

FINAL REPORT

December 2017



KY 86 Scoping Study
Breckinridge and Hardin Counties
KYTC Item No. 4-8901.00



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KY 86 Scoping Study KYTC Item No. 4-8901.00

EXECUTIVE SUMMARY

INTRODUCTION

The Kentucky Transportation Cabinet (KYTC) initiated the KY 86 Scoping Study in Breckinridge and Hardin Counties to examine the need for and types of improvements necessary along KY 86 between the US 60 intersection in Breckinridge County and the US 62 intersection in Hardin County. The study area is shown in **Figure ES-1**. This study serves as the first step in establishing goals, completing an existing conditions analysis, identifying potential concerns, developing cost estimates, and evaluating preliminary alternatives along the 26.325-mile-long corridor.

PURPOSE AND NEED

The purpose of the KY 86 Scoping Study is to enhance regional mobility and to provide a safer east/west corridor across Breckinridge and Hardin Counties. KY 86 provides the most direct regional connection between Hardinsburg, Cecilia, Elizabethtown, the Western Kentucky Parkway, and I-65. I-65 is a major north-south interstate highway that travels through Western Kentucky from Nashville, Tennessee in the south to Louisville, Kentucky in the north.

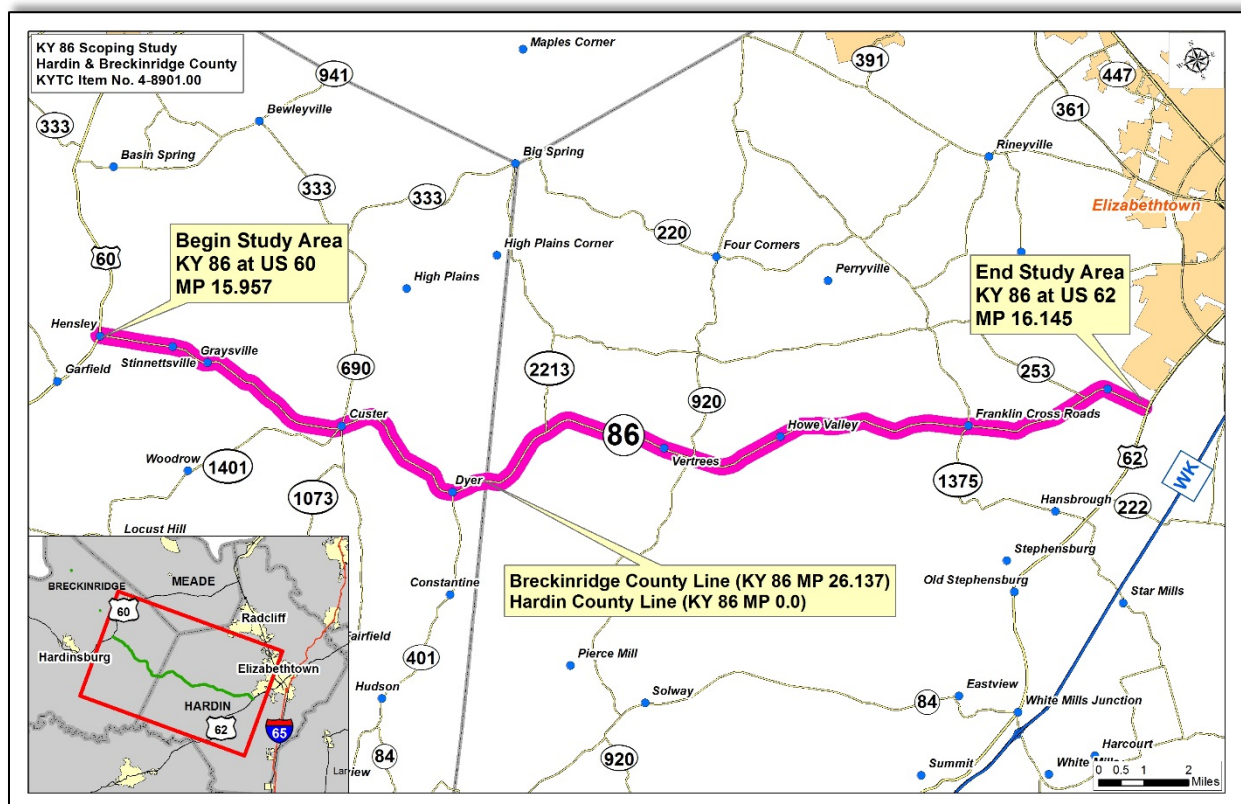


Figure ES-1: Study Area

Within the study corridor, KY 86 is functionally classified as a Rural Minor Arterial from US 60 in Breckinridge County to Cecilia in Hardin County and an Urban Minor Arterial from Cecilia to US 62. The posted speed limit throughout most of the corridor is 55 mph, except in Cecilia and several unincorporated communities, where the posted speed limit drops to 35 mph. The majority of KY 86 has nine-foot-wide lanes and eighteen-inch shoulders, which does not meet the minimum recommendations. The road widens to include 12-foot lanes in Cecilia, which is desirable. A review of the as-built plans found 18 horizontal curves (25 percent) and 160 vertical curves (66 percent) along KY 86 do not satisfy current “Green Book”¹ design guidelines for the existing functional classification and posted speed limits.

