Stantec

US 460
Corridor Study

Item No. 10-80101
Johnson and Magoffin Counties, Kentucky

DECEMBER 2024

TEAM KENTUCKY®
TRANSPORTATION CABINET

Final Report

US 460 Corridor Study

KYTC Item No. 10-80101.00

Kentucky Transportation Cabinet Central Office, Division of Planning Highway District 10 (Jackson) and District 12 (Pikeville)

In partnership with:

December 2024

Executive Summary

The Kentucky Transportation Cabinet (KYTC) initiated the *US 460 Corridor Study*, KYTC Item No. 10-80101.00, in Johnson and Magoffin Counties to evaluate the need for and potential benefits that may be realized from improving the route between Salyersville and Paintsville. The study area is shown in **Figure ES-1.**

Existing Conditions

US 460 is a major east-west arterial through eastern Kentucky and a regionally important route. Within the Appalachian Region, US 460 connects Salyersville and Paintsville while also providing a direct route to the Mountain Parkway in Magoffin County. Because of this connectivity, US 460 serves dual roles: it provides access to local businesses / homes *and* serves as an artery for regional through traffic. Listed on the National Highway System (NHS) and the National Truck Network (NN), US 460 also provides connectivity to important regional resources such as Paintsville Lake State Park and Paintsville Appalachian Regional Healthcare (ARH) Hospital.

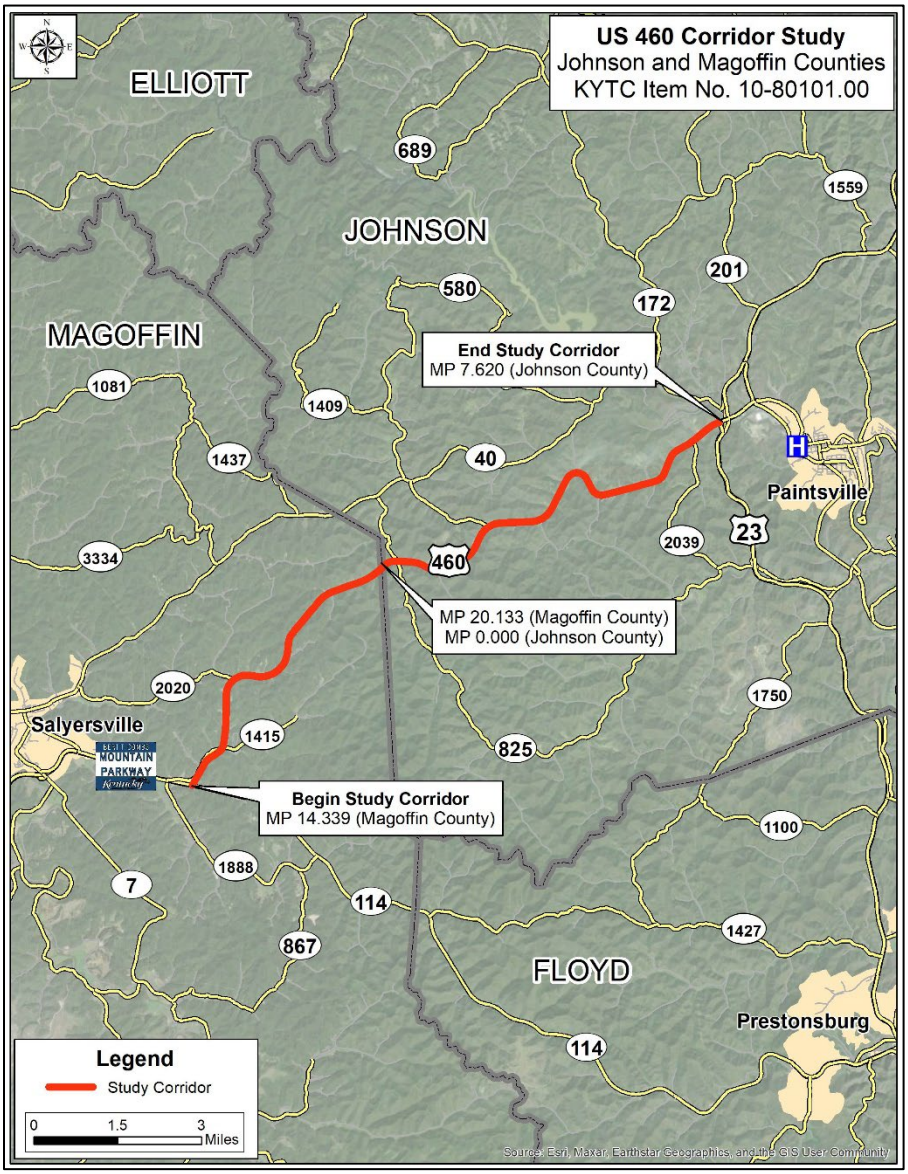

Figure ES-1: US 460 Study Corridor

US 460 is a rural, undivided two-lane principal arterial with 12-foot lanes and ten-foot shoulders with a posted speed limit of 55 miles per hour (mph). The just under 13.5-mile-long study portion of US 460 has four eastbound passing lanes and four westbound passing lanes, with approximately 1.5 to three miles between passing lanes. Approximately 51 percent of the study corridor allows passing via dashed centerline striping or a passing lane. A review of roadway geometrics revealed no substandard horizontal curves (based on a 55 mph design speed) and one substandard sag vertical curve at milepoint 16.9 in Magoffin County. However, travel speeds in excess of 55 mph are common.

Current daily traffic volumes range from 5,100 vehicles per day (VPD) near Paintsville to 3,400 VPD in Magoffin County. Results from a Highway Capacity Software (HCS) traffic analysis revealed that US 460 currently operates at an acceptable Level of Service (LOS).

Traffic forecasts were developed using growth rates from the *2022 Mountain Parkway Expansion Traffic Forecast Report*, which included 1.92 percent annual growth for trucks and -0.25 percent for autos. Based on this annual growth rate, US 460 is expected to carry up to 6,000 VPD in 2045 and would continue to operate at an acceptable LOS without additional capacity. Using the assumption that a two-lane road with passing lanes operates with a LOS D at 16,000 VPD, annual daily traffic would have to grow at a rate ranging from 3.74 to 6.87 percent per year through 2045 before US 460 operates at a less-than-desirable LOS D.

Current and future traffic volumes along US 460 have acceptable traffic operations without need for additional capacity.

Kentucky State Police Crash data collected from 2018 to 2022 revealed a total of 77 reported crashes on the study portion of US 460, five of which resulted in a fatality (6 percent) and 23 resulted in an injury (30 percent). The most common crash types were single vehicle (56 percent) and rear end crashes (25 percent). The Crash Data Analysis Tool (CDAT) was used to perform an Excess Expected Crashes (EEC) analysis. EEC is a measure of the crash frequency at a given site compared to what is expected based on current conditions (geometrics, traffic, etc.). A positive EEC indicates more crashes are occurring than would be expected. All segments on US 460 had negative EECs, indicating fewer crashes have occurred than what would be expected.

Superelevation, where the outer edge of the roadway pavement is raised higher than the inner edge within a curve to allow vehicles to more comfortably negotiate the curve, was field-measured at three horizontal curves identified as high-density crash spots, as shown in **Table ES- 1**. The measured superelevation was higher than the recommended maximum of eight percent on rural roads in mountainous terrain, based on KYTC geometric guidelines[1].

Table ES-1: US 460 Superelevation Rates

Route	County	Milepoint	Superelevation
US 460	Magoffin	15.5	9.3%
	Johnson	0.3	12.8%
		4.3	10.7%

[1] https://transportation.ky.gov/Highway-Design/Highway%20Design%20Manual/HD-700.pdf

Local Official / Stakeholder Outreach

Over the course of the study, the project team met with local officials and stakeholders to provide information and to solicit input on transportation concerns and potential improvements to the study corridor. Overall, feedback from the local officials and stakeholders suggested the greatest concern is improving safety on US 460.

Improvement Concepts

Three improvement concepts were developed to improve safety and mobility along the US 460 study corridor. The improvement concepts include spot improvements, four-lane widening, and a 2+1 roadway conversion.

Spot improvements – Safety improvements to lower the superelevation by decreasing the height difference from the inner roadway curve to the outer roadway curve and flattening horizontal curves at three high crash density locations.

Four-Lane Widening – Widening the existing roadway from two to four lanes with a depressed grass median, as shown in **Figure ES-2.** This improvement concept includes two twelve-foot lanes in each direction, 12-foot outside shoulders (10 feet paved), and a 40-foot depressed median. This section is consistent with the Mountain Parkway Expansion.

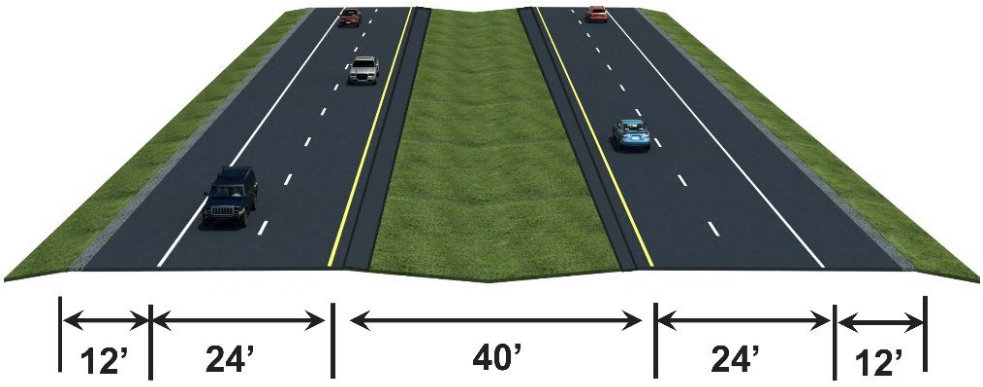

Figure ES-2: Four Lane Widening

2+1 Roadway – A three-lane road with two lanes in one direction (one meant for passing). The direction of the passing lane alternates and provides increased capacity and less waiting time behind slow vehicles and trucks. **Figure ES-3** presents a possible typical section for a 2+1 roadway. Lane, shoulder, and median widths may vary.

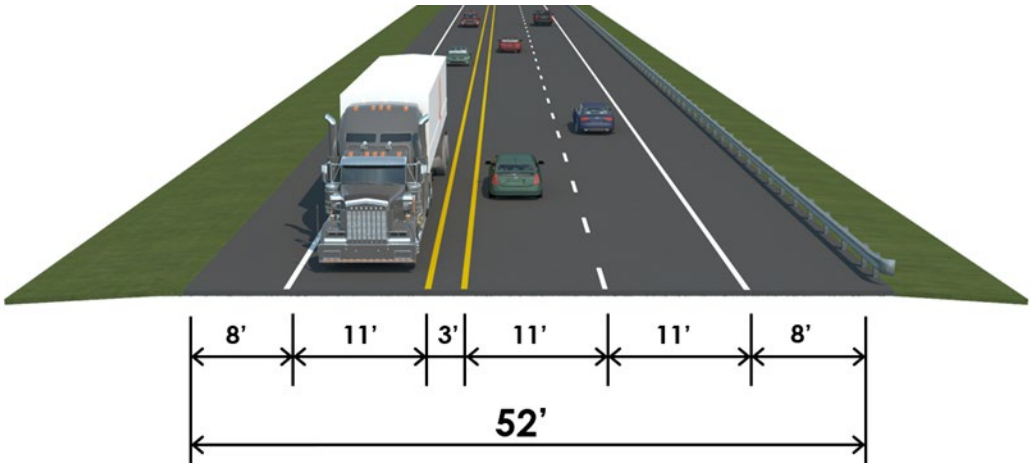

Figure ES-3: 2+1 Improvement Concept

Conclusions

A return on investment (ROI) analysis was performed to compare the improvement concept costs, including design, right-of-way acquisition, utility relocations, and construction, to the 20-year safety benefit, as shown in **Table ES-2**. The safety benefits were estimated using crash modification factors (CMFs) from the Crash Modification Clearinghouse. A CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. An ROI above 1.0 indicates the safety benefits outweigh the costs. The spot improvements have the highest ROI as they were specifically targeted to provide proven crash reduction countermeasures in areas with the highest concentrations of injury and fatal crashes, while the 2+1 Roadway has ROIs ranging from 0.58 to 2.52. This range is due to the estimated crash reduction from various CMFs. The lower ROI is based on a CMF that assumes reduction of head on, rear end, and sideswipe crashes only, while the higher ROI is based on crash reduction for all crash types. The four-lane widening has the lowest ROI of 0.28.

Table ES-2: 20-Year Return on Investment

Concept	2024 Total Cost	Safety Benefit	20-Yr ROI
Spot Improvements	$10,770,000	$63,000,000	5.85
2+1 Roadway	$41,880,000	$105,400,000*	2.52*
		$24,400,000**	0.58**
4-Lane Widening	$225,389,000	$64,100,000	0.28

Based on the projected traffic volumes, cost estimates, and anticipated safety benefits, the local officials and stakeholders showed strong support for the 2+1 Roadway concept. The concept has been found to provide many of the benefits of a four-lane widening (i.e. increased efficiency for traffic flow while improving safety) at a significantly reduced cost and within a smaller footprint. Additionally, the 2+1 improvement concept could extend and / or connect the existing passing lanes on US 460, allowing it to be constructed over time as sections of independent utility.

KYTC has implemented 2+1 concepts along other routes in Kentucky (KY 55 in Adair County, KY 55 in Marion / Washington County) where projected traffic volumes do not justify four lanes but were higher than could be comfortably accommodated with two lanes and limited passing opportunities. The results of these past projects have been positive, including a 38 percent reduction in crashes on KY 55 in Marion and Washington Counties in the two years after construction of the 2+1. While capacity is not expected to be an issue on US 460, the additional passing lanes will improve safety and travel time reliability, while also adding the capacity needed if traffic on the corridor grows more than expected.

Next Steps

The next step following this study for any potential improvements would be Phase 1 Design (Preliminary Engineering and Environmental Analysis). This project is funded as KYTC Item No. 10-80101 in *Kentucky's 2024-2030 Enacted Highway Plan* with $3,750,000 in Design (2025), $1.12 million for Right-of-Way (2027), $500,000 for Utilities (2027), and $37.5 million for Construction (2028). As part of the preliminary design, the typical section should be revisited to ensure all project goals are addressed.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The Kentucky Transportation Cabinet (KYTC) initiated the *US 460 Corridor Study,* KYTC Item No. 10-80101.00, in Johnson and Magoffin Counties to evaluate the need for and potential benefits that may be realized from improving the route between Salyersville and Paintsville. Magoffin County is in the eastern portion of KYTC District 10 and Johnson County is in the western portion of KYTC District 12, as shown in **Figure 1.**

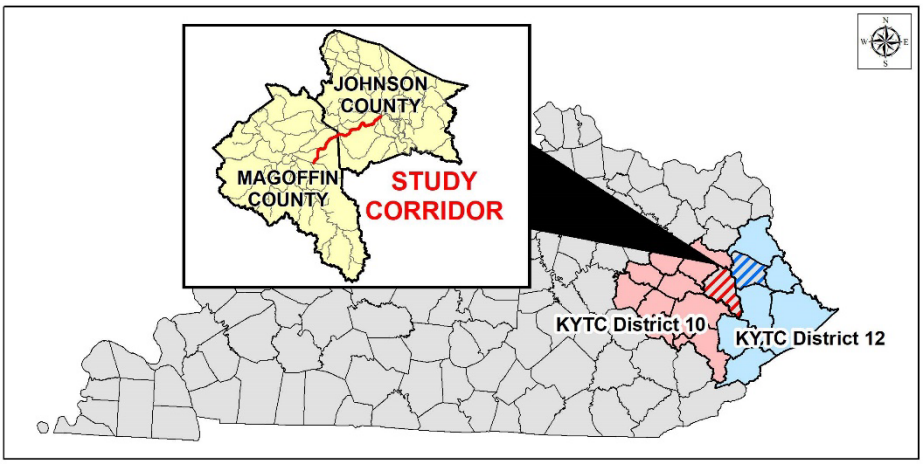

Figure 1: KYTC Districts 10 & 12

This study is funded with State Construction Funds (SPP). Future phases for this project are listed in *Kentucky's FY 2022 – 2028 Highway Plan,* as mentioned in Section 1.2.

1.1 STUDY CORRIDOR

US 460 is a major east-west arterial through eastern Kentucky, and a regionally important route. Within the Appalachian Region, US 460 connects Salyersville and Paintsville while also providing a direct route between KY 114 and the Mountain Parkway and US 23. Because of this connectivity, US 460 serves dual roles: it provides access to local businesses and homes and serves as an artery for regional through traffic. The study corridor, shown in **Figure 2**, includes just under 13.5 miles of US 460 from the KY 114 intersection at milepoint 14.339 in Magoffin County to US 23 in Johnson County at milepoint 7.620. Listed on the National Highway System (NHS) and the National Truck Network (NN), US 460 also provides connectivity to important regional resources such as Paintsville Lake State Park and Paintsville Appalachian Regional Healthcare (ARH) Hospital.

Magoffin County has an area of 310 square miles and is the 60th largest county in Kentucky. According to 2022 data provided by the Kentucky State Data Center (KSDC), Magoffin County's population has decreased over the past 20 years and continued decline is expected. Salyersville is the county seat of Magoffin County and had a 2020 census population of 1,591.

