grade Crossings by Warning Device, 2013



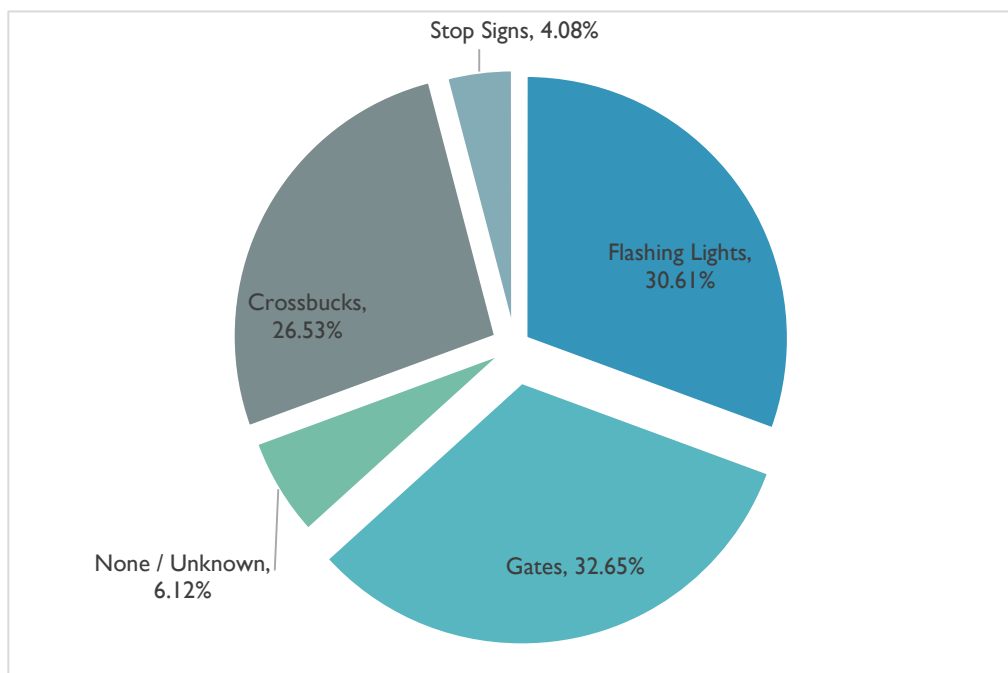
Source: Kentucky Transportation Cabinet Division of Right of Way and Utilities, Rail Safety Branch, 2013

Highway-rail at-grade crossing accidents have decreased overall in Kentucky since 1994. **Figure 4-11** shows the highway-rail at-grade crossing accidents from 1994 to 2013. A total of 49 highway-rail at-grade crossing accidents occurred in Kentucky in 2013, compared to 80 in 1994.

Figure 4-11: Kentucky Highway-Rail At-Grade Crossing Crashes, 1994-2013

Source: Federal Railroad Administration Office of Safety, 2014. Note: No data was available for 1997 or 2001

Figure 4-12 shows Kentucky public highway-rail at-grade crossing accidents for 2013 by warning devices. Crossbucks, flashing lights, stop signs, and gates account for nearly 94 percent of crossings at which accidents occurred. Crossings without warning devices or unknown account for the remaining 6 percent of accidents.

Figure 4-12: Kentucky Highway-Rail Crossing Accidents by Warning Device, 2013

Source: Federal Railroad Administration Office of Safety, 2014

FRA maintains statistics on the number of fatalities and injuries at highway-rail at-grade crossings and pedestrian trespass locations. In 2013, Kentucky was in the top 20 in the U.S. for both fatalities (15th) and injuries (tied for 18th) at highway-rail at-grade crossing facilities. However, the commonwealth has seen a steady decrease in fatalities since 2010, while the trend of injury accidents has remained stable. **Table 4-6** shows the fatality and injury accidents from 2008 to 2013.

Table 4-6: Injury and Fatality Highway-Rail At-Grade Accidents, 2008-2013

Year	Fatalities	Injuries
2008	4	17
2009	1	22
2010	10	23
2011	7	29
2012	5	24
2013	5	23

Source: Federal Railroad Administration Office of Safety, 2013

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:

- 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 be viewed at <http://transportation.ky.gov/Railroads/Pages/Rail-Plan.aspx>.

4.4 PIPELINE

Approximately 37,000 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 two oil refineries that had a combined operating capacity in 2014 of approximately 247,500 barrels per calendar day. 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.