The current traffic volumes on KY 86 range between 1,700 and 4,200 vehicles per day (vpd) with 2.5 to 11 percent trucks. Of that, 59 percent of the trucks are single unit trucks and school buses rather than long-haul freight. It should also be noted that the majority of large trucks are traveling the entire corridor length and the truck percentage varies due to the range in vehicles per day. By 2040, traffic volumes are expected to grow to between 1,900 to 4,700 vpd with a truck percentage between 2.7 and 11.7 percent. A volume to capacity (V/C) and level of service (LOS) analysis indicates the two-lane road can accommodate the existing and future traffic demand.

Purpose and Need

- A two-lane road can adequately accommodate the existing and future traffic demand.
- Safety is the primary concern along KY 86.
- Given the location and types of crashes (primarily single vehicle collisions), it appears roadway geometrics could be a contributing factor.

Over the ten-year period between July 1, 2006, and June 30, 2016, 398 crashes were reported along the study area. Of these, six (1.5 percent) resulted in fatalities and 105 (26.4 percent) resulted in injuries. Along the study corridor, 19 spots were identified to have a critical crash rate factor (CRF) greater than 1.0².

ALTERNATIVE DEVELOPMENT

As noted in the Purpose and Need Statement, safety is the primary concern along KY 86. Based on early input from stakeholders and local officials, the project team decided the focus of the study would be to identify safety improvements that can be implemented quickly and independently. Along with spot improvements, this study examined a complete reconstruction alternative and the no-build alternative.

Alternatives Considered

- No-Build
- Complete Reconstruction
- Spot Improvements

The No-Build alternative does not meet the project purpose but was carried forward as a baseline for comparison.

¹ American Association of State Highway and Transportation Officials (AASHTO), *A Policy on Geometric Design of Highways and Streets*, 6th Edition, 2011.

² Per the Kentucky Transportation Center’s (KTC) annual *Analysis of Traffic Crash Data in Kentucky (2011-2015)*, a CRF greater than 1.00 indicates that crashes may be occurring more often than can be attributed to random occurrence.

Complete reconstruction consists of widening driving lanes and shoulders along the study portion of KY 86 and bringing roadway geometrics to a 55-mph design speed. The total cost of this improvement concept would be approximately \$160 million. The high cost would likely make such an undertaking infeasible as it would have to compete against other statewide projects for funding. The project team decided the complete reconstruction alternative was not a viable improvement concept and should not be carried forward in the alternative development process.

The Spot Improvements generally include short segments of the corridor with relatively lower costs that can be implemented individually. Nineteen locations were identified as spot improvement projects, shown in **Figure ES-2**.

PUBLIC INVOLVEMENT

Public engagement for the KY 86 Scoping Study was undertaken through a two-step process involving meetings with project stakeholders and local officials, followed by meetings with the general public in both Breckinridge and Hardin Counties. The purpose of the meetings was to provide information about the study and the improvements under consideration, discuss conceptual alternatives, and solicit input.

Surveys were distributed to the local officials, stakeholders, and the public. Twenty-five surveys were returned during the Hardin County public meeting and 39 surveys were returned during the Breckinridge County meeting.

- When asked what issues exist on KY 86 that should be addressed by this project, the most common responses were safety, excessive speeds, sharp curves, and narrow shoulders.
- 75 percent of Hardin County respondents and 57 percent of Breckinridge County respondents preferred spot Improvements over the complete reconstruction alternative.
- Spot Improvements 10, 13, and 19 were identified as the top three priorities at the Hardin County public meeting. One survey was received from the local officials/stakeholders meeting in Hardin County. Spot Improvement 19 was selected as the top priority.
- Spot Improvements 2, 4, and 6 were identified as the top three priorities at the Breckinridge County public meeting. Four surveys were received from the local officials/stakeholders meeting in Breckinridge County. Spot Improvement 2 was selected as the top priority.