With an area of 262 square miles, Johnson County is the 77th largest county in Kentucky. According to 2022 data provided by the KSDC, Johnson County's population has declined over the past 20 years and continued decline is expected. The county seat of Johnson County is Paintsville, with a 2020 census population of 4,312.

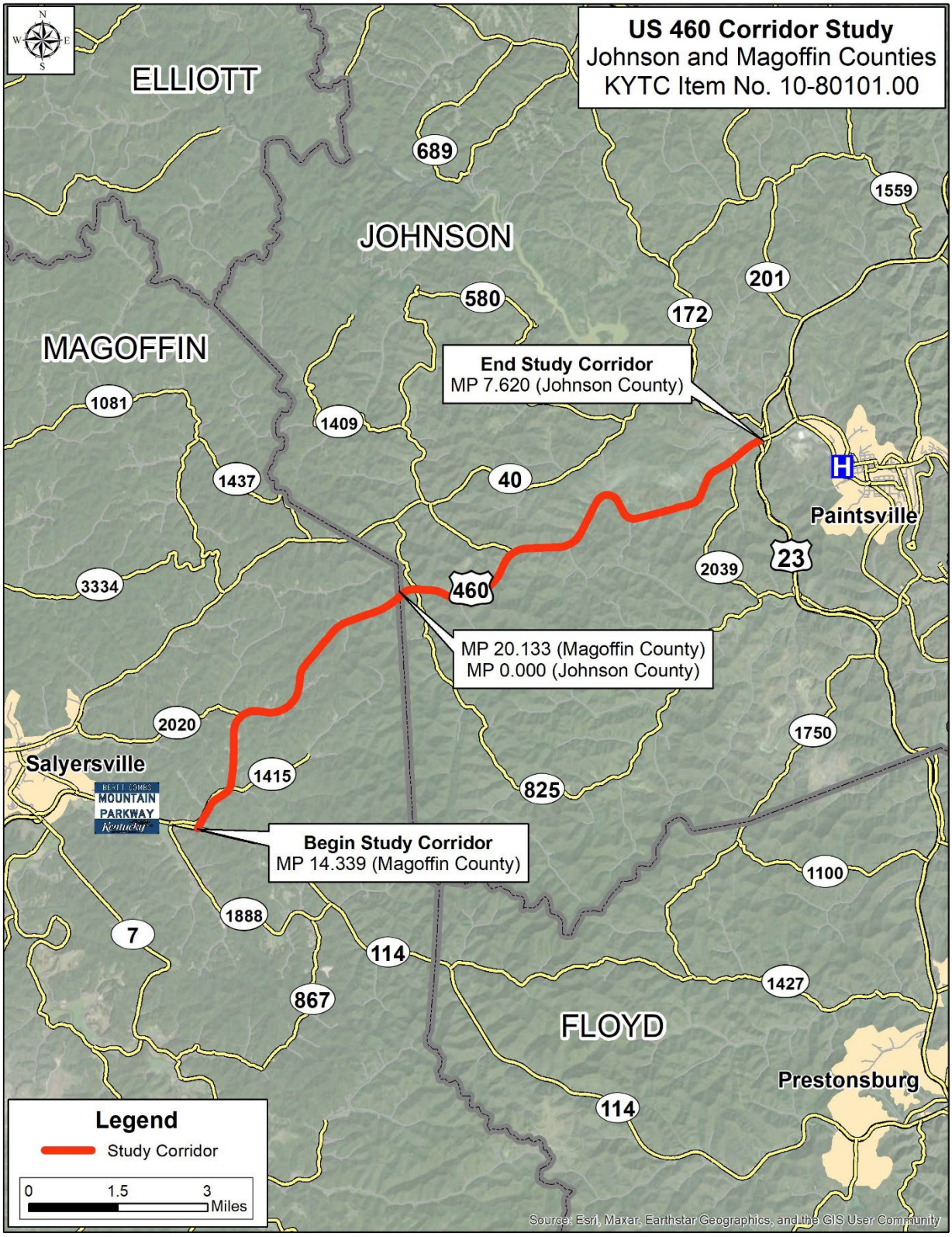

Figure 2: Study Area

1.2 PLANNED AND COMMITTED PROJECTS

The *US 460 Corridor Study* was first listed in Kentucky's FY 2022 – 2028 Highway Plan as follows:

- KYTC Item No. 10-80101: Improve US 460 from the intersection with KY 114 to the interchange with US 23. Length is 13.46 Miles. $176,641,800 was budgeted in State Priority Project (SPP) funds. (P = $1 million (2022), D = $7.95 million (2025), R = $7.212 million (2026), U = $10.479 million (2026), C = $150 million (2027)).

There are three additional projects on or near the US 460 study corridor, as shown in **Figure 3**:

- KYTC Item No. 10-169.00 includes extending the Mountain Parkway Corridor from US 460 to the Floyd/Magoffin County line. (C = $35 million (2024), $50 million (2027), $50 million (2028), $77.54 million (2029), $2.08 million (2030)). This is listed in the 2024 Enacted Highway Plan as a Kentucky Mega Project.
- KYTC Item No. 10-20013.00 includes addressing pavement conditions on US 460 from MP 14.57 to 20.37 in Magoffin County (C = $1.485 million).
- KYTC Item No. 12-80250.00 includes constructing an access road to the proposed Johnson County High School and Middle School Campus (R = $750,000 (2024), U = $350,000 (2025), C = $2,000,000 (2026), $8,609,253 (2027))

2.0 EXISTING CONDITIONS

Conditions of the existing transportation network were examined and are discussed in the following sections. The information compiled includes roadway facilities and geometrics, crash history, and traffic volumes within the study area. Data for this section were collected from KYTC's Highway Information System (HIS) database, KYTC's Traffic Count Reporting System, aerial photography, and field inspection.

2.1 FUNCTIONAL CLASSIFICATION

Functional classification is the process of grouping streets and highways according to the character of travel service they provide. The functional classification of the study corridor and adjacent routes are shown in **Figure 4.** US 460 is classified as a rural principal arterial, or a route that provides a high level of mobility for substantial statewide travel. US 23 and KY 114 are also categorized as principal arterials.

2.2 ROADWAY GEOMETRY

KYTC's HIS database was used to identify roadway geometry. US 460 currently includes two 12-foot through lanes throughout the study corridor (with eight passing lanes, discussed in Section 2.2.2), as shown in **Figure 5.** The other east-west routes have lane widths less than 11 feet.

Shoulder widths along the study corridor and adjacent routes are shown in **Figure 6.** US 460 has 10-foot paved shoulders.

