# 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 highway 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.[29]

### 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.[30]

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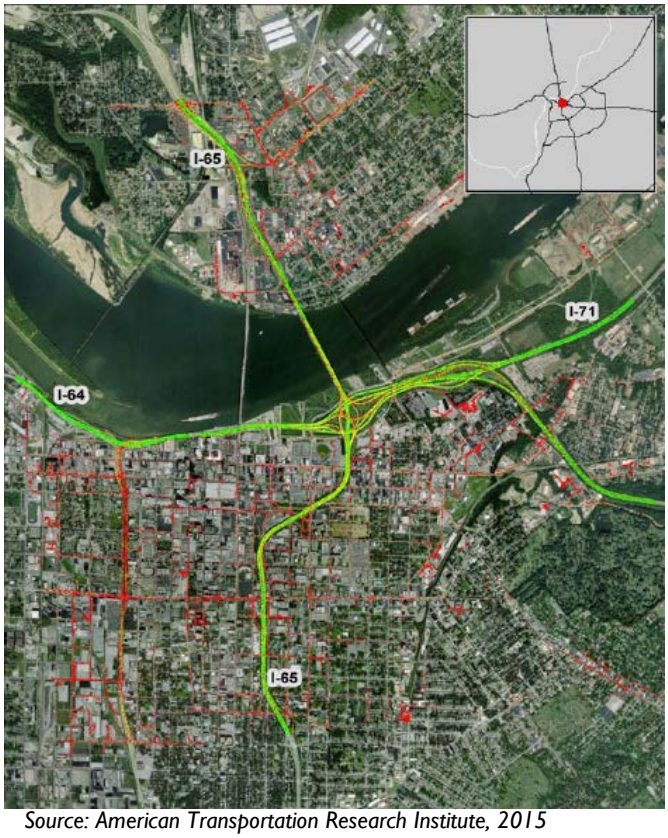
[29] *http://www.thinkkentucky.com/kyedc/pdfs/kytrannw.pdf, Accessed on March 16, 2016.*

[30] *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.

## 4.1.2 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.[31] 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 4-1**. The average grades for each roadway type are over the targeted score of 80.

**Table 4-1: 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 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 4-2**.

**Table 4-2: Statewide Pavement Conditions by State Primary Road System, 2013**

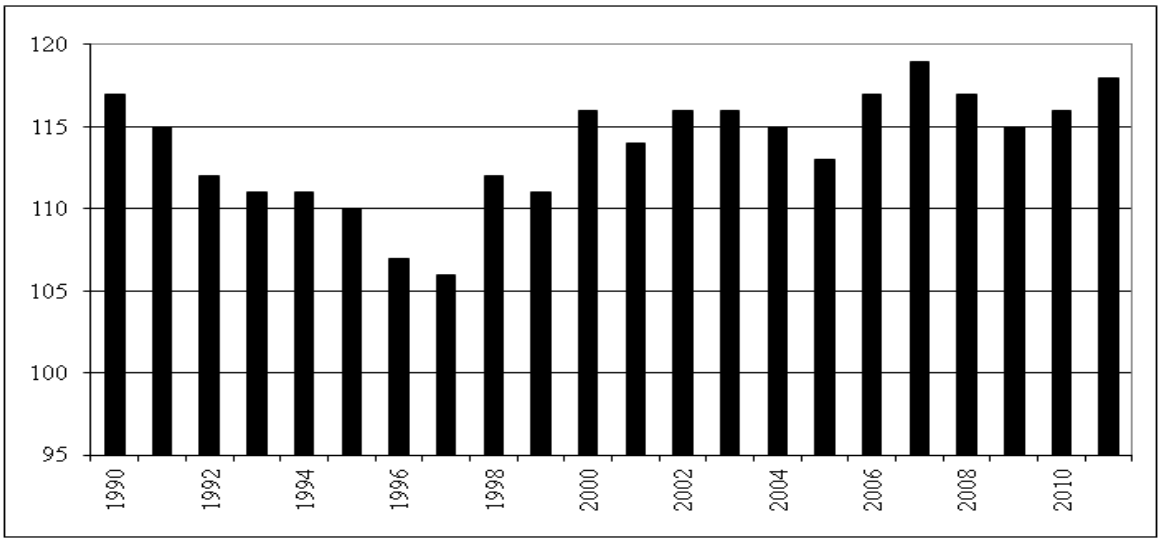
| System | Centerline Miles | % Good | % Fair | % Poor |
|---|---|---|---|---|
| Interstates | 801 | 54% | 27% | 19% |
| Parkways | 619 | 48% | 26% | 26% |
| State Primary, Secondary, and Supplemental | 13,376 | 60% | 12% | 28% |
| Rural Secondary | 12,763 | 53% | 38% | 9% |
| **All Routes** | **27,559**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