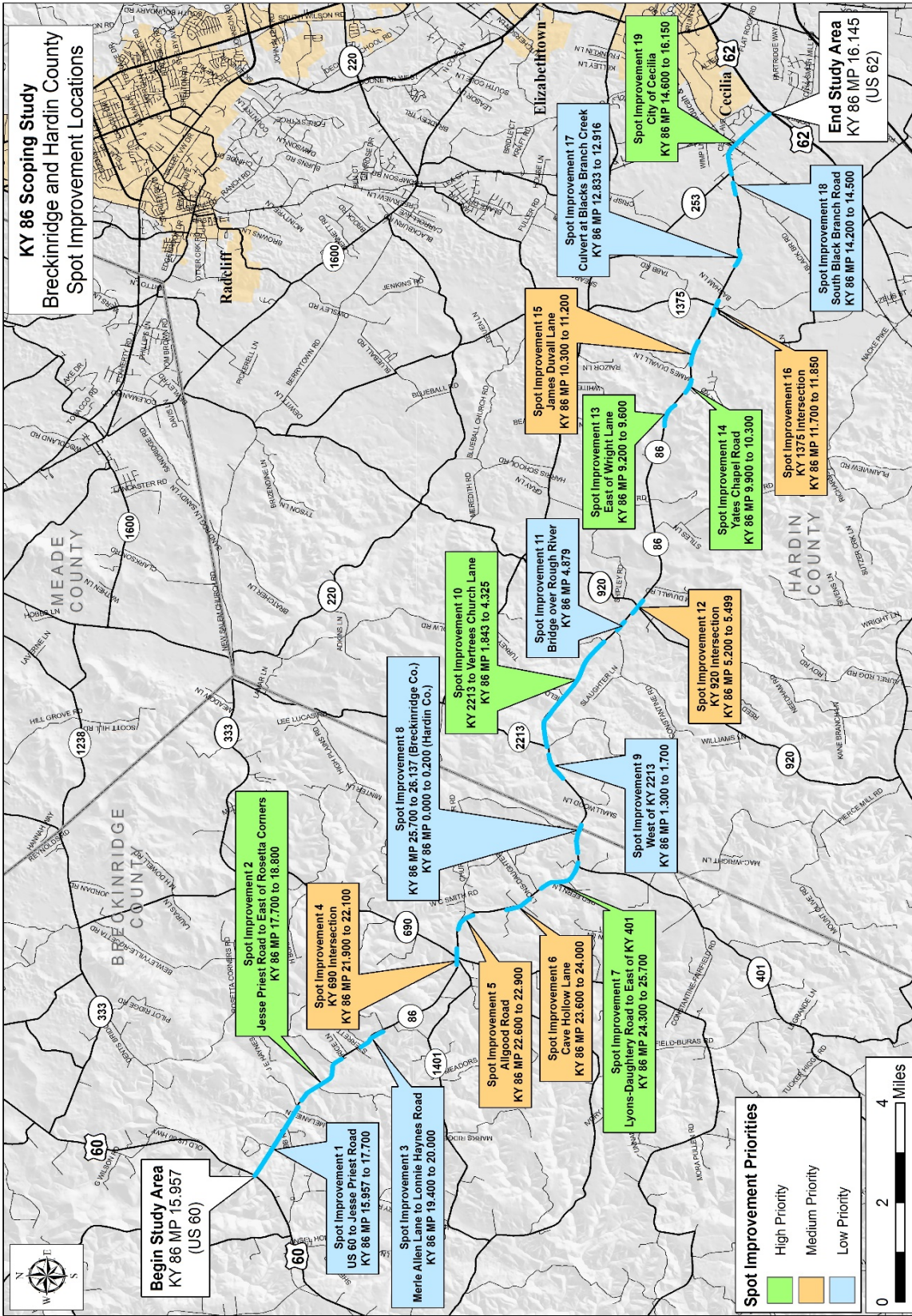


Figure ES-2: Spot Improvement Locations

In addition to the public engagement process, the project team held three meetings to coordinate key issues. The project team consisted of representatives of the KYTC Central Office, KYTC District 4 Office, the Lincoln Trail Area Development District (LTADD), and the consultant.

RECOMMENDATIONS

Prioritization for the KY 86 Scoping Study was based on the project's ability to meet the purpose and need, the existing conditions analysis, the input received, and the alternative development process detailed in the final report. The project team prioritized the improvements into high, medium, and low priority. **Table ES-1** summarizes the design, right-of-way, utility, construction, and total cost estimates for the six high priority projects. Brief descriptions of all spot improvements developed by the project team follow.

Table ES-1: High Priority Project Cost Estimates

High Priority Spot Improvements	County (Begin MP-End MP)	Project Length (miles)	Improvement Options	2017 Cost Estimates				
				Design	Right-of-Way	Utility	Construction	Total
Spot Improvement 2 Jesse Priest Rd to East of Rosetta Corners	Breckinridge (17.700-18.800)	1.100	Widen Shoulders	\$50,000	\$0	\$0	\$500,000	\$550,000
			Flexible Delineators					
			High-Friction Pavement Surface					
			Realignment	\$570,000	\$1,000,000	\$1,000,000	\$3,800,000	\$6,370,000
Spot Improvement 7 Lyons-Daughtery to East of KY 401	Breckinridge (24.300-25.700)	1.400	Widen Shoulders	\$60,000	\$0	\$0	\$600,000	\$660,000
			Flexible Delineators					
			High-Friction Pavement Surface					
			Pave Intersection Approach	\$560,000	\$750,000	\$1,000,000	\$3,700,000	\$6,010,000
Spot Improvement 10 KY 2213 to Vertrees Church Lane	Hardin (1.843-4.325)	2.482	Realignment					
			Remove Vegetation	\$50,000	\$0	\$0	\$500,000	\$550,000
			Widen Shoulders					
			Replace Bridge	\$110,000	\$150,000	\$50,000	\$700,000	\$1,010,000
			Lengthen Culvert and Improve Clear Zone	\$20,000	\$0	\$0	\$100,000	\$120,000
Spot Improvement 13 East of Wright Lane (Coon Hunters Club)	Hardin (9.200-9.600)	0.400	Passing Lane	\$420,000	\$350,000	\$100,000	\$2,800,000	\$3,670,000
			Remove Vegetation	\$30,000	\$0	\$0	\$250,000	\$820,000
			Widen Shoulders					
			Flexible Delineators					
			High-Friction Pavement Surface					
Spot Improvement 14 Yates Chapel Road	Hardin (9.900-10.300)	0.400	Realignment	\$120,000	\$200,000	\$100,000	\$800,000	\$1,220,000
			Widen Shoulders	\$30,000	\$0	\$0	\$250,000	\$280,000
			Flexible Delineators					
Spot Improvement 19 City of Cecilia	Hardin (14.600-16.150)	1.550	High-Friction Pavement Surface	\$450,000	\$1,500,000	\$2,000,000	\$3,000,000	\$6,950,000
			Vertical Realignment					
			Drainage Improvements					
			Signal Ahead Warning Sign					

High Priority (in no particular order)

- **Spot Improvement 2 – Jesse Priest Road to east of Rosetta Corners Road:** This spot improvement includes KY 86 from Jesse Priest Road to east of Rosetta Corners in Breckinridge County (MP 17.700 to MP 18.800). This portion of the route includes three high crash spots with CRFs ranging from 1.24 to 1.86. Of the 21 reported crashes over the past ten years, one was a fatal collision and eight (38 percent) were injury collisions. This portion of the route also includes a combination of sharp curves and poor stopping sight distance. Short-term improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the three horizontal curves. A long-term improvement option is to realign the segment, replacing three of the horizontal curves with a single curve. This location is on KYTC's Unscheduled Needs list as PIF 04 014 D0086 4.10. Looking at logical termini, consideration should be given to combining Spot Improvements 1 and 2 into a single project.