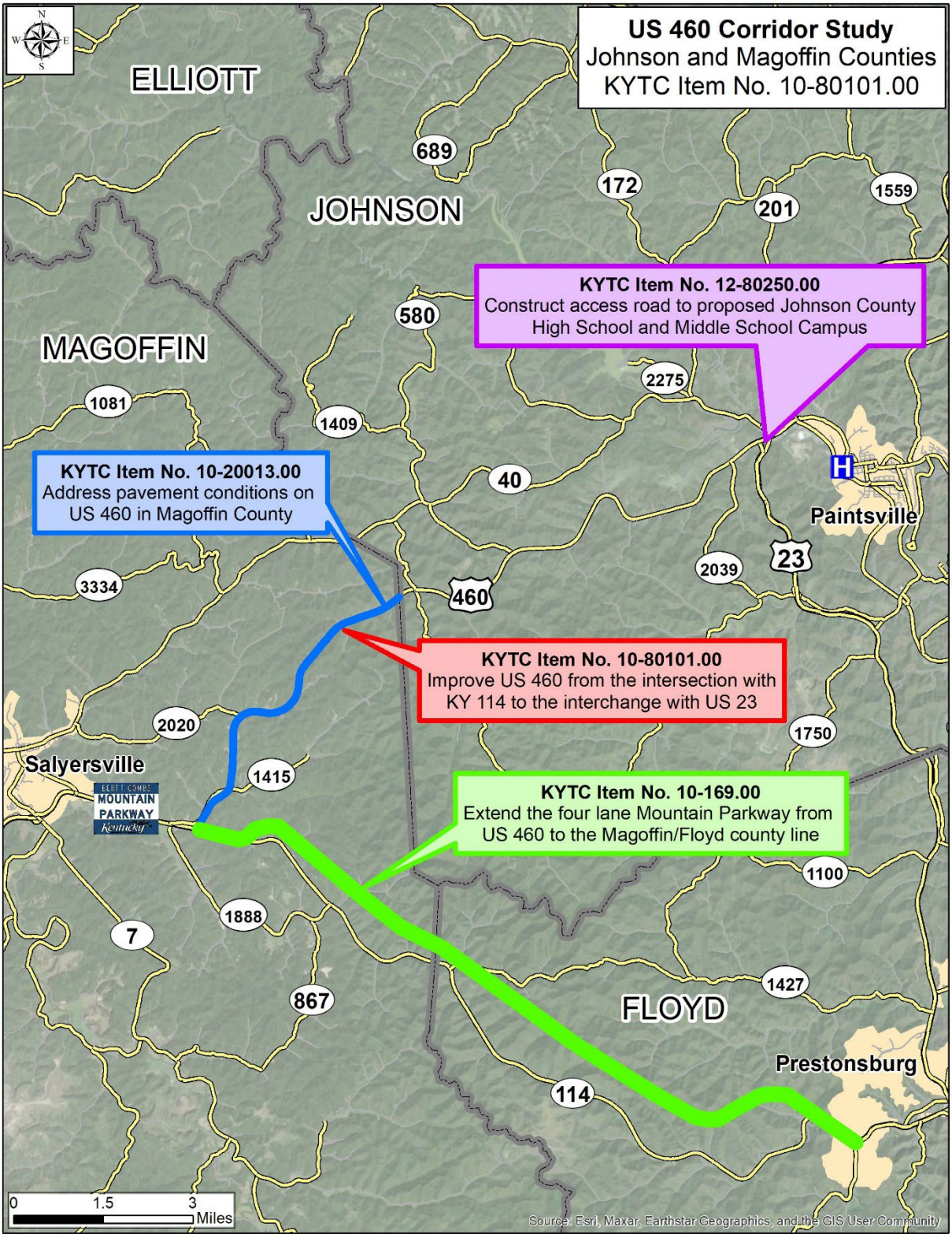

Figure 3: US 460 Current Projects

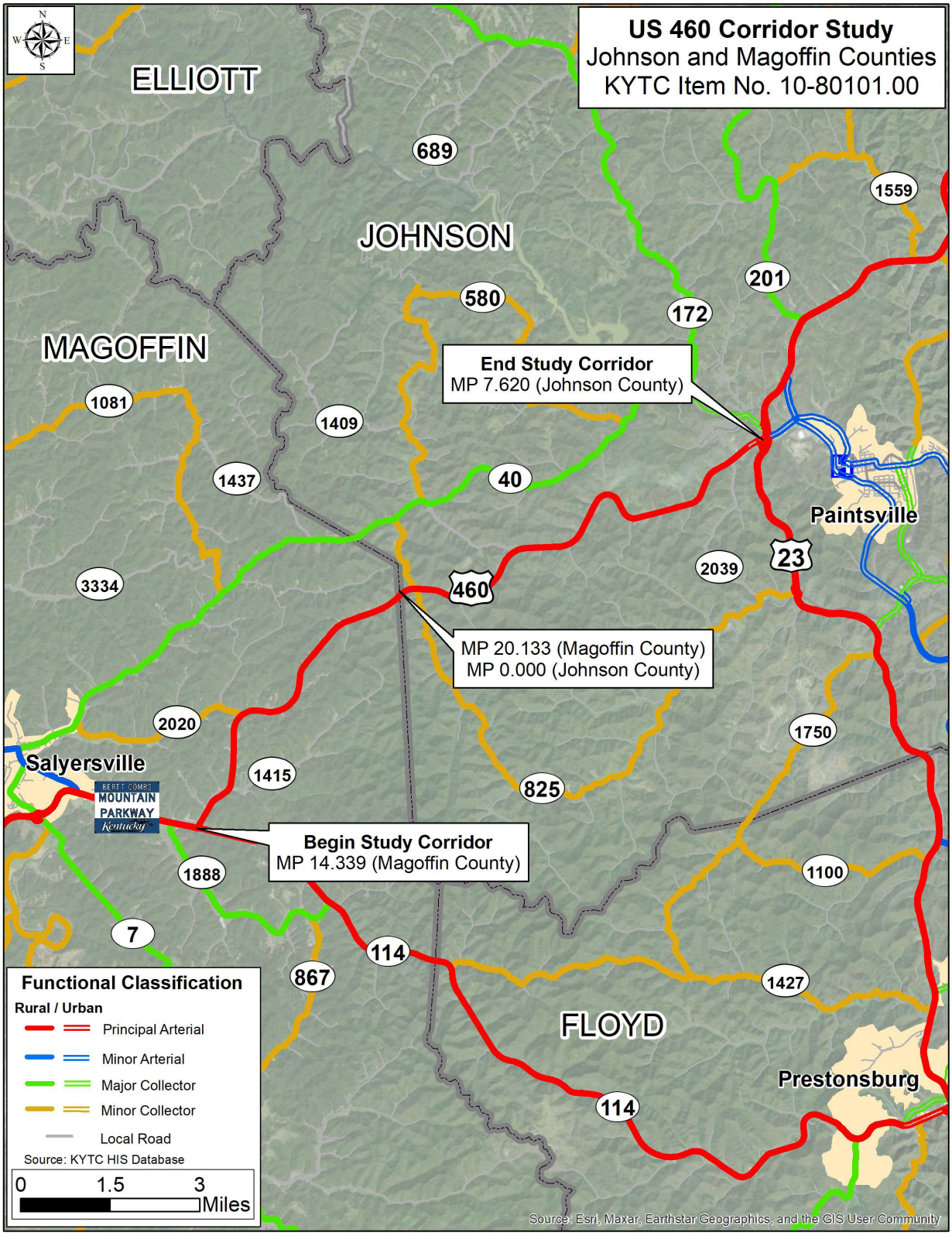

Figure 4: Functional Classification

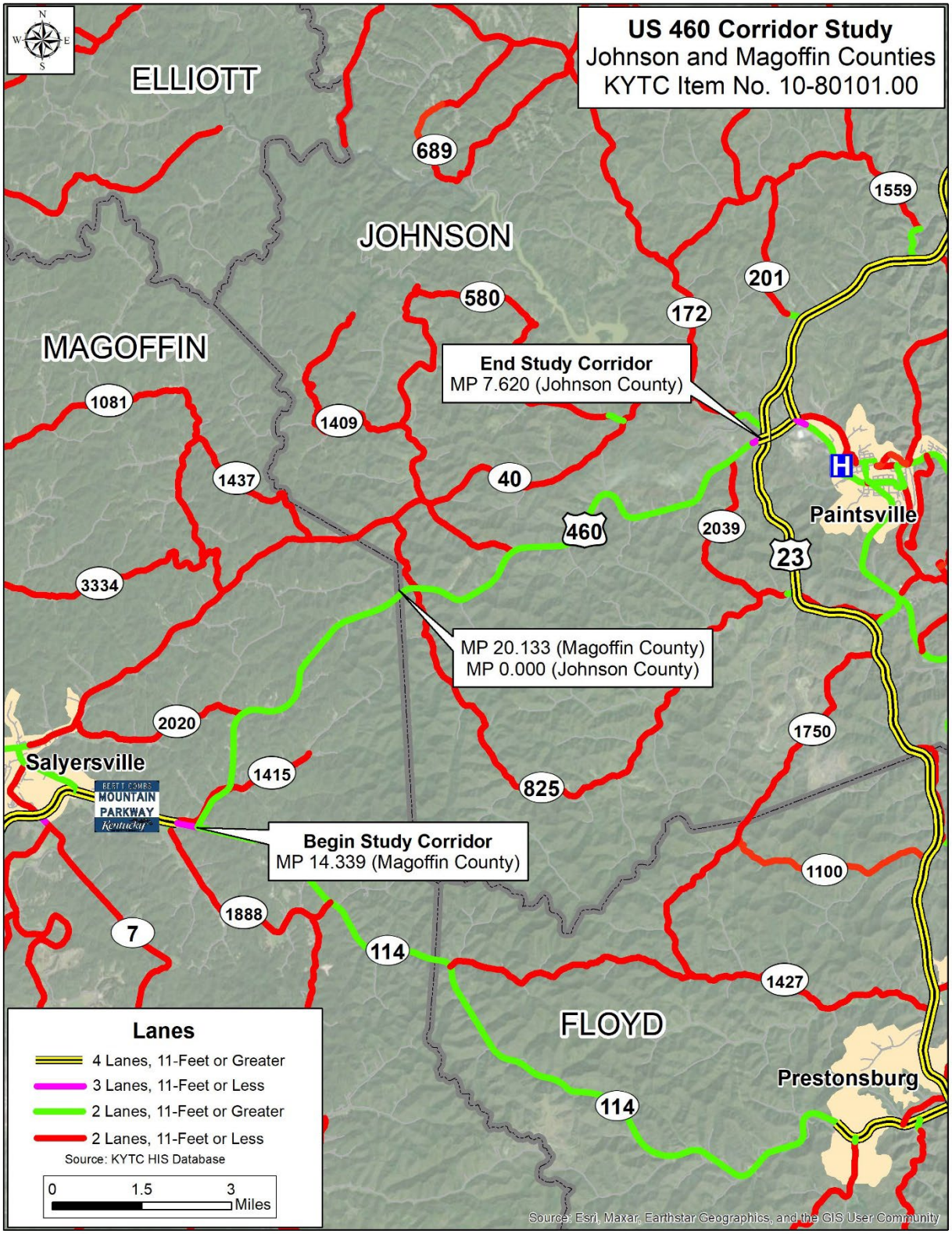

Figure 5: Lane Widths

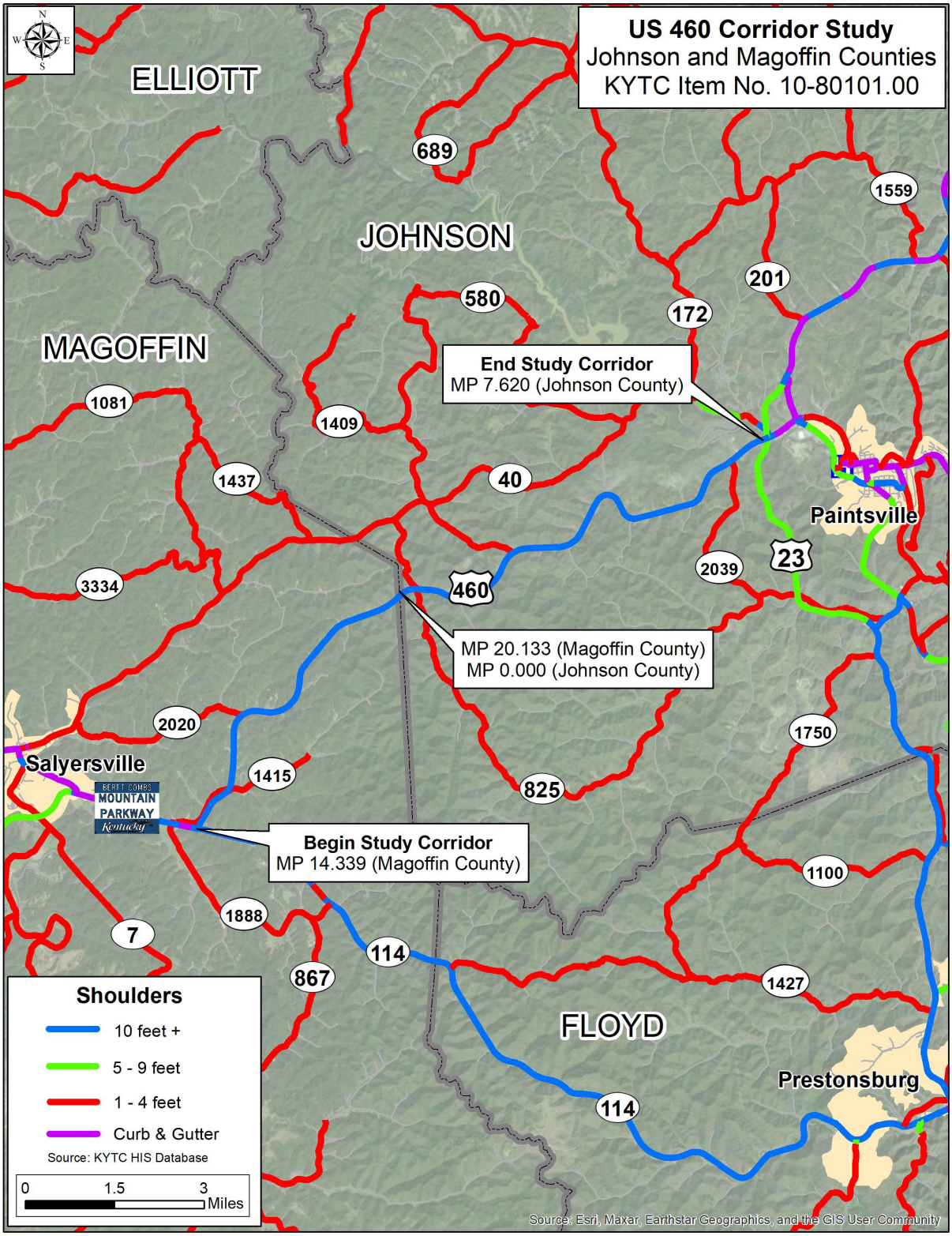

Figure 6: Shoulder Widths

2.2.1 Passing Lanes

There are eight dedicated passing lanes along the study corridor, as shown in **Figure 7**. Four of the passing lanes are in the eastbound direction and four are in the westbound direction for a total of 4.57 miles. Dashed centerline striping also indicates that passing is allowed on tangent sections where passing lanes are not present, and striping and passing lanes combine to indicate passing is possible for approximately 51 percent of the 13.5-mile-long study corridor.

2.2.2 Curvature and Grades

A review of record drawings revealed no substandard horizontal curves and one substandard vertical curve, at mile point 16.9, with a headlight stopping sight distance (HSSD) of 486 feet**.** The recommended HSSD at this location is 495 feet. Several segments have grades exceeding five percent, and generally passing lanes that also serve as truck climbing lanes are provided in these areas. High crash density locations were compared to the geometric summaries and passing lanes, as shown in **Figure 8** and **Figure 9.** A more detailed crash analysis is presented in Section 2.5 and a summary of the full geometric analysis is presented in **Appendix A**.

2.2.3 Superelevation

Superelevation is the rotation of the pavement on the approach to and through a horizontal curve, intended to assist the driver by counteracting the lateral acceleration produced by tracking the curve. The KYTC Highway Design Manual states that in general, a maximum superelevation of eight percent is to be used on rural roadways due to snow and ice frequencies[1].

Superelevation rates were evaluated for the entire corridor based on a review of the record drawings. All horizontal curves meet current design guidelines for a 55 mile per hour (mph) design speed, but three curves were further evaluated based on a combination of plan review and field inspection. Superelevation at these three locations was field-measured. **Figure 10** and **Table 1** present a summary of the superelevation measurements, which were all found to be above the recommended eight percent threshold. Additionally, four of the five collisions that resulted in fatalities between 2018 and 2022 occurred on these curves with superelevation rates greater than the recommended threshold.

Table 1: US 460 Superelevation Measurements

County	Route	MP	Latitude	Longitude	Superelevation
Magoffin	US 460	15.5	37.809968	-82.886	9.3%
Johnson	US 460	0.3	37.788509	-82.94515	12.8%
Johnson	US 460	4.3	37.74108	-83.00447	10.7%

[1] https://transportation.ky.gov/Highway-Design/Highway%20Design%20Manual/HD-700.pdf