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

[31] *Kentucky Transportation Cabinet, 2015 Maintenance Rating Program Report*

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

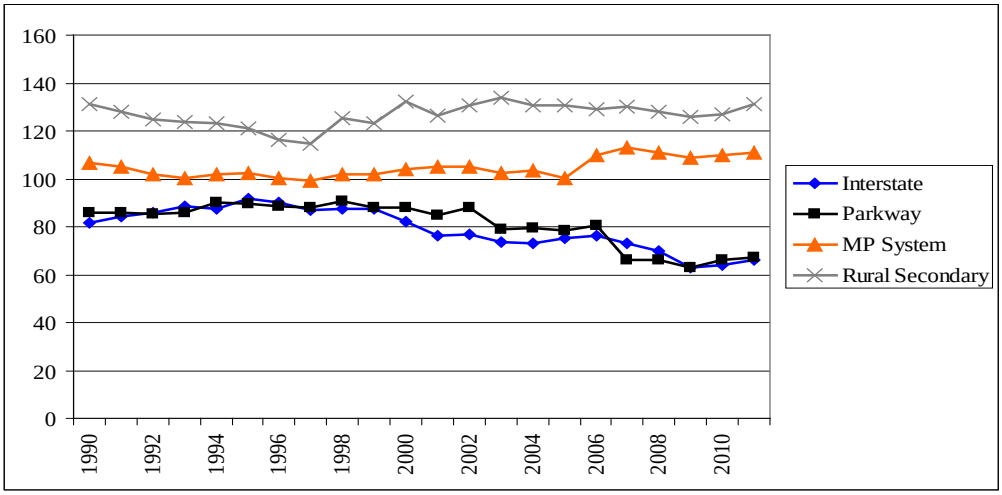



*Source: Kentucky Transportation Cabinet*

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**

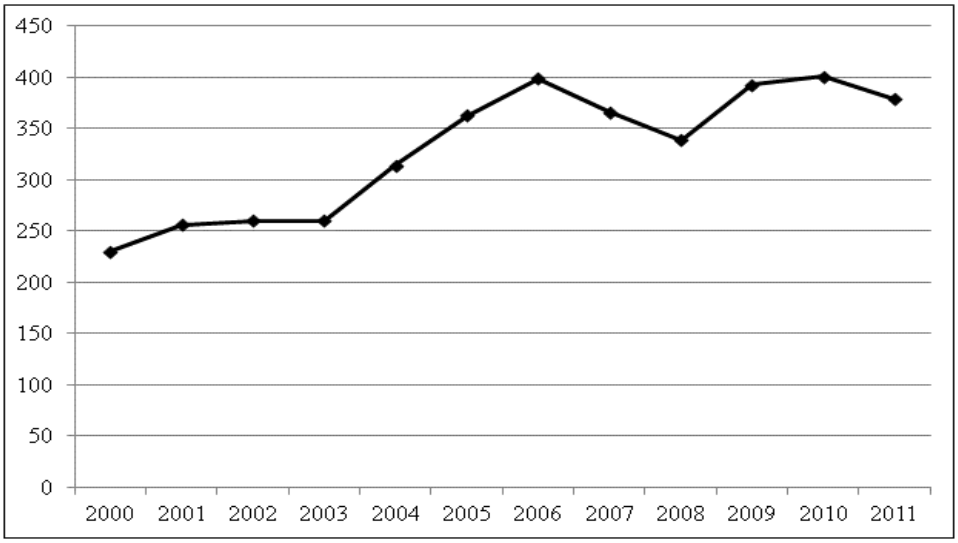