- **Spot Improvement 7 – Lyons-Daughterly Road to east of KY 401:** This spot improvement includes KY 86 from Lyons-Daughterly Road to east of KY 401 in Breckinridge County (MP 24.300 to MP 25.700). This location is a high crash spot with a CRF of 2.49 and was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the 27 reported crashes over the past ten years, one was a fatal collision and nine (33 percent) were injury collisions. This portion of the route includes a combination of sharp curves and poor stopping sight distance. Short-term improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the four horizontal curves. Wider paved shoulders should also be considered to accommodate bicycles in Dyer. A long-term improvement option is realigning the route to eliminate many of the curves. KY 401 would likely need to be extended to the realignment. An additional improvement option along this portion of KY 86 includes paving the intersection approaches at Lyons-Daughterly Road and Dyer Cemetery Road. There is a local firehouse at the corner of Lyons-Daughterly Road and KY 86. Larger radii should be considered at this intersection as part of repaving the approach to better accommodate fire trucks.



➤ **Spot Improvement 10 – KY 2213 to Vertrees**

Church Lane: This spot improvement includes KY 86 between KY 2213 and Vertrees Church Lane in Hardin County (MP 1.843 to MP 4.325).

This location was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the 22 reported crashes over the past ten years, five were injury collisions (23 percent). Fifteen of the crashes (68 percent) were single vehicle crashes including vehicles that ran-off the road and hit a fixed object such as guardrail.

This portion of KY 86 has minimal clear zone between the roadway and adjacent trees, guardrail, culverts, and bridge. Improvement options include removing vegetation and the tree canopy to improve sight-lines, widening shoulders where guardrail is needed, replacing the bridge, and lengthening the culvert and improving the clear zone. Another improvement option includes adding a passing lane at Arch Hill.



- **Spot Improvement 13 – East of Wright Lane (Cherry Tree Coon Hunters Club):** This spot improvement includes KY 86 east of Wright Lane in Hardin County (MP 9.200 to MP 9.600). This portion of the route includes a 45-mph horizontal curve with poor stopping sight distance. This portion of the route includes two high crash spots with CRFs ranging from 1.21 to 1.70 and was identified as an area of concern at the first Local

Officials/Stakeholders Meeting. Of the 13 reported crashes over the past ten years, three were injury collisions (23 percent). Nine of the crashes (69 percent) were single vehicle crashes including vehicles that ran off the road. Improvement options include removing vegetation to improve the clear zone and sight-lines, widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. An additional improvement option includes realigning KY 86.



- **Spot Improvement 14 – Yates Chapel Road:** This spot improvement includes KY 86 near Yates Chapel Road in Hardin County (MP 9.900 to MP 10.300). This portion of the route includes a 50-mph horizontal curve and is a high crash spot with a CRF of 1.21. Of the 14 reported crashes over the past ten years, one was a fatal collision and seven were injury collisions (50 percent). The fatal collision was a head-on collision in the horizontal curve. Ten of the crashes (71 percent) were single vehicle crashes. Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve.



- **Spot Improvement 19 – City of Cecilia:** This spot improvement includes KY 86 through the city of Cecilia in Hardin County (MP 14.600 to MP 16.150). This location was identified as an area of concern at the first Local Officials/Stakeholders Meeting. There were 31 crashes on this portion of KY 86 between 2006 and 2016, 15 (48 percent) of which were rear end collisions. One improvement option is to widen KY 86 to three-lanes through Cecilia in Hardin County to include a center two-way left turn lane and bike lanes. A center two-way left turn lane would reduce these types of crashes and reduce congestion³. Additional improvements include realigning the vertical alignment on KY 86 at the KY 253/Lewis Lane intersection to improve stopping sight distance, drainage improvements to reduce flooding on KY 86, and adding “Signal Ahead” warning signage prior to KY 86/US 62 intersection to improve intersection and traffic signal conspicuity. The priorities are improving the drainage along KY 86 and improving the sight distance at the KY 253 intersection. Widening this portion of KY 86 to three-lanes is not considered a high priority.



³ Persaud, B., C. Lyon, K. Eccles, N. Lefler, D. Carter, and R. Amjadi. Safety Evaluation of Installing Center Two-Way Left-Turn Lanes on Two-Lane Roads. Federal Highway Administration, FHWA Report No. FHWA-HRT-08-042, December 2007.