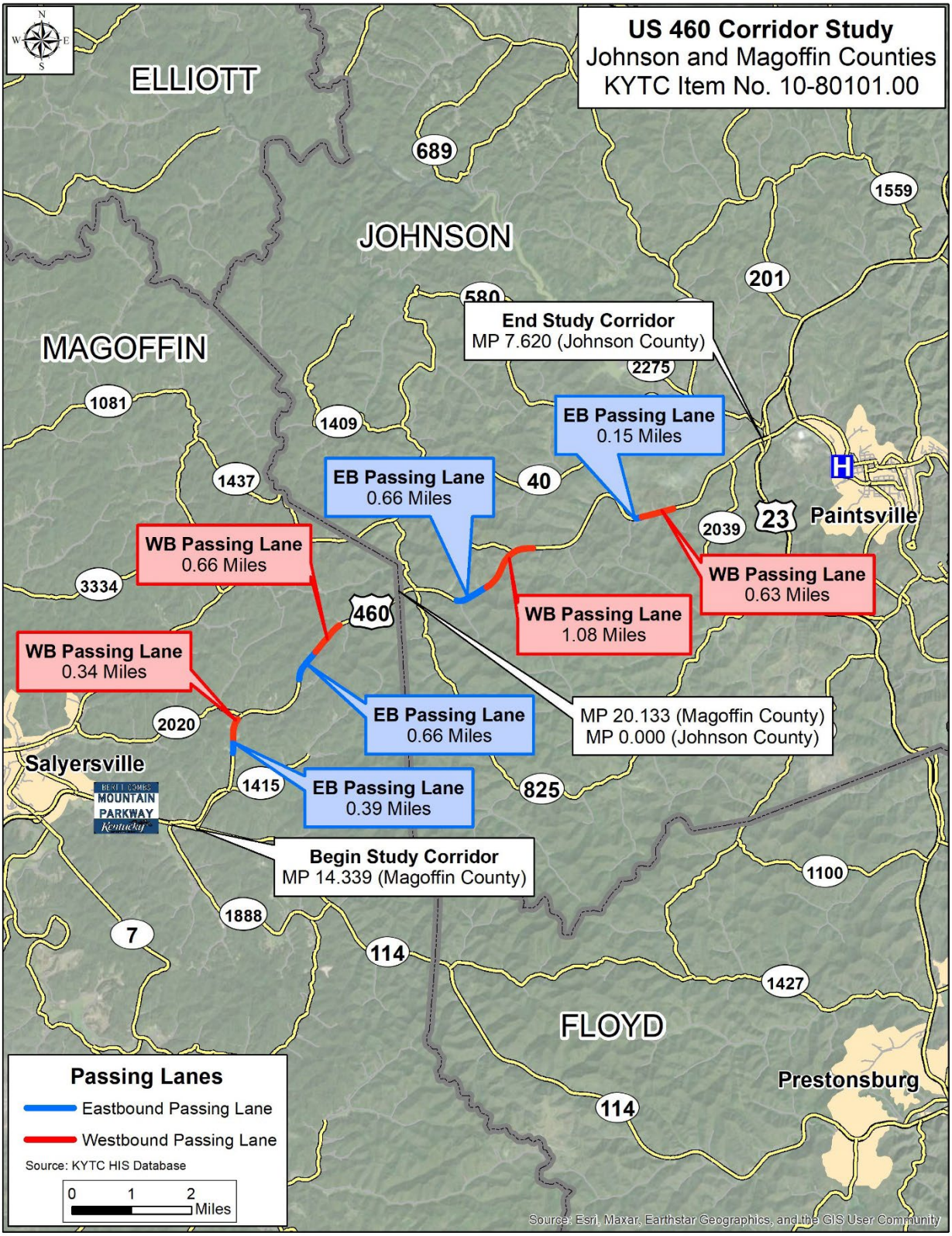

Figure 7: US 460 Passing Lanes

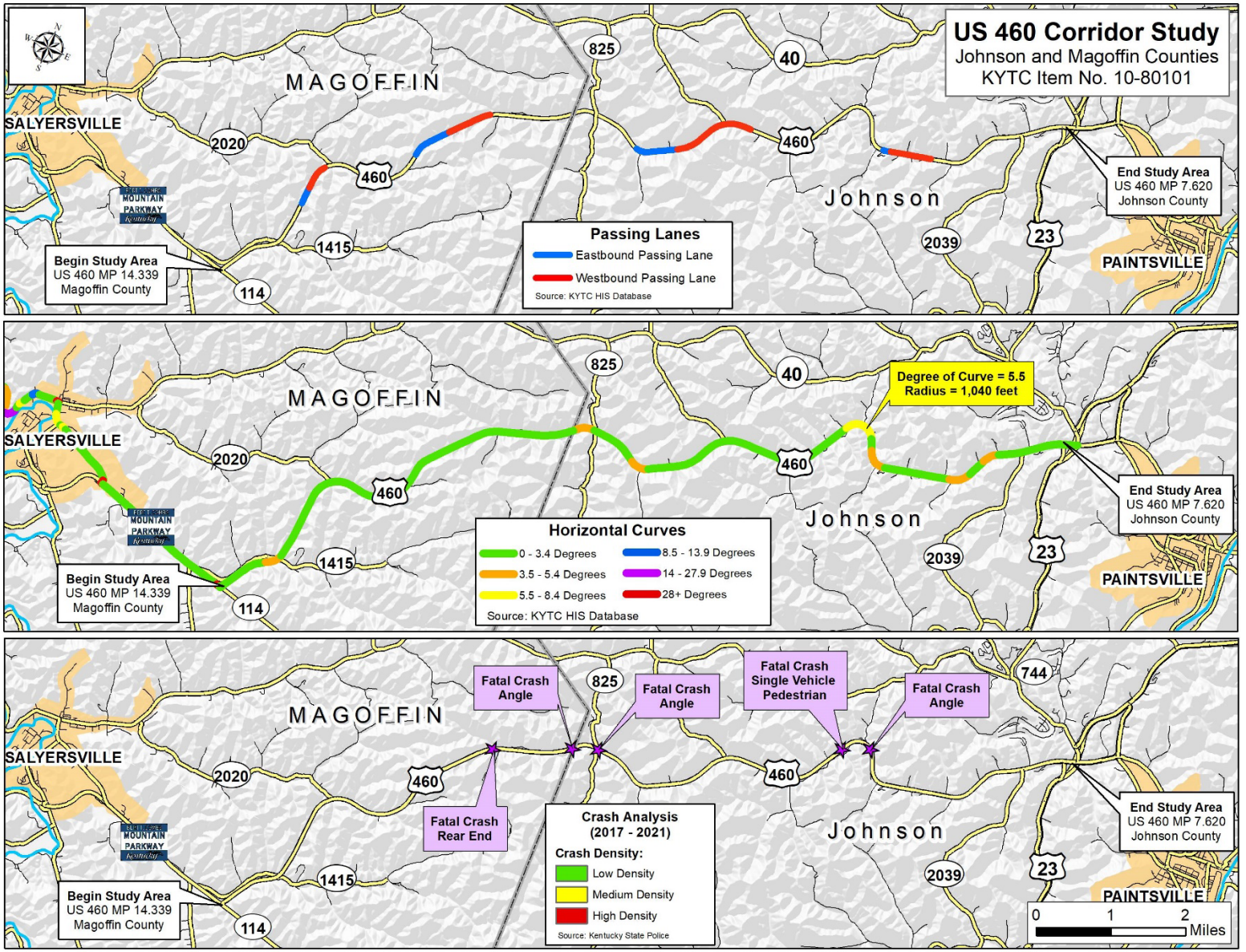

Figure 8: Horizontal Curves

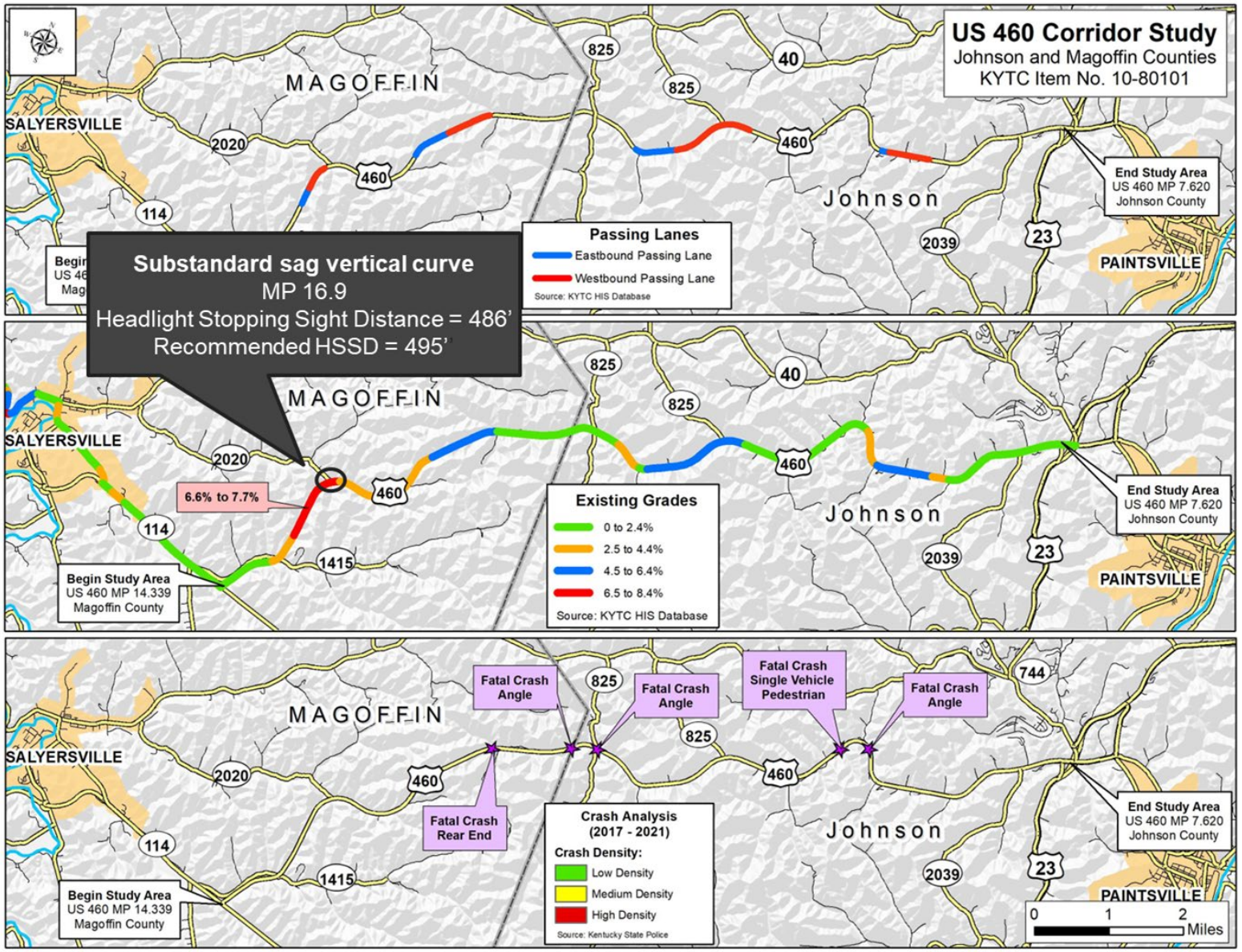

Figure 9: Grades

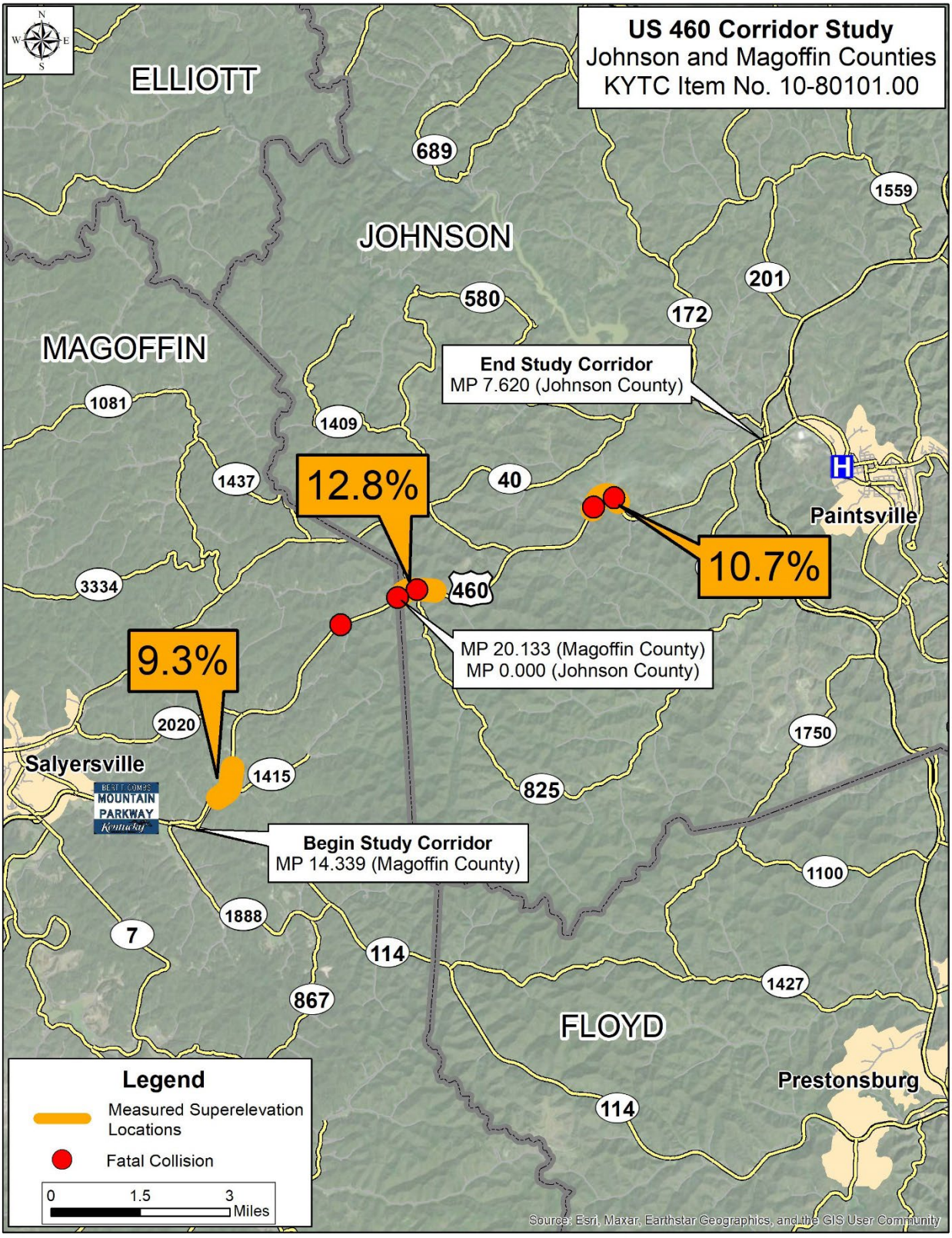

Figure 10: Field Measured Superelevation

2.3 SPEED LIMIT

Posted speed limits along the study corridor and adjacent roads are shown in **Figure 11**. US 460 maintains a 55-mph speed limit along the majority of the study corridor. As it approaches US 23, the speed limit reduces to 45 mph near Paintsville.

2.4 EXISTING TRAFFIC ANALYSIS

Existing daily traffic volumes were reviewed for the study corridor and adjacent roadways. The most current annual average daily traffic (AADT) volumes from KYTC's traffic count stations are shown on **Figure 12.** Daily traffic on US 460 ranges from 3,200 vehicles per day (VPD) in Johnson County near the county line to 5,500 VPD near US 23 in Paintsville. Truck percentages on US 460 range from seven percent in Magoffin County to 14 percent in Johnson County. KY 114 and US 23 have the highest levels of traffic in the area, with 8,800 VPD and 11,300 VPD, respectively.

Level of service (LOS), a qualitative measure describing operational conditions, was used to evaluate the adequacy of the existing roadway. In rural areas, LOS C or better is desirable and in urban areas, LOS D or better is desirable. A Highway Capacity Software (HCS) analysis indicates that US 460 currently operates at LOS A during the a.m. and p.m. peak hours.

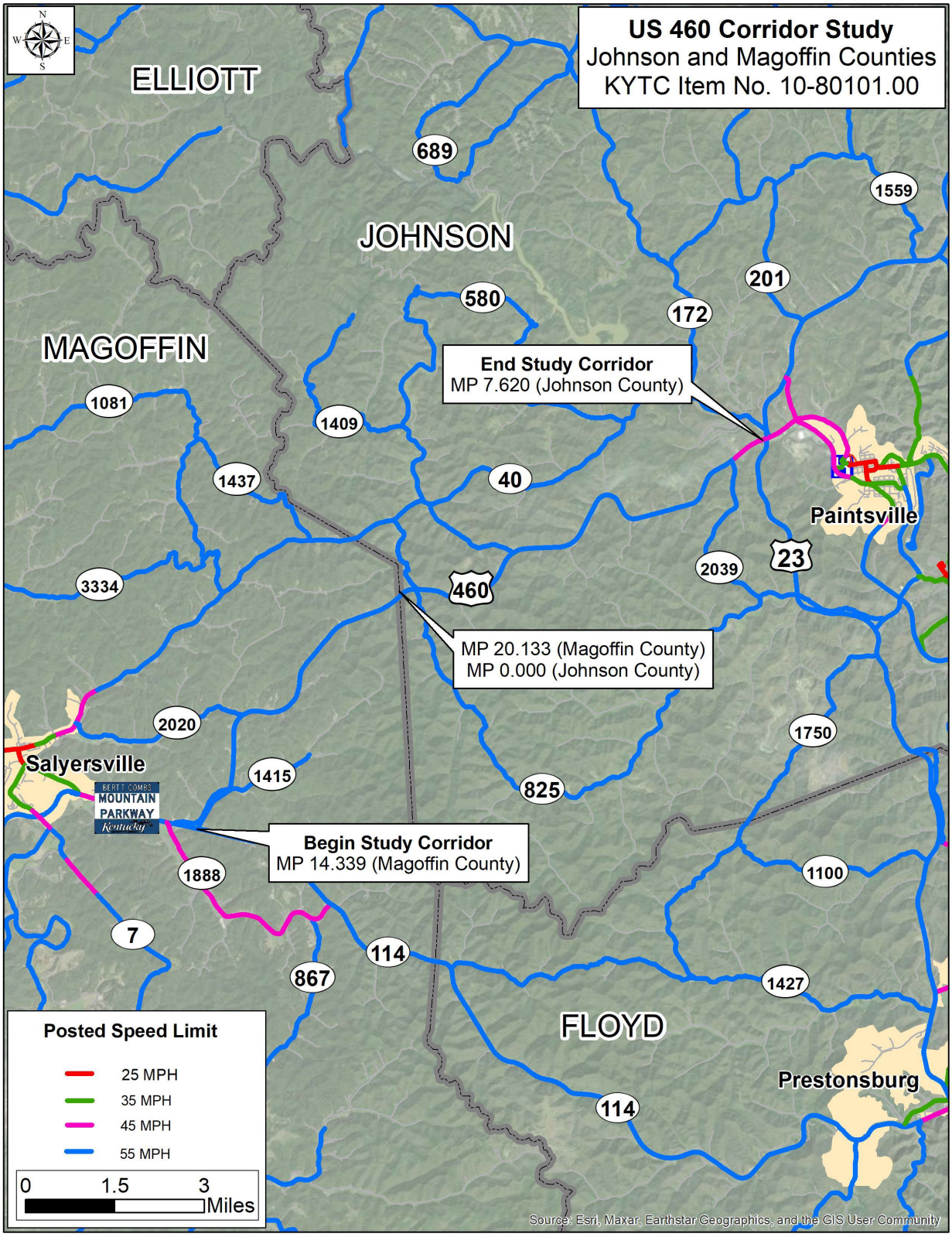

Figure 11: Speed Limit

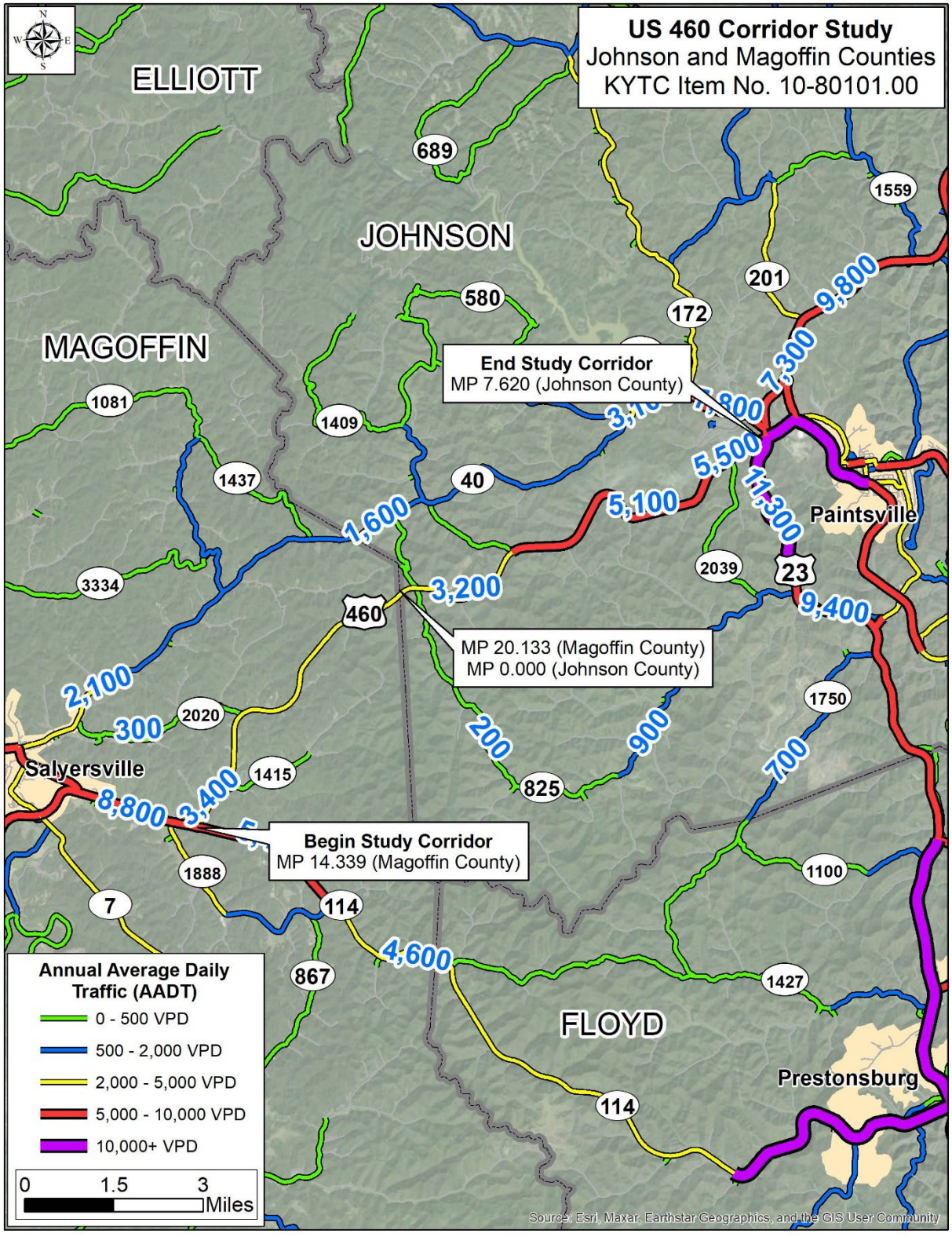

Figure 12: Annual Average Daily Traffic (AADT)

2.5 CRASH HISTORY

Crash data were collected along US 460 for the five-year period between 2018 and 2022[2]. Over that period, there were 77 crashes on the study portion of US 460. The crash records are included in **Appendix B.** Of the 77 reported crashes, five resulted in a fatality (six percent), 23 resulted in an injury (30 percent), and 49 resulted in property damage only (64 percent), as shown in **Figure 13**.

Of the five fatal collisions that occurred on US 460 between 2018 and 2022, four occurred within the limits of the curves discussed in Section 2.2.2 with superelevation rates greater than nine percent. At the horizontal curve near the Magoffin / Johnson County line, one fatal collision was the result of a vehicle crossing the centerline and colliding head on with a tractor trailer. The second fatality at this location was an angle collision that occurred when a vehicle pulled off of the shoulder in front of oncoming traffic. Two fatal collisions also occurred at the horizontal curve near MP 4.3 in Johnson County, one of which was a wet weather collision and the second was a collision with a pedestrian standing in the road for unknown reasons.

The most common crash types, as shown in **Figure 14**, were single vehicle (56 percent) and rear end crashes (25 percent). Additional crash data collected between 2018 – 2023 showed 28 animal collisions (31 percent) along the study corridor, 13 of which occurred in 2022.

Injury crash reports were requested for the 26 injury collisions on US 460 between 2017 – 2021, the original time period for the crash analysis. These collisions were analyzed to determine the severity of the injury collisions using the KABCO categorization scale. Of the 26 injury crashes, 15 (58 percent) were classified as "C" indicating a possible injury, seven (27 percent) were "B" indicating a suspected minor injury, and four (15 percent) were "A" indicating a suspected serious injury.

In addition to analyzing the severity of the injury collisions, the fatal and injury collisions were also summarized based on the reported contributing factors of the crash. The following breakdown summarizes the 31 fatal or injury crashes (26 injury and five fatal collisions):

- 10 were due to driver inattention
- Five were due to poor visibility (fog, rain, glare)
- Three were due to sickness (including medical emergencies)
- Three involved operating a vehicle while under the influence of drugs or alcohol,
- Three were animal collisions
- Two involved vehicle malfunctions
- Two occurred on wet pavement
- Two were rear end collisions
- One involved a pedestrian crossing US 460

[2] http://crashinformationky.org/

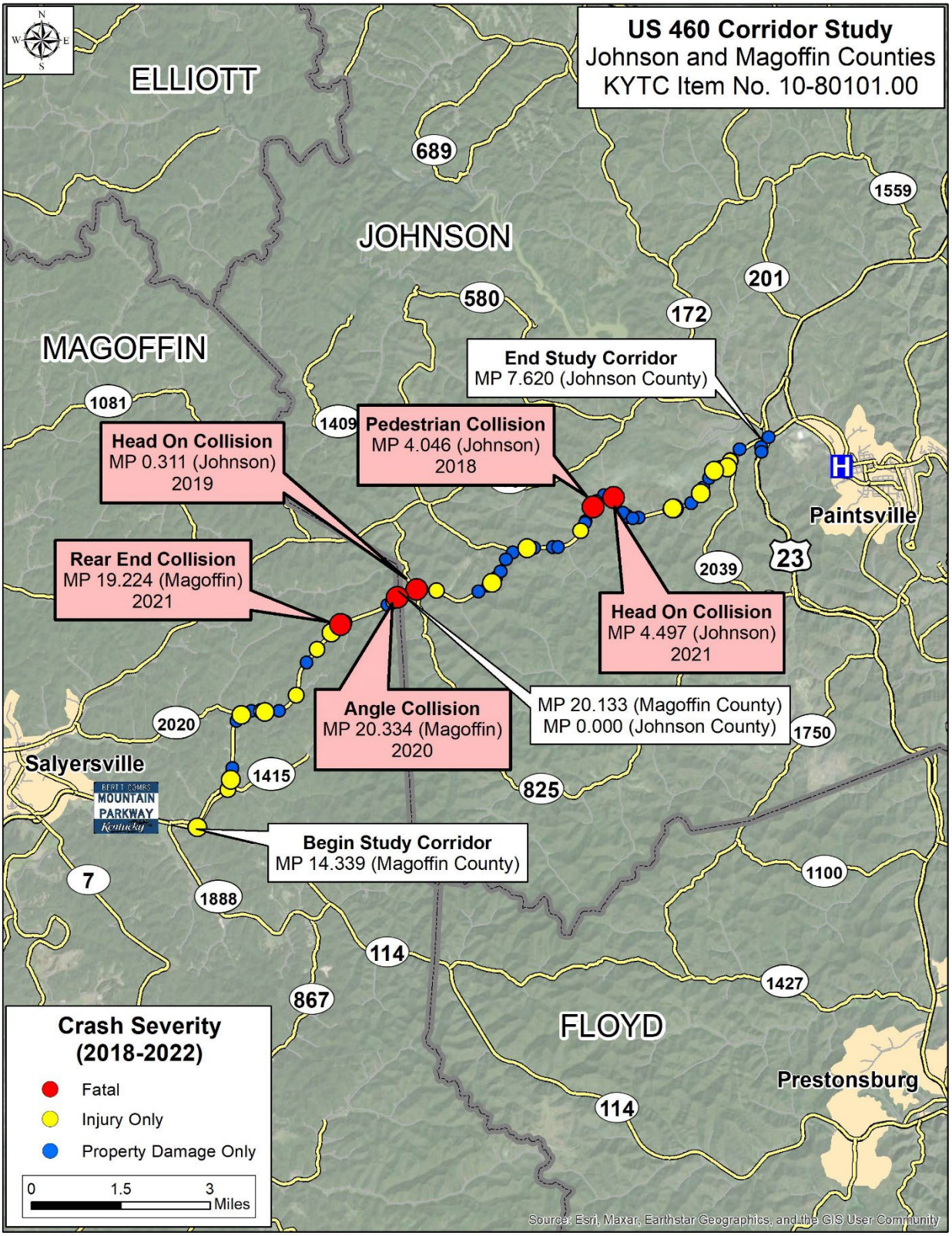

Figure 13: Crash Severity (2018 - 2022)