*Source: Kentucky Transportation Cabinet*

### 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**

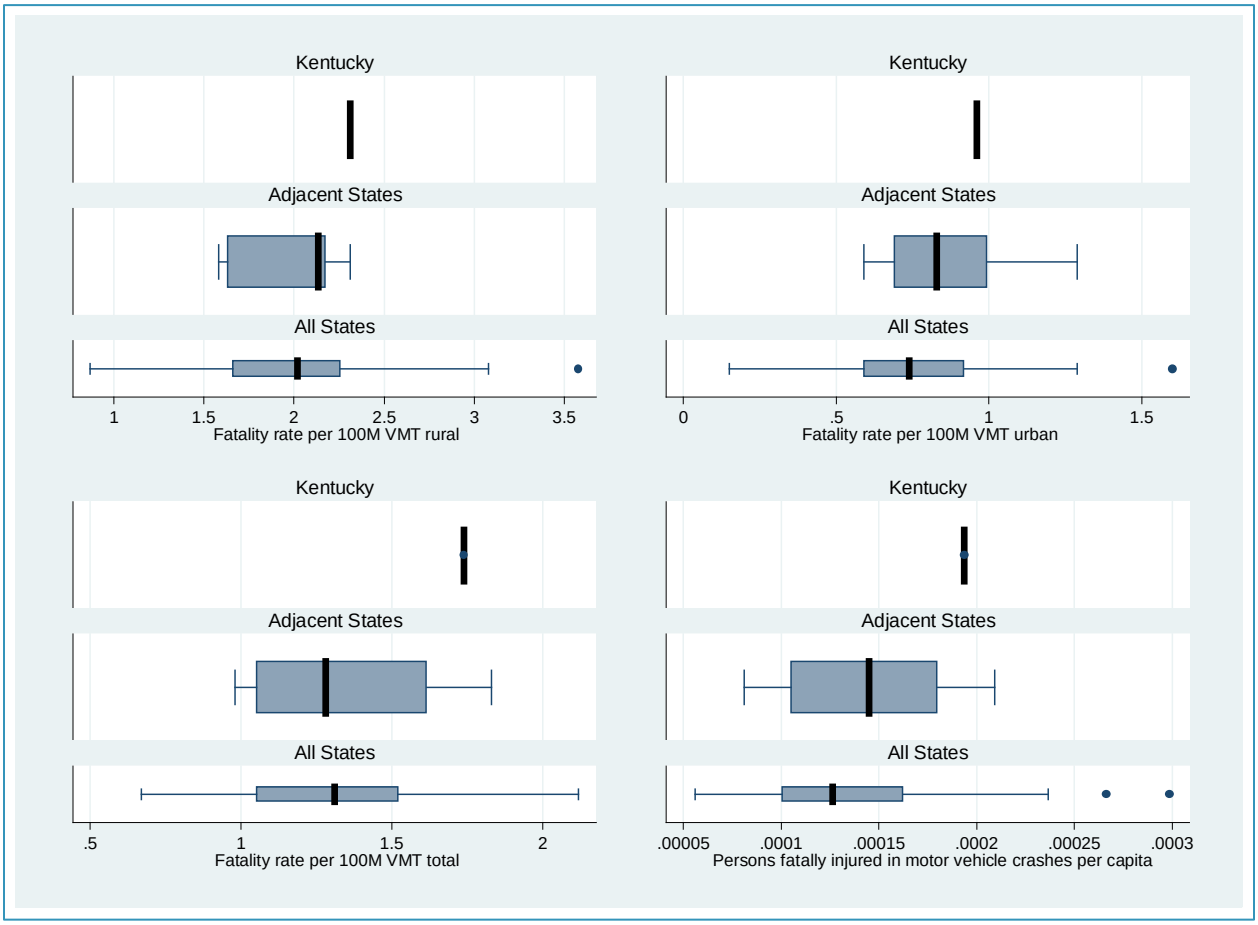



*Source: Kentucky Transportation Cabinet*

## 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.

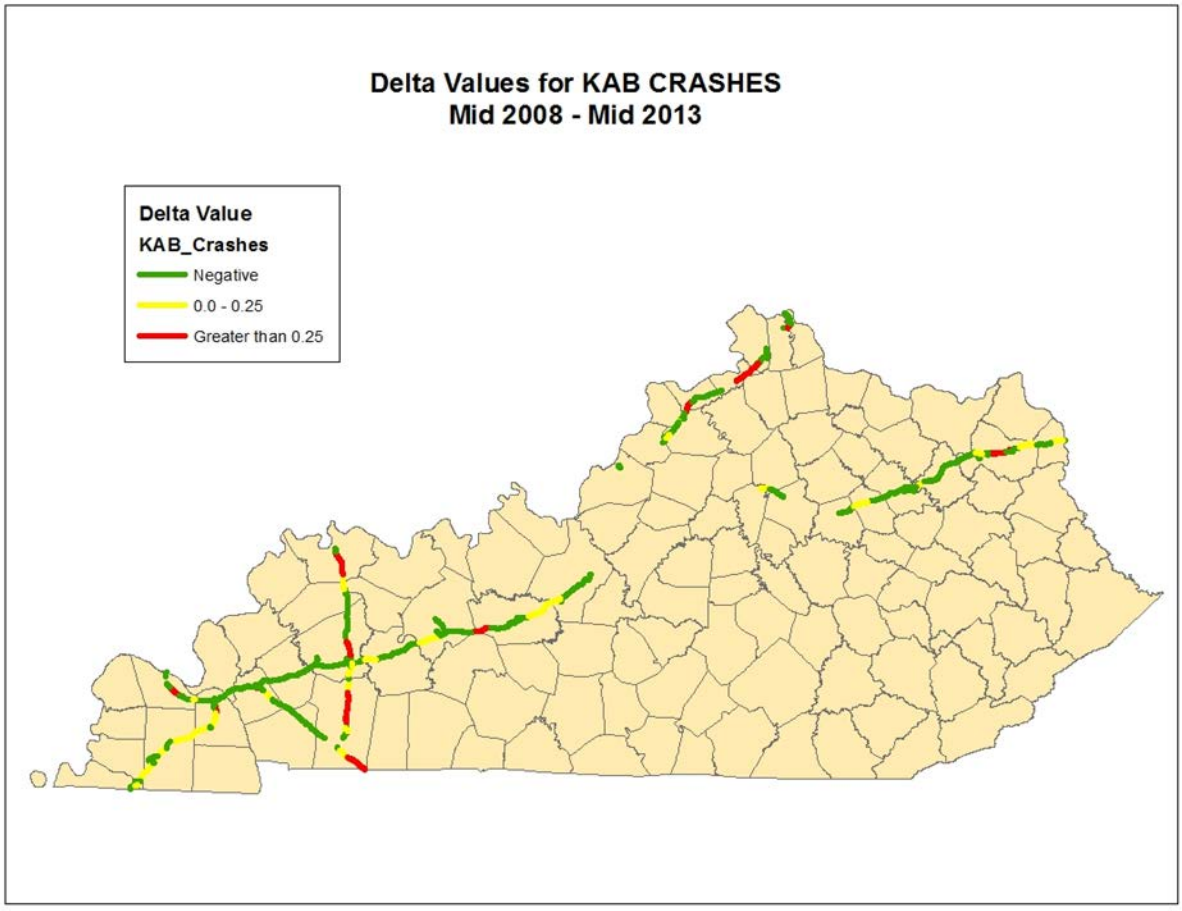
## Figure 4-5: Fatality Rate Comparison – All Vehicles