Medium Priority (in no particular order)

- **Spot Improvement 4 – KY 690 Intersection:** There is a general store and a post office located at the KY 690 intersection and access is poorly defined. One improvement option is to realign the skewed intersections at KY 690 and KY 1401 to the north and implement access management improvements in front of the Custer General Store. Wider paved shoulders should also be considered to accommodate bicycles in Custer. An additional improvement includes installing a flashing intersection beacon at KY 690.
- **Spot Improvement 5 – Allgood Road:** Improvement options include removing vegetation to improve the clear zone and sight-lines, widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. Allgood Road is connected to Conder-St. John Road, and the Allgood Road approach to KY 86 is skewed. Removing the direct connection from Allgood to KY 86 would improve safety at the horizontal curve. Access to KY 86 would be maintained at Conder-St. Johns Road, a more perpendicular intersection located immediately to the east.
- **Spot Improvement 6 – Cave Hollow Lane:** Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. An additional improvement along this portion of KY 86 includes improving the clear zone and lengthening the culvert. Note: as part of this project wider shoulders, flexible delineators, and the application of a high-friction pavement surface at the horizontal curve were recently completed at Spot Improvement 6, near Cave Hollow Lane.
- **Spot Improvement 12 – KY 920 Intersection:** Field's Grocery is located at this busy intersection and access is poorly defined. One improvement option is to implement access management improvements to better define access. An additional improvement is to move the passing permitted striping away from the intersection.
- **Spot Improvement 15 – James Duvall Lane:** Short-term improvement options include addressing drainage issues and removing vegetation along the vertical curves to improve the clear zone and sight-lines. A long-term improvement includes realigning the vertical curves to improve the stopping sight distance.
- **Spot Improvement 16 – KY 1375 Intersection:** A short-term improvement option includes removing vegetation east of KY 1375 to improve the sight-lines at the intersection. A long-term improvement option includes realigning the vertical curves west of KY 1375 to improve the stopping sight distance. Wider paved shoulders should also be considered as part of the realignment to accommodate bicycles in Franklin Cross Roads.

Low Priority (in no particular order)

- **Spot Improvement 1 – US 60 to Jesse Priest Road:** One improvement option is to widen the shoulders along this portion of KY 86. The narrow shoulders and shoulder breaks provide less than desirable recovery opportunity for vehicles leaving the travel way. Additional improvements along this portion of KY 86 include improving the clear zone at a steep roadside ditch and paving the minor approaches to KY 86 at Wee Springs Road and Lucas-Moore Lane
- **Spot Improvement 3 – Merle Allen Lane to Lonnie Haynes Road:** Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the two horizontal curves.
- **Spot Improvement 8 – West of Breckinridge County Line and east of Hardin County Line:** Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. An additional improvement along this portion of KY 86 includes improving the clear zone and lengthening the culvert.
- **Spot Improvement 9 – West of KY 2213:** Improvements include removing vegetation to improve the clear zone and sight-lines and widening shoulders where guardrail is needed at the horizontal curve.
- **Spot Improvement 11 – Bridge over Rough River:** A short-term improvement is to remove vegetation to improve the clear zone and sight-lines on the approaches. A long-term improvement is to replace the bridge.
- **Spot Improvement 17 – Culvert at Blacks Branch Creek:** An Improvement option includes lengthening the culvert and improving the clear zone.
- **Spot Improvement 18 – South Black Branch Road:** Improvement options include widening shoulders and improving the clear zone and relocating the utility pole at South Black Branch Road.

NEXT STEPS

The 2016 Kentucky Highway Plan includes \$500,000 for the planning phase of this project, funds that were used to perform the KY 86 Scoping Study. The next phase for the project would be Phase 1 Design, which would include Preliminary Engineering and supporting Environmental Analysis to further evaluate the high priority projects. As this Scoping Study did not spend the entire planning budget, there are some funds remaining for preliminary design of one or more improvement projects. Additional phases of the project are not funded in the 2016 Highway Plan.



FINAL REPORT



KY 86 Scoping Study
Breckinridge and Hardin Counties
KYTC Item No. 4-8901.00

Prepared for:



Kentucky Transportation Cabinet
Central Office, Division of Planning
Highway District 4, Elizabethtown

Prepared by:



December 2017

1.0 INTRODUCTION

The KY 86 Scoping Study, Kentucky Transportation Cabinet (KYTC) Item Number 4-8901.00, was initiated to evaluate the need for and impacts of transportation improvements along KY 86 in Breckinridge and Hardin Counties. The project includes an examination of the 26.325-mile route between the US 60 intersection in Breckinridge County and the US 62 intersection in Hardin County.

The KY 86 project is listed in the 2016 Highway Plan as Item No. 04-8901.00: reconstruction study on KY 86 from US 60 (MP 15.957) to the Hardin County Line (MP 26.137). The limits of the study have been extended to include KY 86 in Hardin County from the Breckinridge County Line (MP 0.000) to US 62 (MP 16.145) to meet the Federal Highway Administration (FHWA) definition of logical termini. The project is currently funded through the planning phase with \$500,000 in Federal Surface Transportation Program (STP) funds. Additional phases of the project are not funded in the 2016 Highway Plan.

1.1 STUDY AREA

The study area for the KY 86 Scoping Study is approximately 26.325-miles in length, shown on **Figure 1**. The study corridor serves primarily residential homes and farmland. The study area is bounded to the west by US 60 in Breckinridge County and to the east by US 62 in Hardin County.