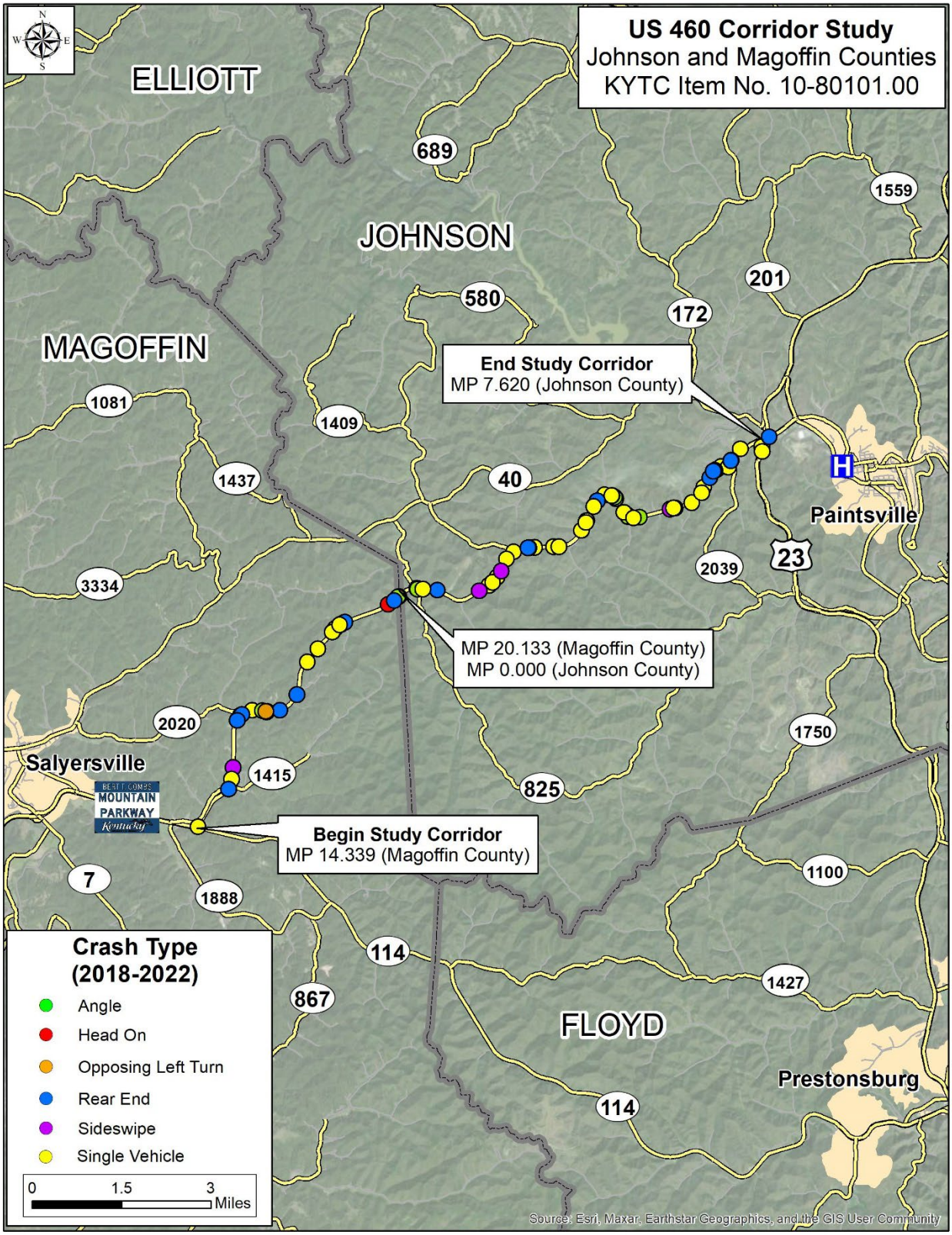

Figure 14: Crash Type (2018 - 2022)

An additional crash analysis was performed based on crash rates from the Kentucky Transportation Center (KTC) report *Analysis of Traffic Crash Data in Kentucky 2018-2022*. Total crash rates along with injury and fatal crash rates were calculated on US 460 from 2018 through 2022. When compared to statewide averages for rural principal arterials, US 460 was found to have higher total crash rates for two segments, higher injury rates for the entire corridor, and higher fatal rates for three of the four segments, as shown in **Table 2.**

Table 2: Rural Principal Arterial Crash Rates

Begin Segment	Begin MP	End Segment	End MP	Length (mi)	Current ADT (VPD)	Total Crashes			Injury Crashes			Fatal Crashes		
						Crashes	Annual Rate*	KY Average*	Crashes	Annual Rate*	KY Average*	Crashes	Annual Rate*	KY Average*
KY 114	14.339	Johnson County Line	20.133	5.79	3405	31	71.8		15	34.7		2	4.6	
Johnson County Line	0	KY 580 (Caudill Branch Rd)	2.305	2.31	3245	16	97.7		4	24.4		1	6.1	
KY 580 (Caudill Branch Rd)	2.305	KY 2039	7.037	4.73	4409	42	91.9	**88**	9	19.7	**19**	2	4.4	**1.6**
KY 2039	7.037	US 23 SB Entrance Ramp	7.62	0.77	4749	4	49.8		3	37.4		0	0.0	

*Rates are per 100 million vehicle miles traveled

Although US 460 is a principal arterial, it is also a rural two-lane road. US 460 crash rates were also compared to statewide averages for rural two-lane roads, as shown in **Table 3.** Compared to other rural two-lane roads across the state, US 460 has experienced fewer injury crashes and total crashes, and a slightly higher number of fatal collisions.

Table 3: Rural Two-Lane Crash Rates

Begin Segment	Begin MP	End Segment	End MP	Length (mi)	Current ADT (VPD)	Total Crashes			Injury Crashes			Fatal Crashes		
						Crashes	Annual Rate*	KY Average*	Crashes	Annual Rate*	KY Average*	Crashes	Annual Rate*	KY Average*
KY 114	14.339	Johnson County Line	20.133	5.79	3405	31	71.8		15	34.7		2	4.6	
Johnson County Line	0	KY 580 (Caudill Branch Rd)	2.305	2.31	3245	16	97.7		4	24.4		1	6.1	
KY 580 (Caudill Branch Rd)	2.305	KY 2039	7.037	4.73	4409	42	91.9	**201**	9	19.7	**46.0**	2	4.4	**2.7**
KY 2039	7.037	US 23 SB Entrance Ramp	7.62	0.77	4749	4	49.8		3	37.4		0	0.0	

*Rates are per 100 million vehicle miles traveled

The Kentucky Transportation Center's (KTC's) Crash Data Analysis Tool (CDAT) was used to perform an Excess Expected Crashes (EEC) analysis. EEC is a measure of the crash frequency at a given site compared to what is expected based on current conditions (geometrics, traffic, etc.). A positive EEC indicates more crashes are occurring than should be expected. Results from this analysis showed two intersections with slightly positive EECs, as shown in **Figure 15.** The US 460 corridor was found to have an EEC less than zero, indicating fewer crashes occurred than expected.

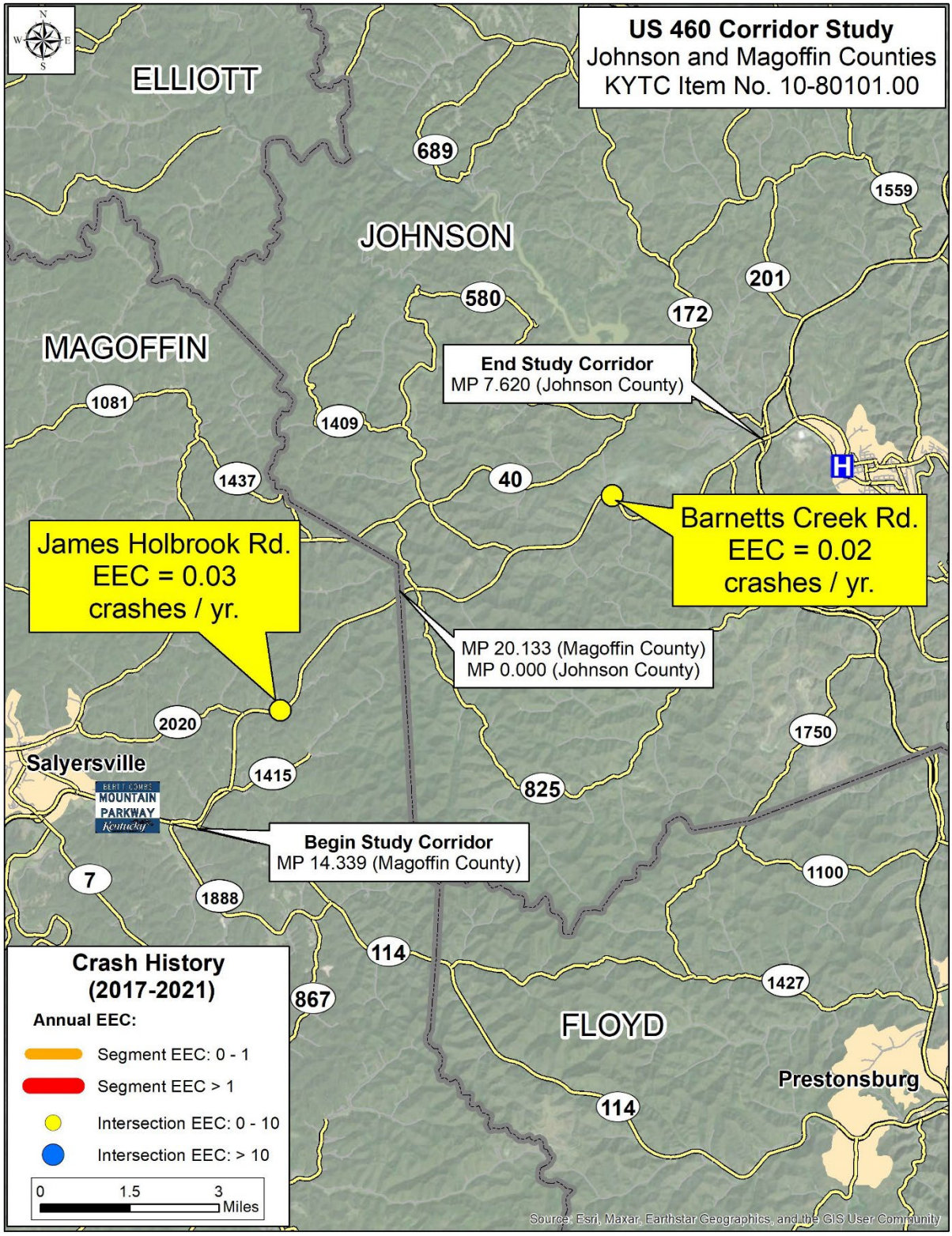

Figure 15: Excess Expected Crashes

3.0 ENVIRONMENTAL OVERVIEW

An Environmental Overview was completed to identify known natural and human features which occur within the study area. These features should be considered during the development and advancement of improvement concepts along with avoidance or minimization of impacts to the sensitive resources. The complete document is included in **Appendix C**.

3.1 NATURAL ENVIRONMENT

There are no National Wetland Inventory (NWI) features mapped within the study area. A review of available data revealed 12 state-listed water wells are present within the study area, which are listed as domestic use wells. The study area falls within the Paintsville Municipal water works protection area. An overview of the water resources in and around the study area is shown in **Figure 16.**

The study area is underlain by bedrock and has no karst features, sinkholes, or caves within the study area. There are approximately 104 listed oil and gas wells reported within the study area. Many of these oil and gas wells have been abandoned but would require remediation if impacted by construction.

According to the U.S. Fish and Wildlife Service's Information for Planning and Consultation (IPaC) there are nine federally listed endangered species, ten federally listed threatened species, eleven state sensitive species, and one special concern species. All have the potential to occur within the study area.

3.2 HUMAN ENVIRONMENT

An overview of the human environment in and around the study area is shown in **Figure 17** and **Figure 18,** showing the western and eastern portions of the study corridor, respectively.

Based on the review of National Register of Historic Places (NRHP), there are no historic districts or registered historical places located within the study corridor. Prime farmland is land that contains the best attributes for producing food with nutrient rich soil producing high yields. All of the study area is classified as non-prime farmland.