*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 Severity**




*Source: Kentucky Transportation Cabinet*

## 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.[32]

[32] *http://www.thinkkentucky.com/kyedc/pdfs/kytrannw.pdf*

## 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 4-3**. 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.

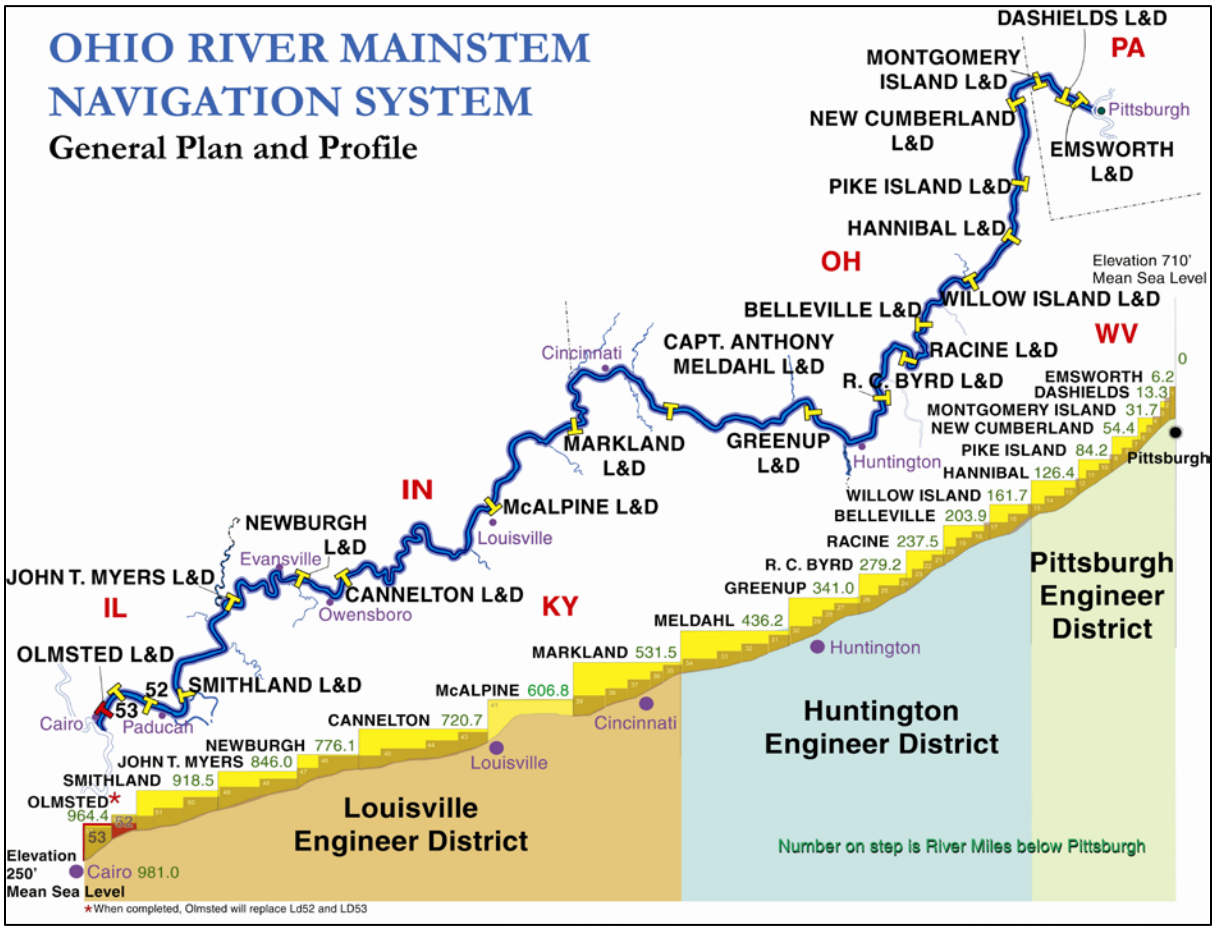
**Table 4-3: Kentucky Locks and Dams**

| 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 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*