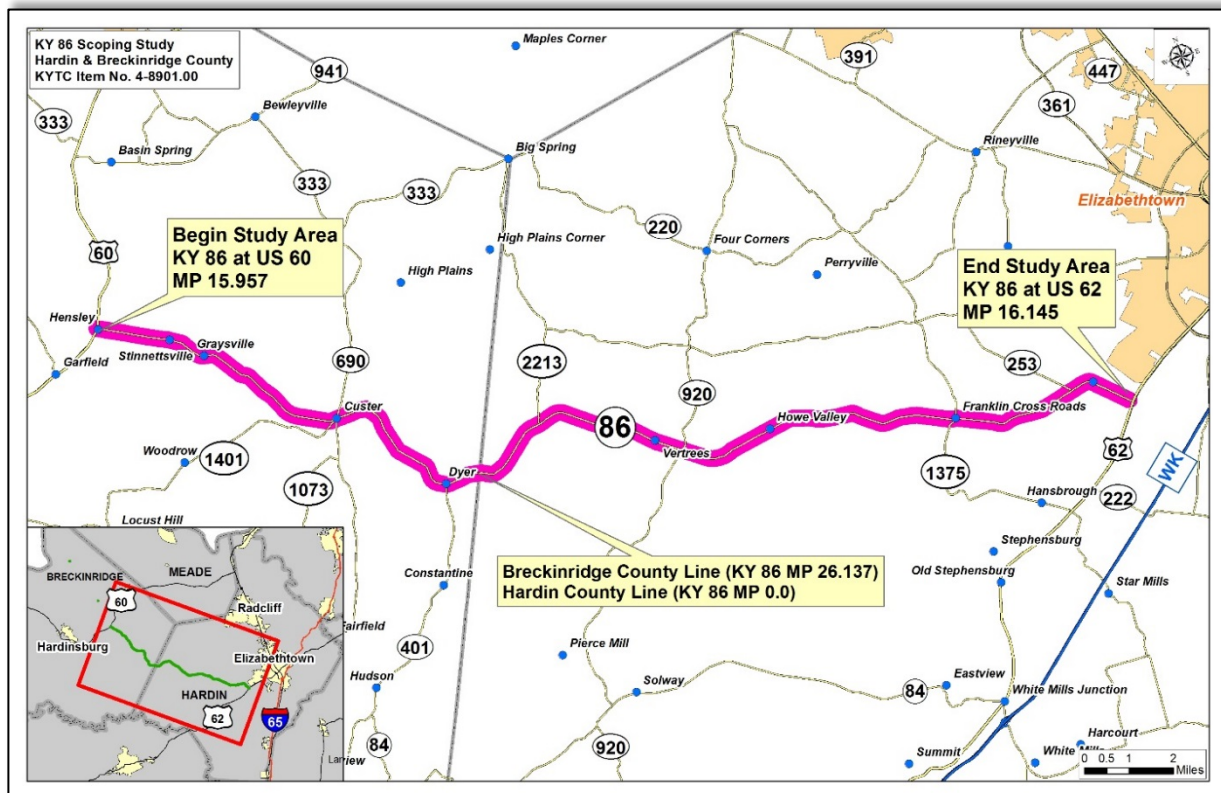


Figure 1: Study Area - KY 86 Scoping Area

This portion of KY 86 carries a mix of both local and regional traffic as it connects the communities of Hardinsburg and Cecilia while also providing regional access to Elizabethtown, the Western Kentucky Parkway, and I-65.

1.2 COMMITTED PROJECTS

There are no other projects in the study area listed in the 2016 Highway Plan. Outside of the Six-Year Plan projects, there are four projects on KYTC's Unscheduled Needs List (UNL) that have an active Project Identification Form (PIF), described below and shown in **Figure 2**.

- PIF 04 014 D0086 4.10 – Address Safety, Geometric Deficiencies, and Maintenance Issues Along KY 86 from US 60 to Rosetta-Corners Road.
- PIF 04 014 D0086 4.20 – Design Study to Identify Deficiencies Along KY 86 from US 62 in Hardin County to US 60 in Breckinridge County. Partial Funds Used for Planning Study and Remaining Funds to Begin Initial Design on Priority Section. This is the current project under consideration with Item Number 4-8901.00.
- PIF 04 047 D0086 45.00 – Planning Study for KY 86 from US 62 to Breckinridge County Line.
- PIF 04 047 D0086 1.00 – Reconstruct the Intersection of KY 86 (Hardinsburg Road) and South Black Branch Road West of Cecilia.