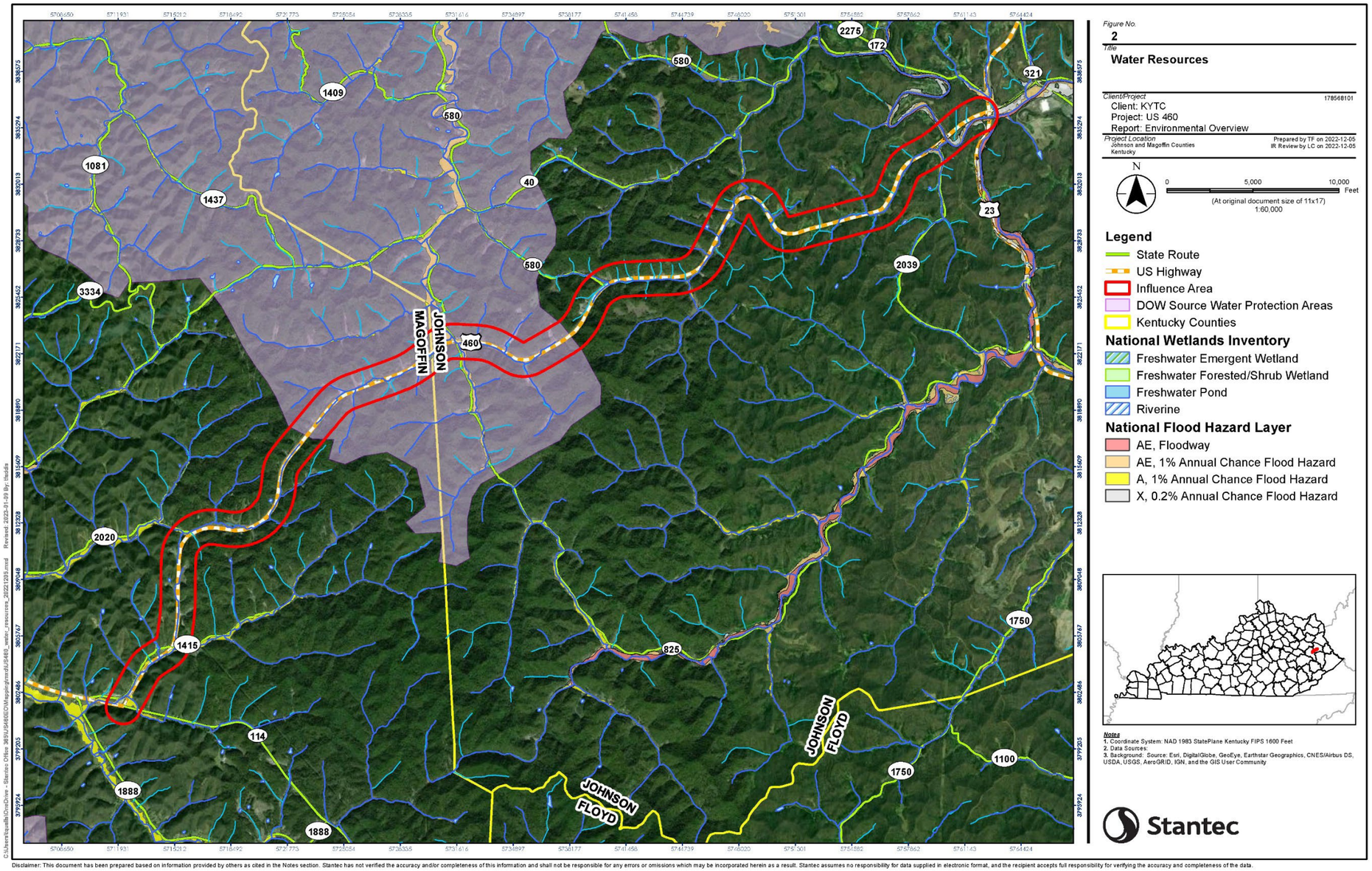

Figure 16: Water Resources

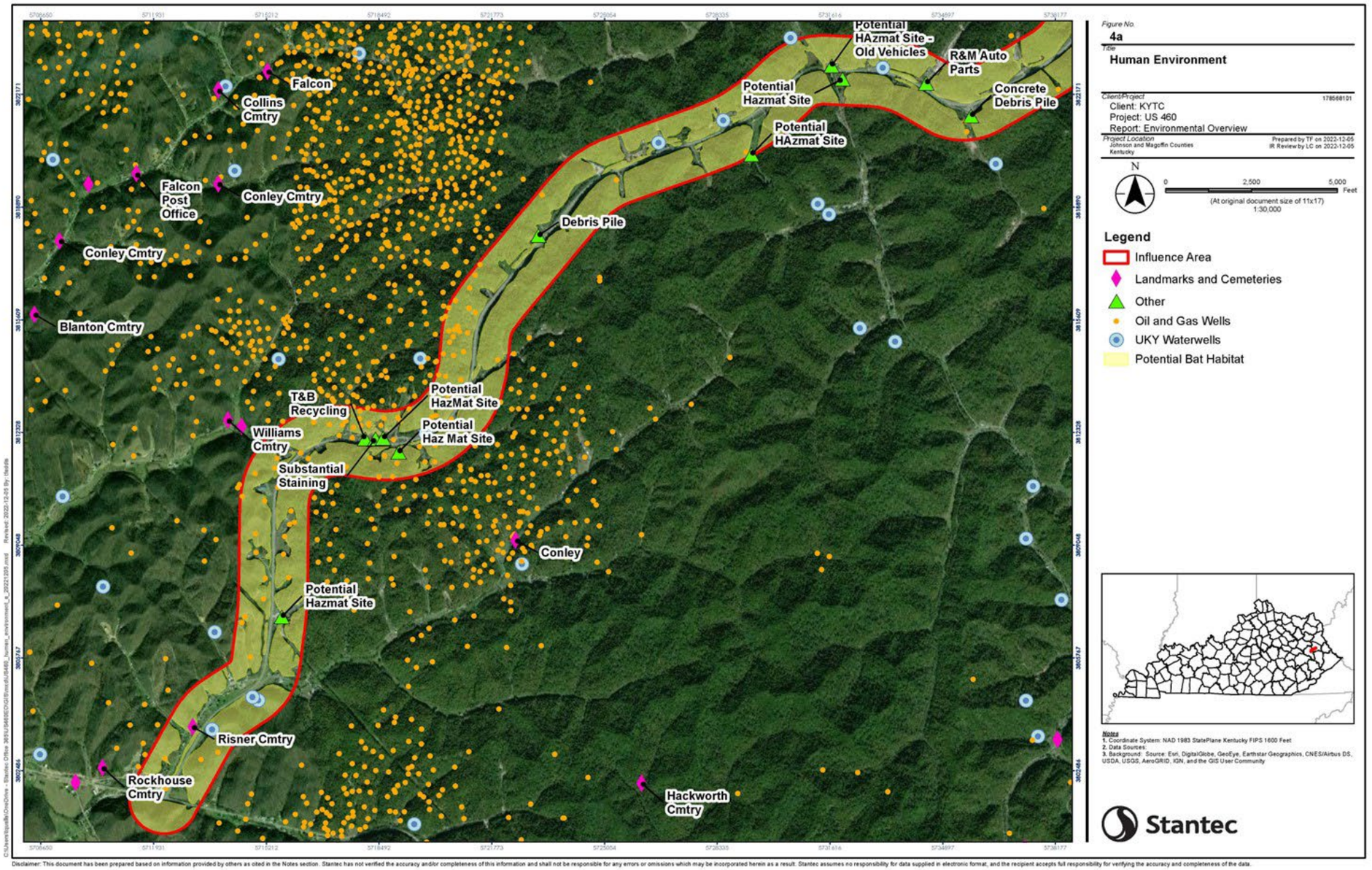

Figure 17: Human Environment (West)

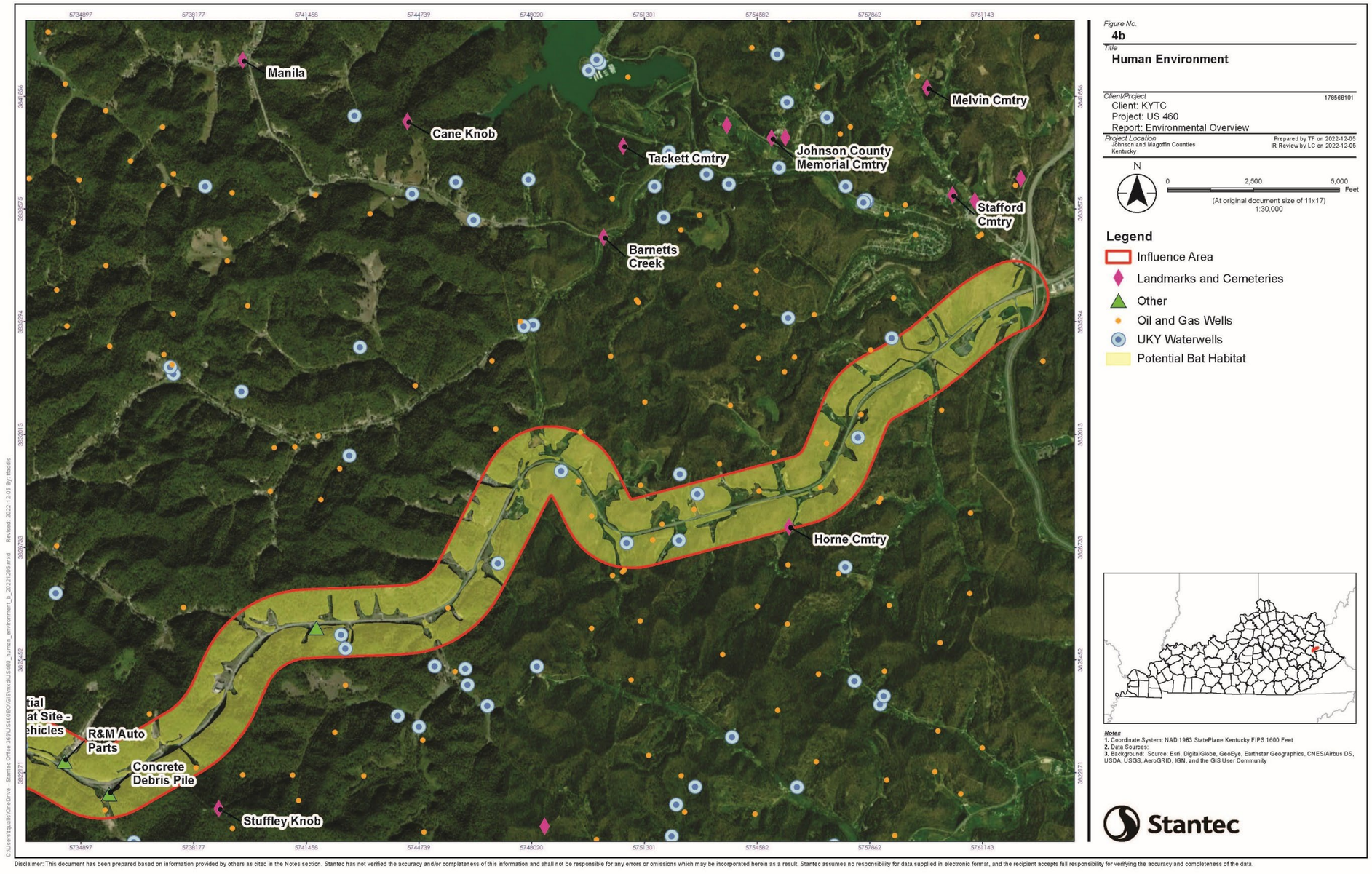

Figure 18: Human Environment (East)

Community resources and sensitive noise receptors in the study area include single family houses, several businesses, a trailer park community and five houses of worship. Utility infrastructure in the area includes approximately two gas transmissions pipelines crossing US 460 near the intersection of KY 2039, Paintsville municipal water works, and one electrical transmission line. The Paintsville Gas and Water Company has a water line running along the south side of US 460 in the western portion of the Johnson County study limits that shifts to the north side near milepost 4.2 approaching Paintsville. The Magoffin County Water District has a water line running along the south side of the corridor between the KY 114 intersection and the Johnson County line. There is one cemetery at mile point 15.2 in Johnson County along the study corridor, but there may be additional private, or family cemeteries present on the study corridor that have not been previously mapped or located.

4.0 FUTURE CONDITIONS

To determine the need for and purpose of potential transportation improvement options, it is necessary to estimate future conditions. This chapter summarizes the anticipated future conditions within the study area.

4.1 POPULATION TRENDS

Population data, including data from the 2020 Census, were obtained from the Kentucky State Data Center (KSDC) at the University of Louisville, Kentucky's official clearinghouse for Census data. Population projections for the state of Kentucky, Johnson County, Magoffin County, Paintsville, and Salyersville are summarized in **Table 4** and shown graphically in **Figure 19** and **Figure 20.** Over the past 20 years, Johnson County and Magoffin County have slightly declined. The population decline is expected to continue in both counties through 2050.

Table 4: Population Estimates and Projections

Area	Census Estimates			Annual Growth	2050 Projection	Annual Growth
	2000	2010	2020	2000 - 2020		2020 - 2050
Kentucky	4,041,769	4,339,367	4,505,836	0.54%	4,785,233	0.20%
Johnson County	23,445	23,356	22,680	-0.17%	21,579	-0.17%
Magoffin County	13,332	13,333	11,637	-0.68%	9,490	-0.68%
Paintsville	4,132	3,459	4,312	0.21%	N/A	
Salyersville	1,604	1,883	1,591	-0.04%	N/A	

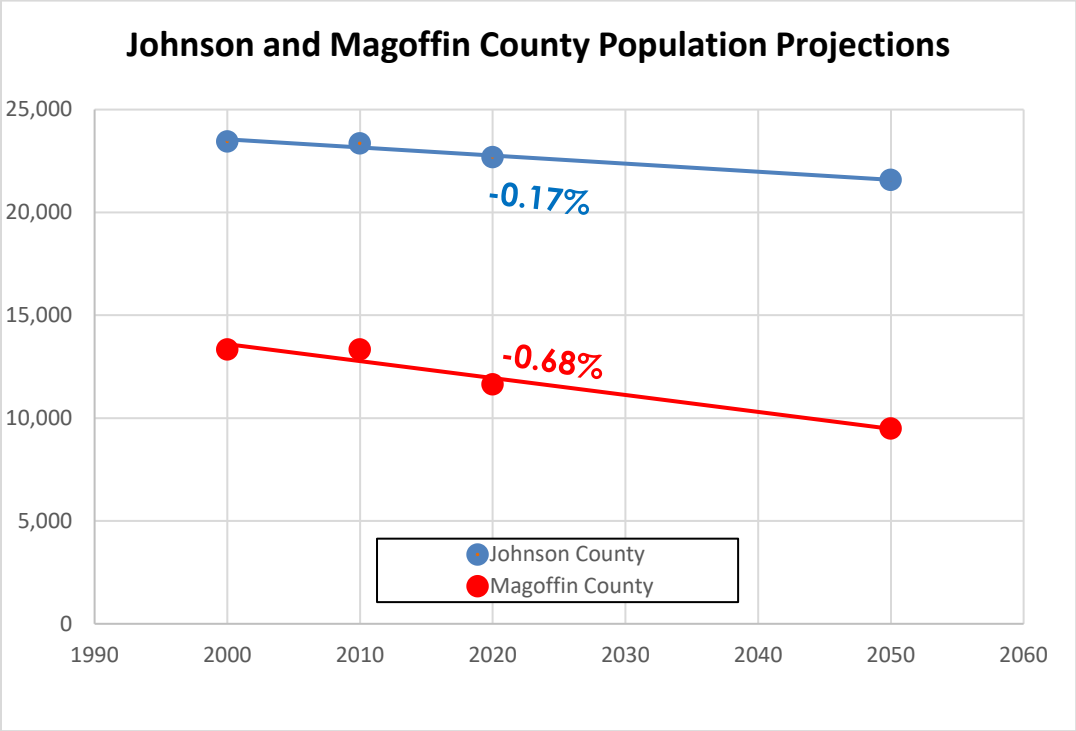

Figure 19: Population Projections – County Level
(Source: Kentucky State Data Center, 2022)

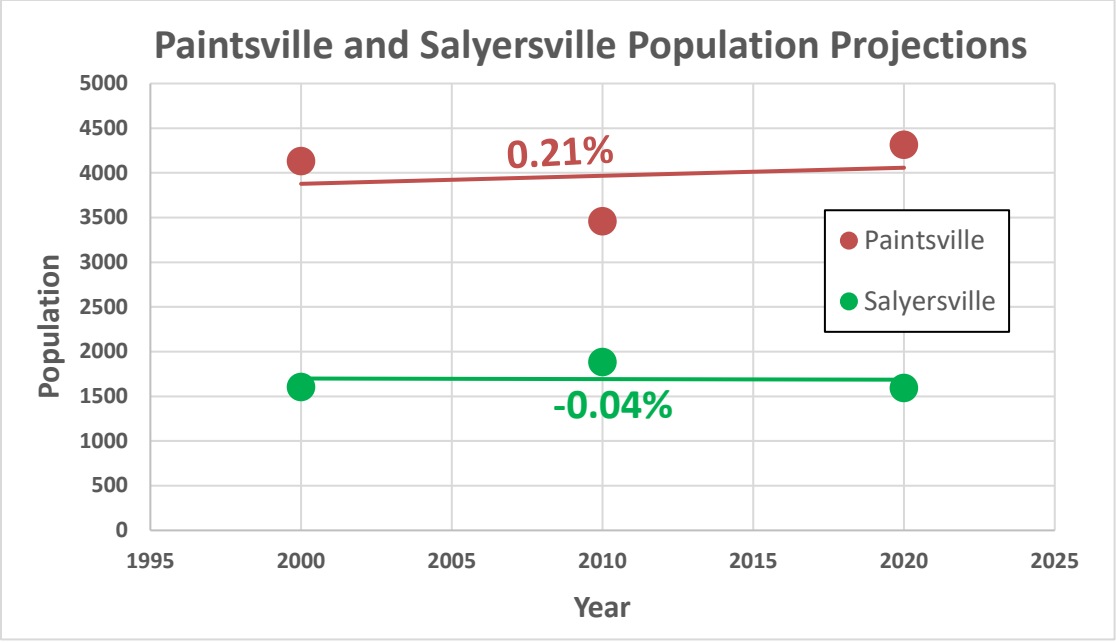

Figure 20: Population Estimates – City Level
(Source: Kentucky State Data Center, 2022)

4.2 HISTORICAL TRAFFIC COUNTS

Historical average daily traffic volumes and annual growth rates, between 2000 and 2022, for US 460 are summarized in **Table 5**. Over the past 10 years, all four stations have shown declining traffic, rangingfrom-0.31 percent to -1.62 percent per year. The red text represents traffic counts from 2020, which are not an accurate representation of recent traffic patterns due to COVID shutdowns in 2020. The 2020 traffic counts are provided for reference but were not used to estimate the compound annual growth rates.

Table 5: KYTC Historical Average Daily Traffic

Year	US 460			
	Magoffin County	Johnson County		
	Sta. 077294	Sta. 058519	Sta. 058518	Sta. 058517
	MP 14.339-20.133	MP 0.000-2.305	MP 2.305-7.037	MP 7.037-7.809
2000				
2001	4,090	4,430	5,350	6,690
2002				
2003				
2004				6,680
2005			4,780	
2006	4,790	4,510		
2007				6,480
2008			5,170	
2009	4,590	4,310		
2010				
2011			5,400	
2012	4,407	4,509		
2013				5,880
2014			5,271	
2015	4,023	3,598		
2016				5,521
2017			5,089	
2018	3,827	3,891		
2019				
2020			4,409	5,027
2021	3,405	3,245		
2022				4,749
Annual Growth Rate (%)	-0.91%	-1.54%	-0.31%	-1.62%

4.3 KENTUCKY STATEWIDE TRAFFIC MODEL (KYSTM)

As an additional data source, study area growth rates from the Kentucky Statewide Traffic Model (KYSTMv19) were reviewed. Between 2023 and 2045, annual KYSTM No-Build growth rates on US 460 range from 0.43 to 0.47 percent per year. Annual KYSTM Build growth rates for the same years, which included four-lane widening on US 460, ranged from 0.64 to 1.04 percent. Growth rates on adjacent roadways vary, but generally show slight positive growth. Growth rates derived from the KYSTM are shown in **Table 6.**

Table 6: 2045 Growth Rates

County	Segment	Average 2019 Volume	2045 No-Build		2045 Build	
			Avg. Volume (VPD)	Growth Rate	Avg. Volume (VPD)	Growth Rate
Magoffin	KY 114 to County line	2,170	2,430	0.44%	2,841	1.04%
Johnson	County line to KY 580	2,283	2,578	0.47%	2,878	0.89%
Johnson	KY 580 to KY 2039	3,355	3,760	0.44%	4,037	0.71%
Johnson	KY 2039 to US 23	2,983	3,339	0.43%	3,519	0.64%

4.4 MOUNTAIN PARKWAY EXPANSION TRAFFIC FORECAST REPORT

Traffic forecasts were developed in 2022 for the Mountain Parkway Expansion Project.[3] A growth rate of 1.92 percent per year was estimated for truck traffic on US 460 and a growth rate of -0.25 percent was assumed for passenger vehicles.