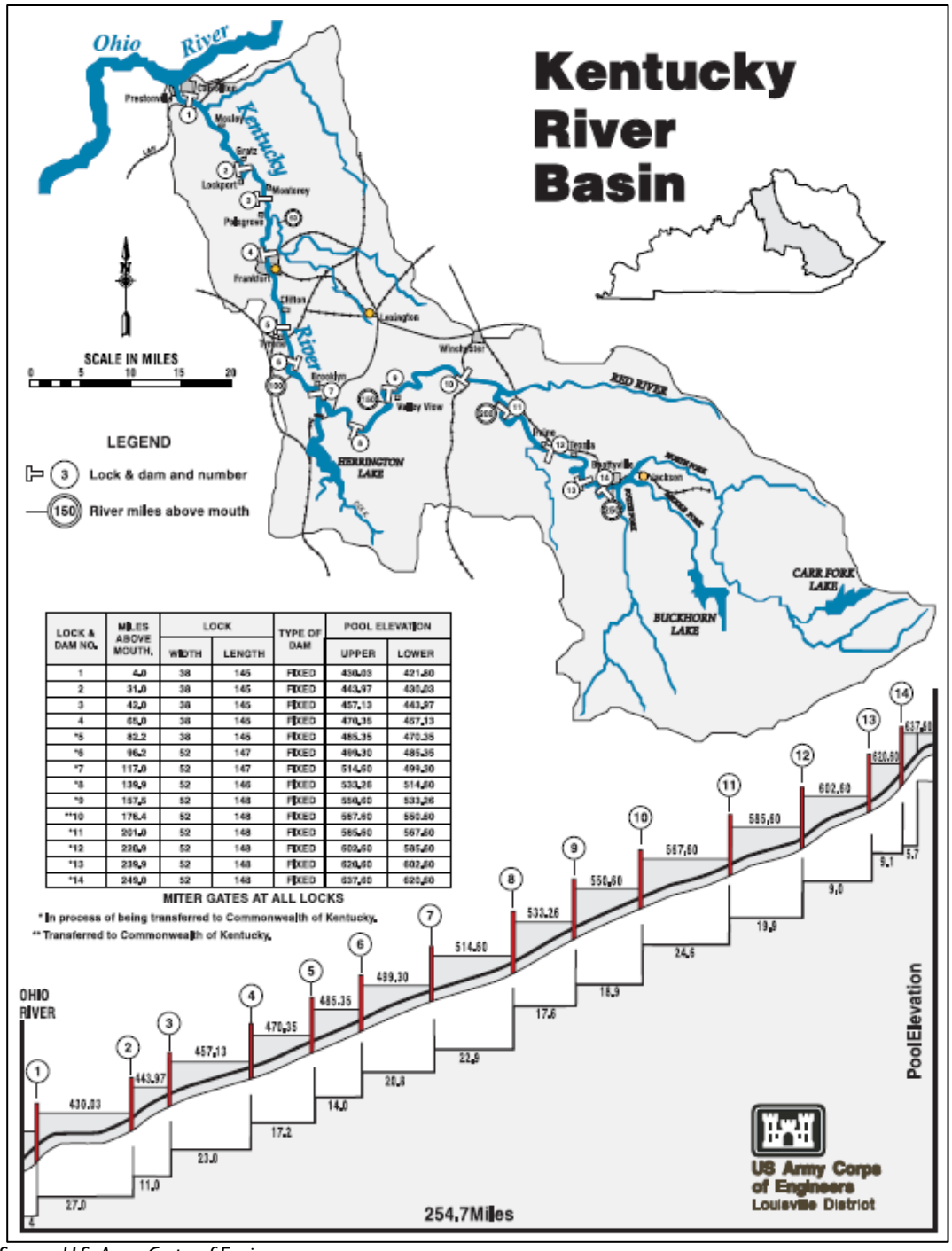
The USACE Louisville District operates the two locks and dams on the Green River. The Green River Locks and Dam No. 1 is located near Henderson. The Green River Locks and Dam No. 2 is located near Calhoun. Both locks and dams were constructed in the 1950s.