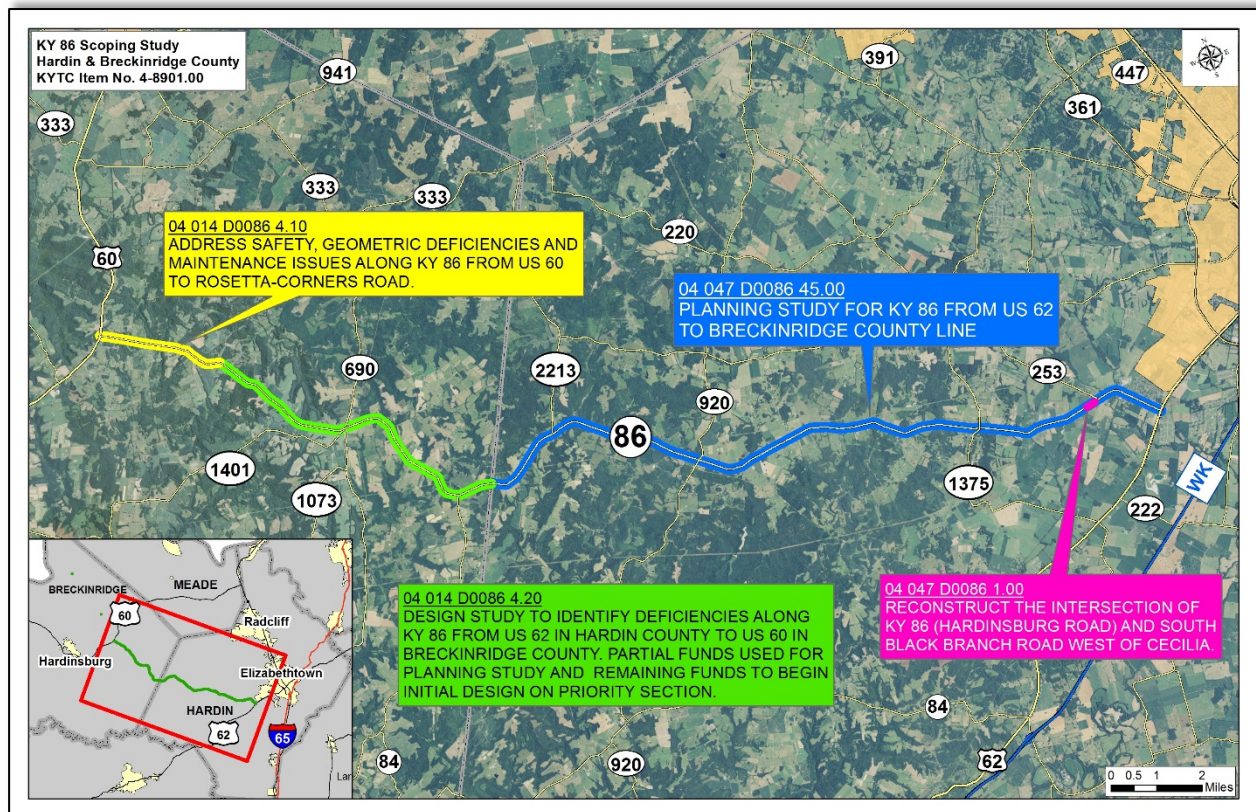


Figure 2: Study Area Unscheduled Needs List Projects

2.0 PURPOSE AND NEED STATEMENT

The purpose of the KY 86 improvement project is to enhance regional mobility and to provide a safer east/west corridor across Breckinridge and Hardin Counties.

The Purpose and Need Statement establishes why KYTC is proposing to advance a transportation improvement and drives the process for improvements, alternative consideration, analysis, and selection. It was developed as a result of the existing conditions analysis, project team input, and local officials/stakeholders input. The following needs were identified over the course of the study. A more detailed discussion regarding these needs is found in Chapter 3.

2.1 IMPROVE SAFETY

A detailed discussion of the crash analysis along KY 86 is found in Section 3.6. Over the ten-year period between July 2006 and June 2016, there were 398 crashes reported on KY 86 between US 60 and US 62. This includes six fatal crashes and 105 injury collisions.

Of the 398 reported crashes, 224 (56 percent) were single vehicle collisions with most being run-off the road collisions. Critical crash rate factors (CRF)¹ were calculated for the five-year study period between July 1, 2011 and June 30, 2016. There are nineteen 0.3-mile-long spots with CRF values greater than 1.0.

KY 86 is a two-lane road with nine-foot-wide lanes and 18-inch-wide paved shoulders. The narrow lane and shoulder widths are considered less than desirable. A review of the as-built plans for KY 86 reveals 25 percent of the horizontal curves do not meet today's standards for the design speed and 66 percent of the vertical curves have stopping sight distance that does not meet the design speed.

Purpose and Need

- Safety is the primary concern along KY 86.
- A two-lane road can adequately accommodate the existing and future traffic demand.

2.2 ENHANCE REGIONAL MOBILITY

KY 86 provides the most direct regional connection for areas between Hardinsburg, Cecilia, Elizabethtown, the Western Kentucky Parkway, and I-65. I-65 is a major north-south interstate highway that travels through Western Kentucky from Nashville, Tennessee in the south to Louisville, Kentucky in the north. Providing a safer, more efficient connection between these areas would improve mobility in Breckinridge and Hardin Counties and the surrounding areas.

¹ The CRF is one measure of the safety of a road, expressed as a ratio of the crash rate at the location compared to the critical crash rate for similar roadways throughout the state. A CRF of 1.00 or greater may indicate that crashes are occurring due to circumstances not attributed to random occurrence.

3.0 EXISTING CONDITIONS

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

3.1 ROADWAY SYSTEM

Functional classification is the grouping of roads, streets, and highways into integrated systems ranked by the level of mobility for through movements and access to adjoining land. This grouping acknowledges that roads serve multiple functions and it provides a basis for comparing roads. Functional classification can be used for, but is not limited to, the following purposes:

- Provide a framework for highways serving mobility and connecting regions and cities within a state.
- Provide a basis for assigning jurisdictional responsibility according to the roadway's importance.
- Provide a basis for development of minimum design standards according to function.
- Provide a basis for evaluating present and future needs.
- Provide a basis for allocation of limited financial resources.

Existing Roadway Characteristics

- Rural Arterial
- Two-lane road with nine-foot wide lanes and 18-inch wide paved shoulders
- 55-mph posted speed limit
- 1,700 to 4,100 vehicles per day (vpd) with up to 11% trucks
- Transitions to an Urban Arterial with Curb & Gutter and a 35-mph speed limit in Cecilia

Figure 3 shows the functional classification of roadways within the study area. KY 86 is functionally classified as a Rural Minor Arterial from US 60 in Breckinridge County to Cecilia in Hardin County and an Urban Minor Arterial from Cecilia to US 62. The posted speed limit throughout most of the corridor is 55 miles per hour (mph) except in Cecilia and several unincorporated communities, where the posted speed limit drops to 35 mph.