4.5 2045 DAILY TRAFFIC FORECASTS

While historical daily traffic and population in the study area have declined over the past 20 years, US 460 is a major east-west arterial through eastern Kentucky and the results from the KYSTM show daily traffic growth at a moderate rate. Based on the lower growth rates estimated from the KYTSM and from historical counts, the project team elected to use growth rates in line with the Mountain Parkway expansion to develop traffic forecasts for the US 460 Corridor Study. Therefore, an annual growth rate of 0.3 percent was selected to reflect steady growth through the year 2045. The growth rate was applied to the latest KYTC traffic counts to develop 2045 daily traffic forecasts, shown in **Figure 21**. 2045 daily traffic on the study corridor is expected to range from 3,700 VPD on the western side of the study corridor up to 6,000 VPD on the eastern portion of the corridor.

[3] http://mtnparkway.com

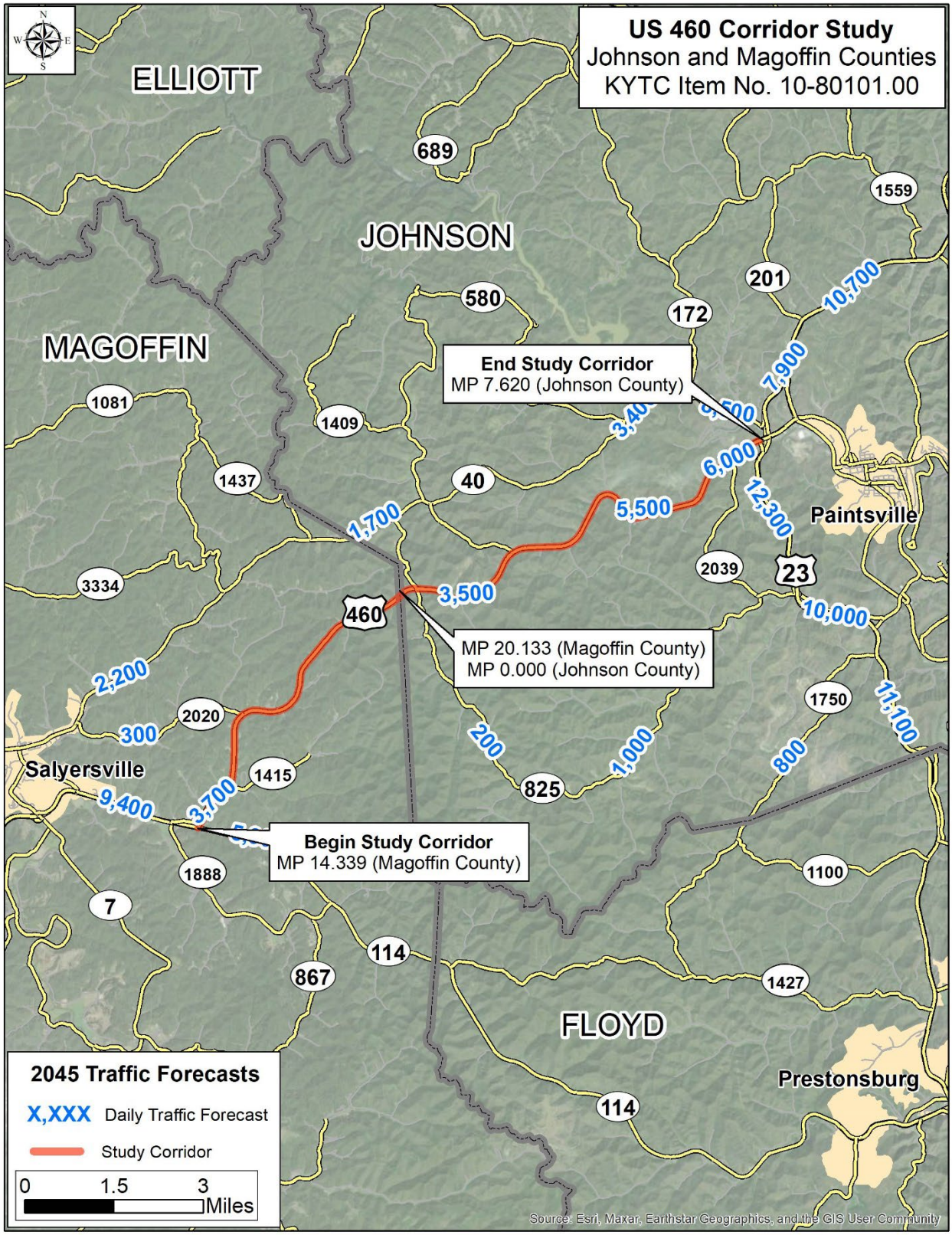

Figure 21: 2045 Daily Traffic Forecasts

4.6 2045 TRAFFIC ANALYSIS

A 2045 HCS analysis was performed to evaluate future capacity needs of the study corridor. The current two-lane configuration operates at LOS A or LOS B in 2045, shown in **Table 7.** This suggests capacity is not a concern for the design year. Subsequent analysis showed that the growth rate of US 460 would need to range from 3.26 percent (near US 23) to 6.07 percent (near KY 114) to reach capacity by 2045.

Table 7: 2045 HCS Analysis

County	Route	Begin	End	AM Peak		PM Peak	
				EB LOS	WB LOS	EB LOS	WB LOS
Magoffin	US 460	KY 114	County Line	A	A	A	A
Johnson		County Line	KY 580	A	A	A	A
		KY 580	KY 2039	A	A	A	A
		KY 2039	KY 23	B	A	A	A

5.0 INITIAL IMPROVEMENT CONCEPT DEVELOPMENT

After reviewing past and current KYTC projects, evaluating existing / future conditions, and reviewing the environmental overview, a purpose and need statement was developed to guide any potential projects that will be developed as part of this study. Any potential project that results from this study will be referred to as the US 460 Improvement Project.

5.1 PURPOSE AND NEED

A Purpose and Need Statement provides the foundation for decision-making and the basis for evaluation and comparison of improvement concepts. While studies such as this generally focus on goals and objectives, the 2022 Highway Plan included significant potential investments towards improving the corridor. Therefore, the project team developed a draft Purpose and Need Statement prior to developing conceptual improvement options.

> *The purpose of the US 460 Improvement Project is to enhance **regional mobility** and to **provide a safer, more efficient connection between Salyersville and Paintsville**. US 460 provides the most direct connection between Paintsville and the Mountain Parkway at Salyersville for vehicles traveling west. Listed on the National Highway System (NHS) and the National Truck Network (NN), US 460 also provides connectivity to important regional resources such as Paintsville Lake State Park and Paintsville Appalachian Regional Healthcare (ARH) Hospital.*

5.2 IMPROVEMENT CONCEPTS

Initial improvement concepts were developed based on a combination of input from the project team, review of existing conditions, and the draft Purpose and Need Statement. Three potential improvement concepts were developed, including spot improvements, four-lane widening, and a 2+1 concept. Initial cost estimates, in 2023 dollars, were developed for the improvements, as shown in **Table 8**. Brief descriptions of each preliminary option are included in the following sections. The spot improvements could be constructed as individual projects.

Table 8: Initial Cost Estimates (2023$)

Concept	Length (miles)	Description	Right-of-Way	Utilities	Design	Construction Cost*
Spot Improvements	1.20	Construct spot improvements at three curves along US 460 - one in Magoffin County (MP 15.2-15.6) and two in Johnson County (MP 0-0.4 & MP 4.2-4.6)	$1,120,000	$300,000	$850,000	$8,500,000
Four Lane Widening	13.5	Widen US 460 to provide four lanes between Salyersville and Paintsville	$14,700,000	$5,000,000	$19,599,000	$195,990,000
2+1 Roadway	13.5	Provide a continuous 2+1 Roadway between Salyersville and Paintsville	$1,120,000	$500,000	$3,750,000	$37,500,000

*Note: Construction Cost includes cost for environmental mitigation

5.2.1 Spot Improvements

Safety improvements were developed at three high crash density spot locations, as discussed in Section 2.2.3, to lower the superelevation by flattening the horizontal curves. **Figure 22** presents the locations of the spot improvements.

5.2.2 Four Lane Widening

The four-lane widening concept expands the existing roadway from two to four lanes with a depressed grass median, shown in **Figure 23.** This improvement concept includes two twelve-foot lanes in each direction, 12-foot outside shoulders, and a 40-foot depressed median. This section is consistent with the Mountain Parkway Expansion.

Because the four-lane widening would cost more than $100 million to implement, a written financial plan would be required for submission to and approval by the Federal Highway Administration (FHWA) per KYTC Design Memo 06-24. More discussion is included in Section 8.2

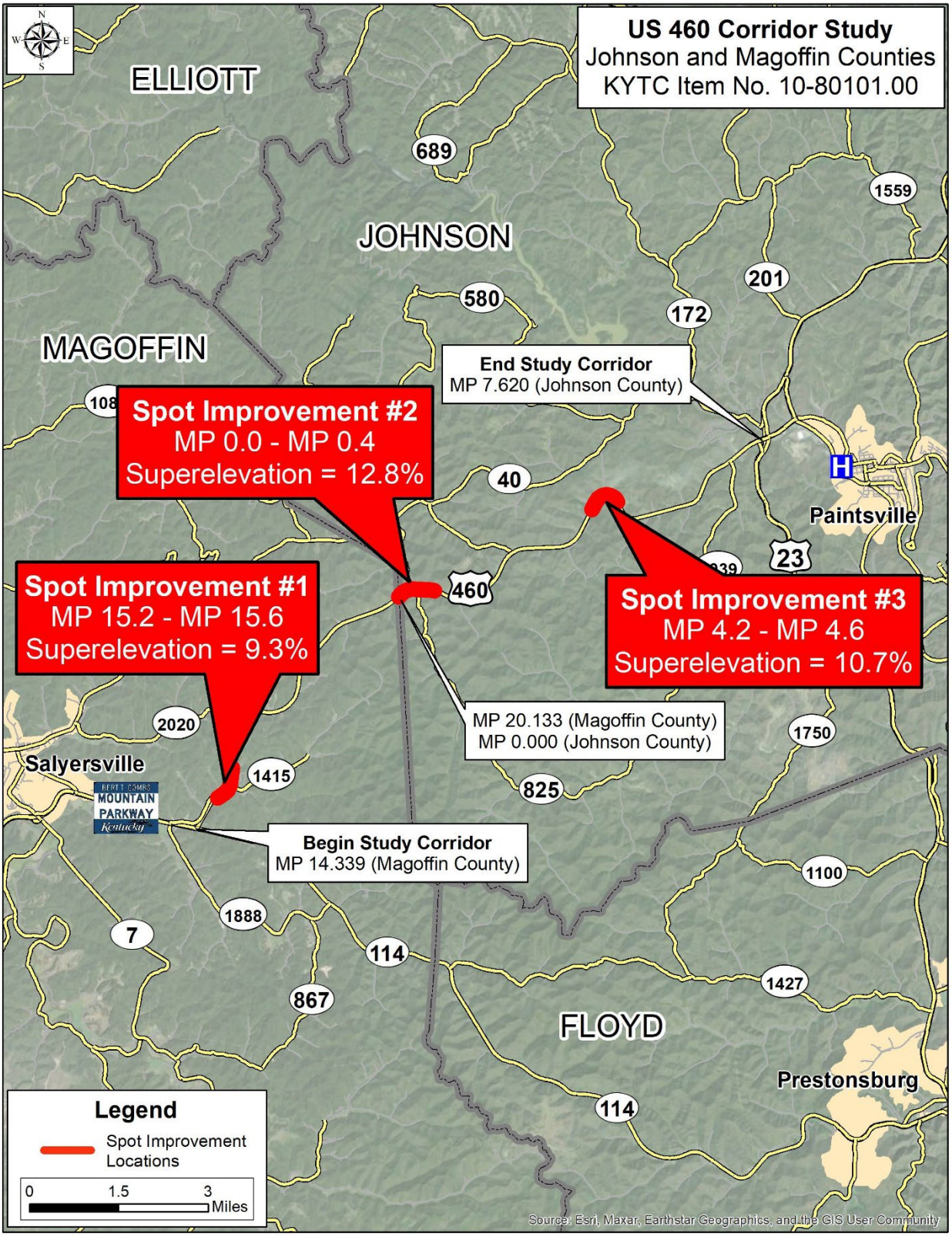

Figure 22: Spot Improvement Locations

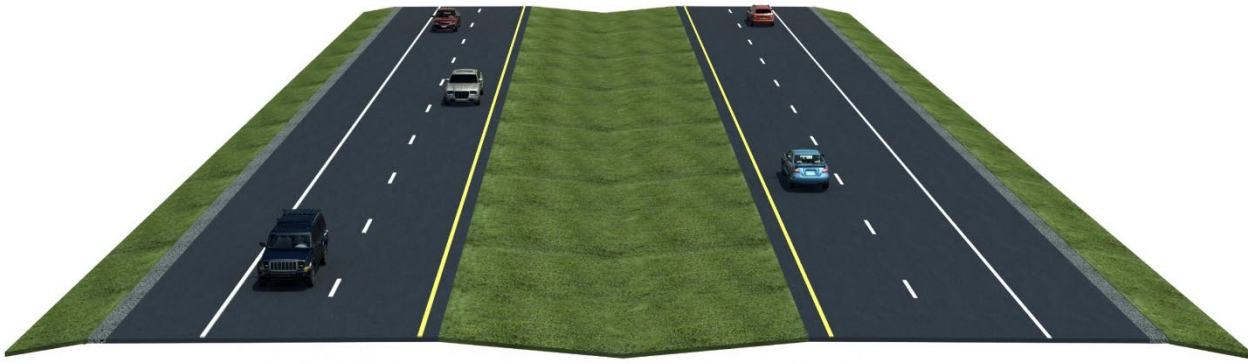

Figure 23: Four Lane Improvement Concept

5.2.3 2+1 Concept

A preliminary 2+1 roadway concept was developed for the entire study corridor. The concept would provide a three-lane roadway, as shown on **Figure 24**, with two lanes in one direction, one of which is dedicated to passing. This is similar to the existing passing lanes provided along the corridor but provides a continuous three-lane section that transitions along the route. The direction of the passing lane alternates approximately every mile and provides increased capacity and less waiting time behind slower vehicles and trucks. **Figure 25** presents the preliminary location of the passing lanes.