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




| LOCK & DAM NO. | MILES ABOVE MOUTH. | LOCK | | TYPE OF DAM | POOL ELEVATION | |
|---|---|---|---|---|---|---|
| | | WIDTH | LENGTH | | UPPER | LOWER |
| 1 | 4.0 | 38 | 145 | FIXED | 430.03 | 421.60 |
| 2 | 31.0 | 38 | 145 | FIXED | 443.97 | 430.03 |
| 3 | 42.0 | 38 | 145 | FIXED | 457.13 | 443.97 |
| 4 | 55.0 | 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 | 514.60 | 499.30 |
| *8 | 139.9 | 52 | 148 | FIXED | 533.26 | 514.60 |
| *9 | 157.5 | 52 | 148 | FIXED | 550.60 | 533.26 |
| **10 | 178.4 | 52 | 148 | FIXED | 567.60 | 550.60 |
| *11 | 201.0 | 52 | 148 | FIXED | 585.60 | 567.60 |
| *12 | 226.9 | 52 | 148 | FIXED | 602.60 | 585.60 |
| *13 | 239.9 | 52 | 148 | FIXED | 620.60 | 602.60 |
| *14 | 249.0 | 52 | 148 | FIXED | 637.60 | 620.60 |

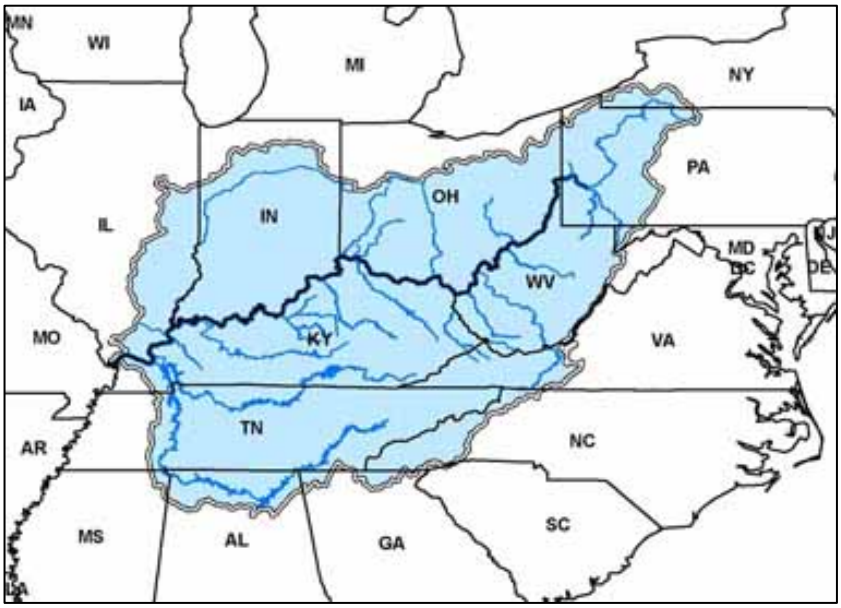
*Source: U.S. Army Corps of Engineers*

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.[33]

**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

[33] *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.[34]

## 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 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.

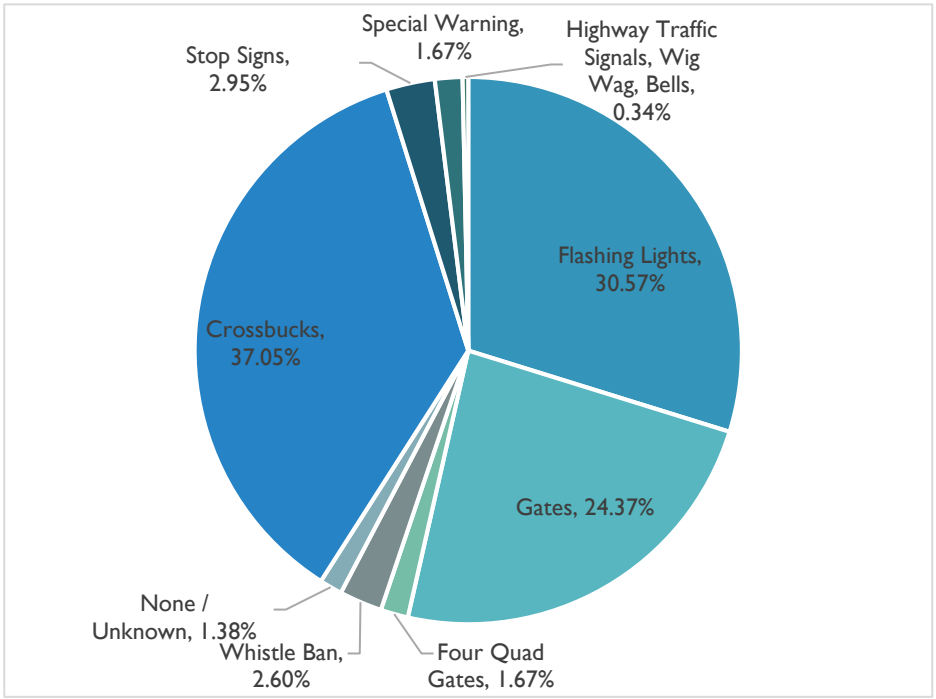
### 4.3.2 Rail Safety

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.