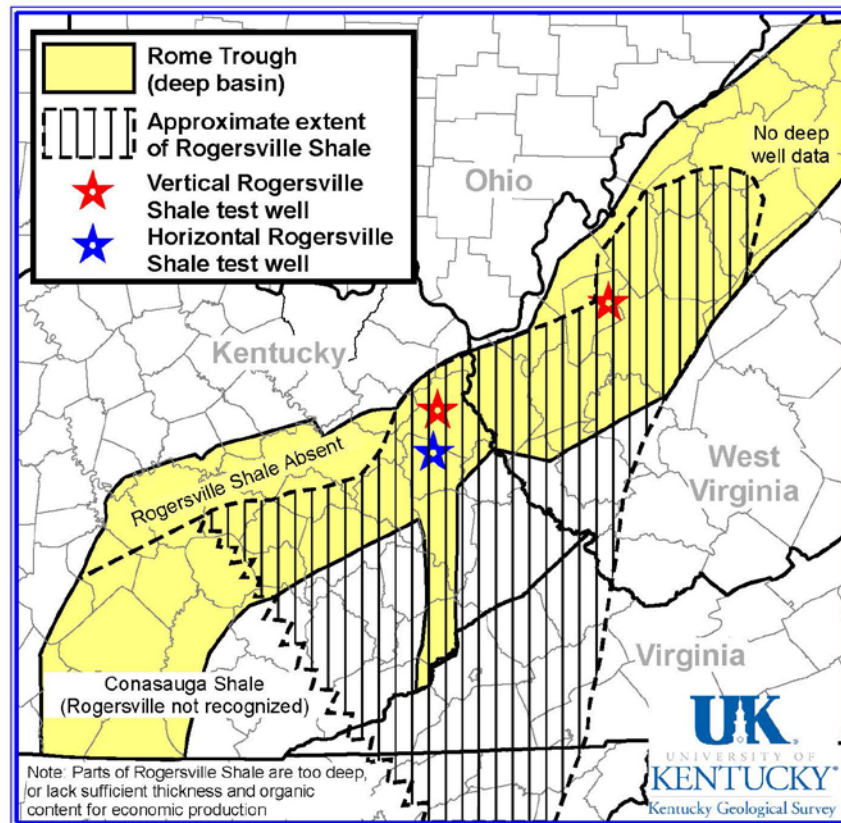
4.4.1 Pipeline Conditions

In Kentucky, 97 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.

According to the EIA, the TGP is planning the Broad Run Expansion project to expand transportation capacity of natural gas on its existing system. This project includes the construction of a new compressor station in Madison County and the modification of two compressor stations in Powell and Boyd counties. The anticipated in-service date is November 2017.³⁷

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 4-13**). Testing and exploration is currently underway to determine its supply and the viability to safely access these resources. If the Rogersville Shale becomes a usable energy source, this would result in future expansion of pipelines in Kentucky.

Figure 4-13: Rogersville Shale



Source: University of Kentucky

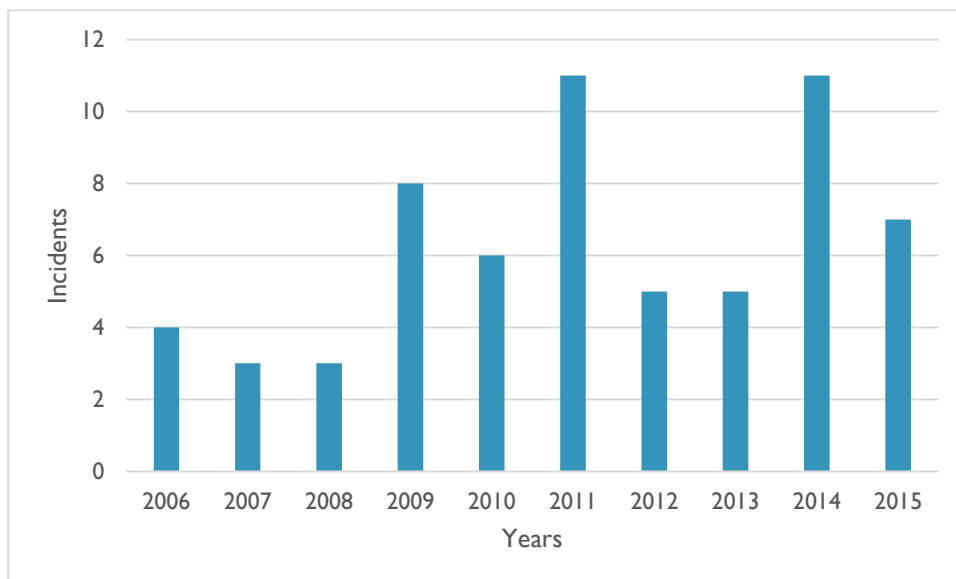
4.4.2 Pipeline Safety

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.

³⁷ http://www.kindermorgan.com/content/docs/Broad_Run_FactSheet.pdf, Accessed on March 18, 2016.

Figure 4-14 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 4-14: Kentucky Pipeline Incidents, 2006-2015



Source: Pipeline and Hazardous Materials Safety Administration, 2016

4.5 AIR CARGO

Rounding out the five modes of transportation, Kentucky is also home to two major air cargo hubs operated by integrated express carriers DHL and UPS. DHL operates its North American hub at Cincinnati/Northern Kentucky International Airport in Hebron, while UPS operates 'Worldport' hub at Louisville International Airport. 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

Airport Name	Number of Runways	Longest Runway Length (feet)
Cincinnati/Northern Kentucky International Airport	4	12,000
Louisville International Airport	3	11,887

Source: Federal Aviation Administration, 2016

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 **Chapter 2**, Cincinnati/Northern Kentucky International Airport and Louisville International Airport were ranked in the top 15 in North America and top 50 in the world in terms of total air cargo tonnage in 2013. Louisville International Airport handled over 2.2 million tons of total air cargo, with a North American ranking of third and world ranking of seventh. Over half a million tons of total air cargo was handled at Cincinnati/Northern Kentucky International with a North American ranking of 12th and world ranking of 40th.

The performance of air traffic control and pilots is perhaps the most critical factor in the capacity of an airport. During the busy periods of an airport, air traffic controllers have to 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.³⁸

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.

³⁸ <http://nats.aero/blog/2013/08/airport-capacity-more-than-just-tarmac-and-terminals/>, Accessed March 18, 2016.