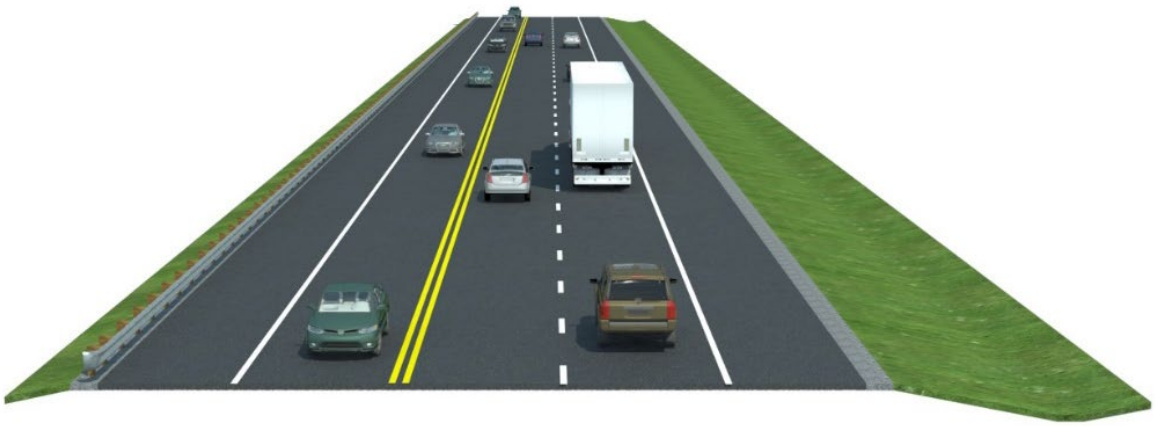

Figure 24: 2+1 Improvement Concept

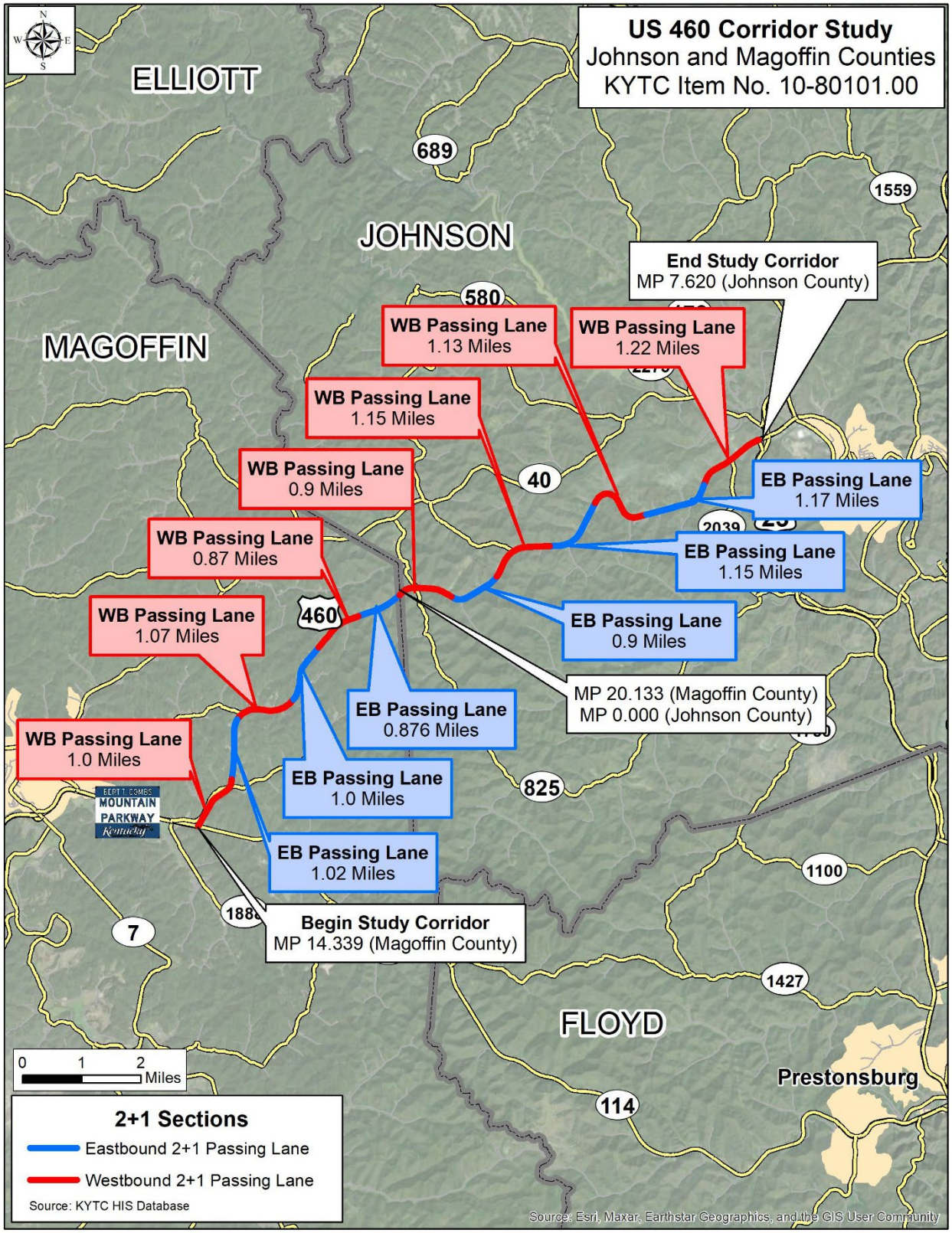

Figure 25: Passing Lanes for the Preliminary 2+1 Concept

6.0 INITIAL PROJECT TEAM AND STAKEHOLDER COORDINATION

Over the course of the study, the project team met with Local Officials and Stakeholders to coordinate on key issues. The project team included representatives from KYTC Central Office, KYTC Districts 10 and 12, and the consultant, Stantec. Detailed summaries of each meeting are presented in **Appendix D**.

6.1 PROJECT TEAM MEETING NO. 1

The first Project Team Meeting for the subject project was held at the KYTC District 10 office and virtually via Microsoft Teams the afternoon of June 19, 2023. The purpose of the meeting was to present the results from the existing conditions analysis and to get feedback from the project team on transportation issues and preliminary improvement concepts.

- Animal collisions were found to be spread throughout the study corridor. They were not centralized to one location.
- Asphalt and earthwork cost estimates were similar to estimates from the Mountain Parkway Expansion.
- The draft Purpose and Need Statement was presented and discussed. The project team approved the draft Purpose and Need Statement for discussion with the local officials.

6.2 LOCAL OFFICIALS / STAKEHOLDER NO. 1

A Local Officials / Stakeholder Meeting for the subject project was held at the KYTC District 10 office in Jackson, Kentucky and virtually via Microsoft Teams the morning of September 20, 2023. The purpose of the meeting was to present the results from the existing conditions analysis and get feedback on transportation issues in the study area. Key discussion items included the following:

- Improvement concepts were presented to meeting attendees. Local Officials noted safety was a top priority of the study corridor.
    - Spot improvements – This concept focuses on lowering the superelevation rates by flattening the horizontal curves in three locations with high superelevation rates and a high density of crashes.
    - Four-Lane Widening – This concept mimics the typical section proposed for the Mountain Parkway Expansion Project.
    - 2+1 Roadway – This concept has a typical layout of three 11 to 12-foot driving lanes, two 10-foot shoulders, and a 3-foot paved median.
- The draft Purpose and Need Statement was presented to and approved by the local officials.
- Based on the projected traffic volumes, cost estimates, and anticipated safety benefits, the local officials and stakeholders showed strong support for the 2+1 concept.

After the Local Officials / Stakeholder meeting, representatives from Johnson County shared information from their *US 460 East-West Gateway* project. The purpose of the project, which includes widening US 460 between Salyersville and Paintsville, includes the following:

- Completes the goal of four-lane connectivity in eastern Kentucky.
- Supports Kentucky's presence as a logistical hub.
- Promotes regional economic development.
- Improves quality of life
- Provides for enhanced roadway safety.
- Provides the most efficient and cost-effective solution.
- Improve the transportation infrastructure in the region, correlating to more economic development opportunities.
- Reduce worker commute times.
- Reduce transportation costs for businesses.
- Support job creation and expansion away from traditional population centers.

7.0 REVISED IMPROVEMENT CONCEPTS

Improvement concepts were revised based on results from the traffic and safety analyses and feedback from the stakeholders and the project team.

Spot improvements – This concept focuses on lowering the superelevation by flattening the horizontal curves in three locations with high measured superelevation rates. The locations of the proposed spot improvements remained unchanged.

Four-Lane Widening – This concept mimics the typical section proposed for the Mountain Parkway Expansion Project, including a four-lane widening, with four 12-foot lanes, a three-foot flush median, and a four-foot paved outside shoulder on the passing lane side, as shown in **Figure 26**. The developed earthwork, shown in **Figure 27**, and pavement estimates were created using Bentley's Concept Station software.

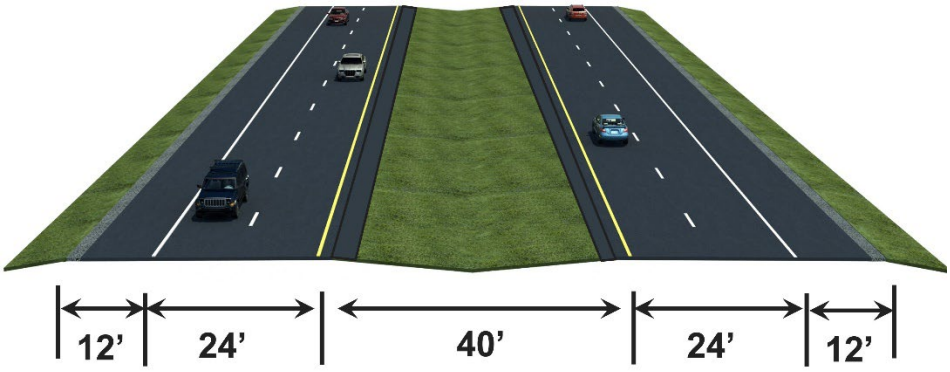

Figure 26: Four-Lane Widening

Figure 27: Four-Lane Widening Example in Concept Station

2+1 Roadway – This concept has a typical layout of three 12-foot driving lanes, two 10-foot shoulders, and a three-foot paved median, as shown in **Figure 28.** Neither District 10 nor District 12 expressed concerns with having 11-foot lanes with a 2+1 section and three-foot offset instead of 12-foot lanes with no offset. The improved roadway will maintain 52 feet of pavement along the entire corridor.

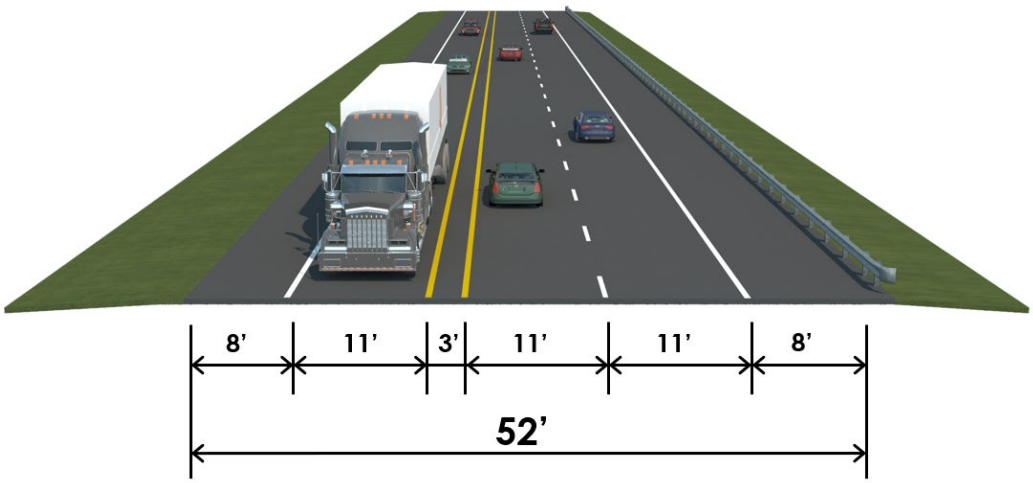

Figure 28: Revised 2+1 Widening Concept

7.1 RETURN-ON-INVESTMENT (ROI) ANALYSIS

A return on investment (ROI) analysis was performed to compare the improvement concept costs, including design, right-of-way, utility, and construction, to the 20-year safety benefit, as shown in **Table 9**. The safety benefits were estimated using crash modification factors (CMFs) from the Crash Modification Clearinghouse. A CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. An ROI above 1.0 indicates the safety benefits outweigh the costs.

The spot improvements have the highest ROI as they were specifically targeted to provide proven crash reduction countermeasures in areas with the highest concentrations of injury and fatal crashes, while the 2+1 Roadway has ROIs ranging from 0.58 to 2.52. This is due to a range in the estimated reduction from various CMFs. The lower ROI is based on a CMF that assumes reduction of head on, rear end, and sideswipe crashes only, while the higher ROI is based on crash reduction for all crash types. The four-lane widening has the lowest ROI of 0.28. A more detailed summary of the ROI analysis is presented in **Appendix E**.

Table 9: Return-On-Investment (ROI) Analysis

Concept	2024 Total Cost	Crash Modification Factor (CMF) ID	Percent Crash Reduction	Safety Benefit	20-Yr ROI
Spot Improvements	$10,770,000	9651	74%	$63,000,000	5.85
2+1 Roadway	$41,880,000	10267	47%	$105,400,000*	2.52*
		10268	49%	$24,400,000**	0.58**
4-Lane Widening	$225,389,000	7574	29%	$64,100,000	0.28

*First option is based on crash reduction for all crash types
**Second option considers only head on, rear end, and sideswipe crashes

7.2 PROJECT TEAM MEETING NO. 2

After development of the revised improvement concepts, the Project Team met for a second time at the KYTC District 10 office in Jackson, Kentucky on March 12, 2024. The purpose of the meeting was to recap the discussion from the Local Officials and Stakeholders meeting and discuss the revised concepts to determine the next steps. Key discussion items included the following:

- The 2+1 concept has a typical layout of three 12-foot driving lanes, two 10-foot shoulders, and a three-foot paved median offset. Neither District 10 nor District 12 expressed concerns with having 11-foot lanes and 3-foot offset instead of 12-foot lanes with no offset. The improved roadway will maintain 52 feet of pavement along the entire corridor.
- The draft of House Bill 266 was discussed. The bill is related to road projects for the 2024-2026 Biennial Highway Construction Plan. The bill included a project cost of $42.87 million to reconstruct US 460 from KY 114 in Magoffin County to just west of the US 23 interchange near Paintsville in Johnson County while using a template of 2+1 lanes and a three-foot median.
- The Safety Performance Functions (SPFs) used to determine EEC were based on a rural two-lane roadway classification. As discussed in Section 2.5, US 460 is classified as a principal arterial. However, the SPFs available in CDAT do not distinguish between functional classifications, but rather rural or urban and two-lane or multi-lane. Therefore, US 460 was best categorized as a rural two-lane roadway.

Similar to the local officials, the project team voiced strong support for the 2+1 concept. In terms of length, approximately two-thirds of this concept would include road widening, while the remaining one-third would take advantage of the existing passing lanes and only include resurfacing.

8.0 CONCLUSIONS

The purpose of the US 460 Improvement Project is to enhance regional mobility and to provide a safer, more efficient connection between Salyersville and Paintsville. Improvement concepts were developed based on a combination of input from the project team, a review of existing conditions, local officials / stakeholder input, and field reconnaissance.

As mentioned in Section 6.2, the local officials and stakeholders showed strong support for the 2+1 concept. The concept has been found to provide many of the benefits of a four-lane widening (i.e. increased efficiency for traffic flow while improving safety) at a significantly reduced cost and within a smaller footprint. KYTC has implemented 2+1 concepts along other routes in Kentucky (KY 55 in Adair County, KY 55 in Marion / Washington County) where projected traffic volumes were not sufficient to justify four lanes but were higher than could be comfortably accommodated with two lanes and limited passing opportunities. The results of these past projects have been positive. **Table 10** presents the before and after crash analysis on KY 55 in Marion and Washington County, demonstrating a 38 percent reduction in the crash rate (crashes per 100 million vehicle miles of travel, or MVMT) in the two years following construction of the 2+1. While capacity is not expected to be an issue on US 460, the additional passing lanes will improve safety and travel time reliability, while also adding the capacity needed if traffic on the corridor grows more than expected.

Table 10: KY 55 2+1 Roadway Before / After Crash Analysis

Scenario	Years	Crashes	Weighted ADT	Length (mi.)	Crash Rate*
Before 2+1	2018-2019	27	9,826	5.37	70.1
After 2+1	2022-2023	17	9,918	5.37	43.7

$$*Rate\ (in\ crashes\ per\ 100\ MVMT) = \frac{Crashes * 100{,}000{,}000}{Volume * 365 * years * length}$$

$$\frac{43.7 - 70.1}{70.1} = 38\%\ \text{Reduction}$$

8.1 COST ESTIMATES

Updated 2024 opinions of probable cost were developed, as shown in **Table 11.** Construction costs include the cost of environmental mitigation.

Table 11: Cost Estimates (in 2024$)

Concept	Length (miles)	Description	Right-of-Way	Utilities	Design	Construction Cost
Spot Improvements	1.20	Construct spot improvements at three curves along US 460 - one in Magoffin County (MP 15.2-15.6) and two in Johnson County (MP 0-0.4 & MP 4.2-4.6)	$1,120,000	$300,000	$850,000	$8,500,000
Four Lane Widening	13.5	Widen US 460 to provide four lanes between Salyersville and Paintsville	$14,700,000	$5,000,000	$18,699,000	$186,990,000
2+1 Roadway	13.5	Provide a continuous 2+1 Roadway between Salyersville and Paintsville	$1,120,000	$500,000	$3,670,000	$36,700,000

8.2 NEXT STEPS

The next step following this study for any potential improvements would be Phase 1 Design (Preliminary Engineering and Environmental Analysis). Additional phases of this project are listed in *Kentucky's FY 2024-2026 Biennial Highway Construction Plan as follows:*[4]

> KYTC Item No. 10-80101: Reconstruct US 460 from KY 114 in Magoffin County to just west of the US 23 interchange near Paintsville in Johnson County. Use a template of 2+1 lanes and a three-foot median. (D = $3,750,000 (2025), R = $1.12 million (2027), U = $500,000 (2027), C = $37.5 million (2028))

In accordance with 23 USC 106, KYTC Highway Design Memo 06-24 notes that any potential project with an estimated cost over $100 million requires development of a written financial plan to be submitted to and approved by the FHWA.[5] While the estimated cost for the recommendations from this study do not exceed $100 million, should these recommendations change, future project teams should follow the procedures outlined in KYTC *Design Memorandum No. 6-24. This memorandum* details compliance with the requirements, including enhanced coordination, a Financial Plan, and adherence to the project development checklist.

[4] http://transportation.ky.gov/Program-Management/Pages/2024-Enacted-Highway-Plan.aspx
[5] http://transportation.ky.gov/Highway-Design/Memos/06-24.pdf

9.0 CONTACTS/ADDITIONAL INFORMATION

Written requests for additional information should be sent to Mikael Pelfrey, Director, KYTC Division of Planning, 200 Mero Street, Frankfort, KY 40622. Additional information regarding this study can also be obtained from the KYTC District 10 Project Manager, Darren Back, at (606) 435-6234 (email at Darren.back@ky.gov).