[34] *http://www.thinkkentucky.com/kyedc/pdfs/kytrannw.pdf*

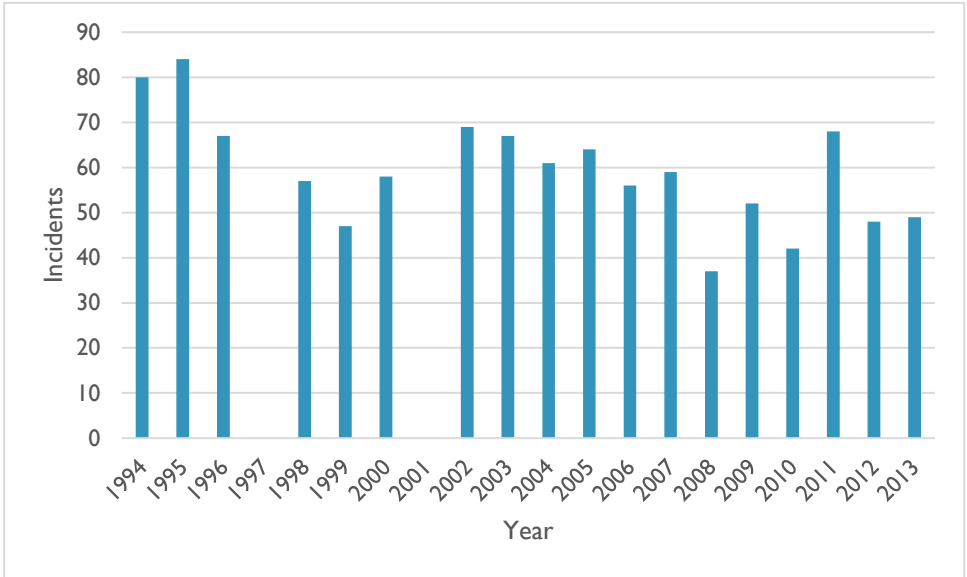
## Figure 4-10: Kentucky Highway-Rail At-Grade Crossings by Warning Device, 2013




*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.

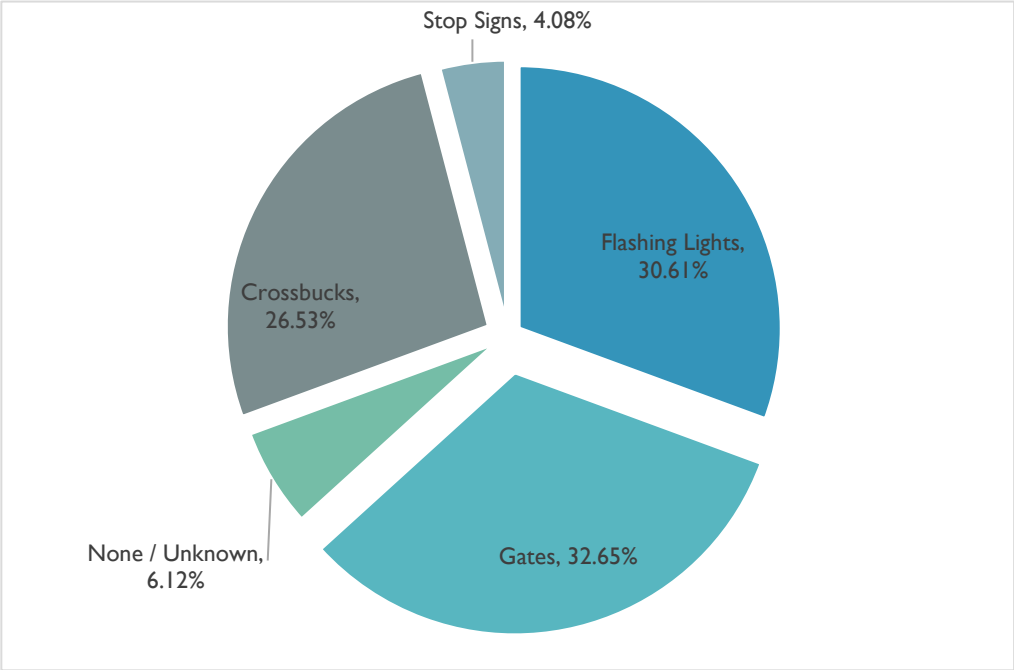
## Figure 4-11: Kentucky Highway-Rail At-Grade Crossing Crashes, 1994-2013




*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 4-4** shows the fatality and injury accidents from 2008 to 2013.

### Table 4-4: 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*

## 4.4 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

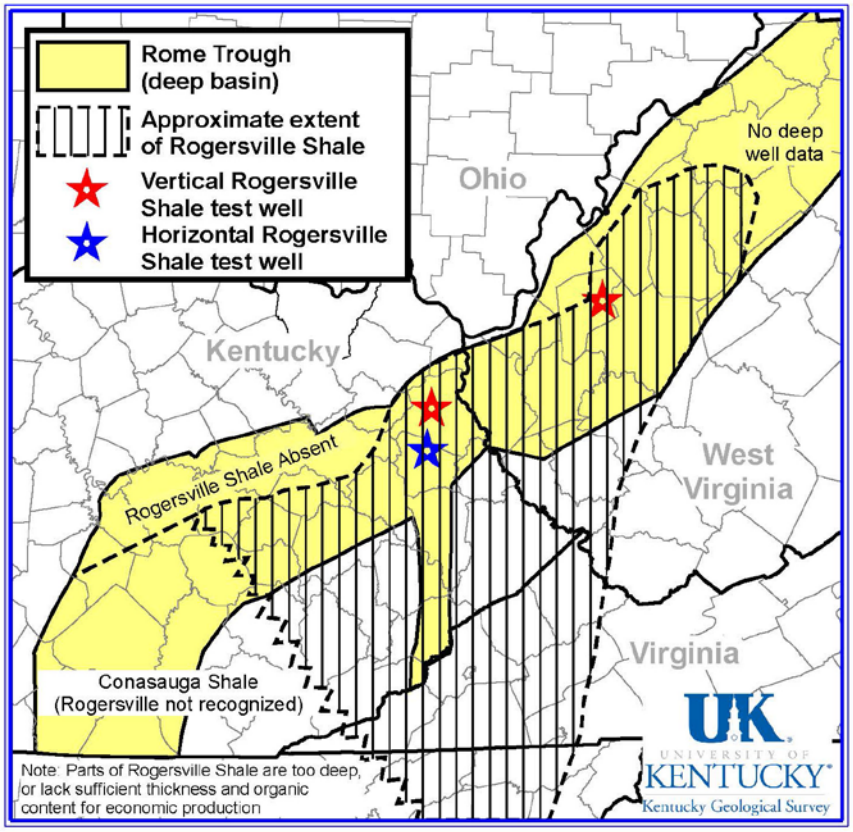
In Kentucky, 97 percent of the pipelines transport natural gas. The total miles of natural gas transmission pipelines are among the highest of any state in the Southeast.

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.[35]

The Rogerville 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 Rogerville Shale becomes a usable energy source, this would result in future expansion of pipelines in Kentucky.

[35] *http://www.kindermorgan.com/content/docs/Broad_Run_FactSheet.pdf, Accessed on March 18, 2016.*

**Figure 4-13: Rogerville Shale**

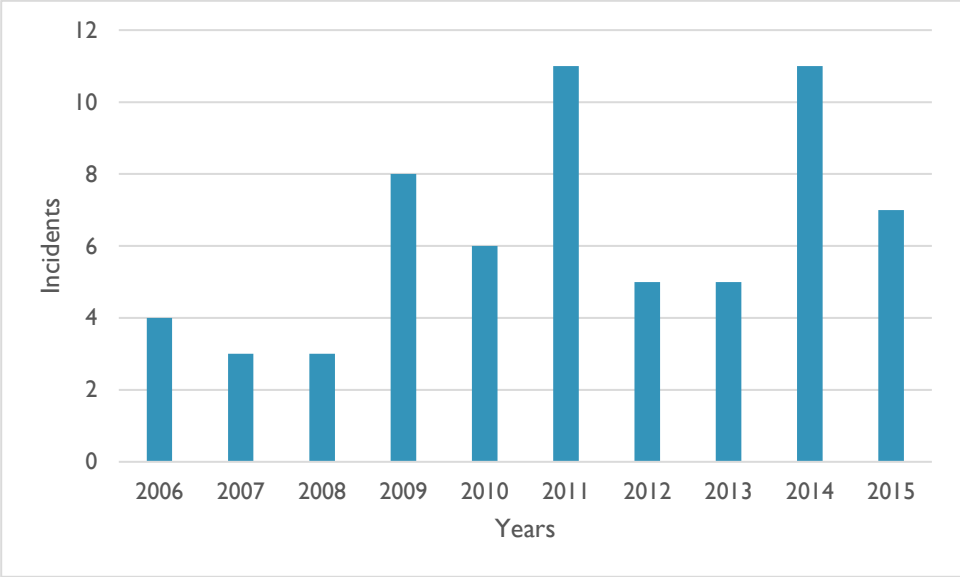



*Source: University of Kentucky*

## 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. **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 4-5**, Cincinnati/Northern Kentucky International Airport and Louisville International Airport can handle cargo planes for both domestic and international operations.

**Table 4-5: 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.[36]

## 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.

[36] *http://nats.aero/blog/2013/08/airport-capacity-more-than-just-tarmac-and-terminals/, Accessed March 18, 2016.*