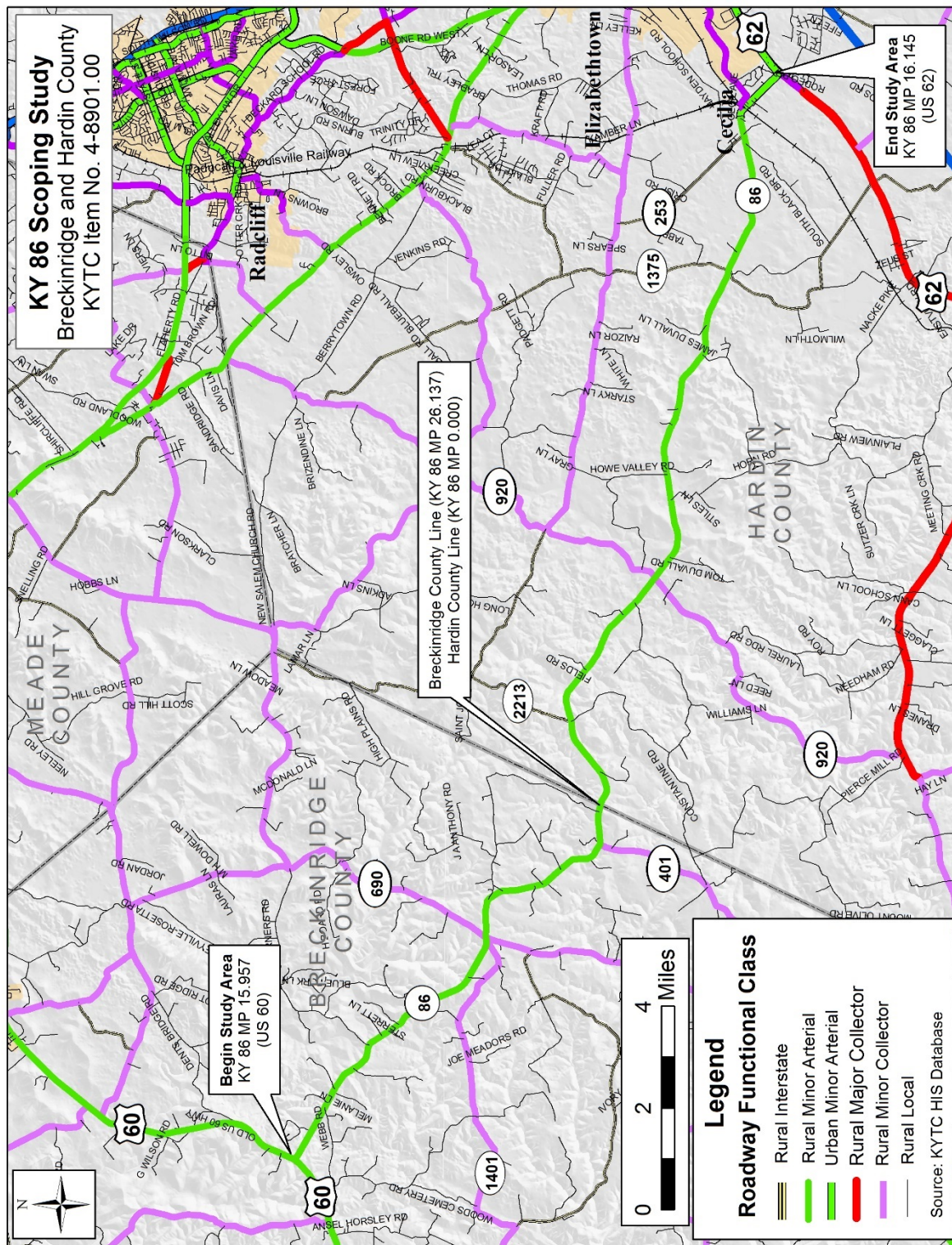


Figure 3: Functional Classification

3.2 ROADWAY GEOMETRIC CHARACTERISTICS

As part of the study effort, a review of existing geometrics along KY 86 and adjacent roadways was performed and compared against geometric standards in AASHTO's *A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011*, commonly referred to as the "Green Book."

Current Green Book design guidelines suggest a minimum of 11-foot-wide lanes on rural arterial roadways with an average daily traffic (ADT) between 1,500 and 2,000 vehicles per day (vpd) and speeds between 45 and 55 mph. A minimum of 12-foot-wide lanes is recommended on rural arterial roadways with an ADT over 2,000 vpd and speeds between 45 and 55 mph (Green Book Table 7-3). For roadways to be reconstructed, a 22-foot traveled way may be retained where the alignment is satisfactory and there is no crash pattern suggesting the need for widening. The majority of KY 86 has nine-foot-wide lanes, which does not meet the minimum recommendations from the Green Book. The road widens to include 12-foot lanes in Cecilia, which is desirable.

In the study area, KY 86 has eighteen-inch paved shoulder widths. Six-foot shoulder widths are recommended for rural arterial roadways with an ADT between 1,500 and 2,000 vpd and eight-foot shoulders are recommended for ADTs higher than 2,000 vpd, but the paved shoulder width may be a minimum of two feet (Green Book Table 7-3). In Cecilia, KY 86 has curb & gutter which is acceptable.

Existing Roadway Geometrics

- Narrow lane and shoulder widths are considered less than desirable
- 25% of horizontal curves do not meet today's standards for the design speed
- 66% of vertical curves have stopping sight distance that does not meet the design speed

A review of the as-built plans for KY 86 reveals there are 72 horizontal curves in the study area, and 18 (25 percent) do not meet today's standards for the design speed. Of the 242 vertical curves in the study area, 160 (66 percent) have stopping sight distance that does not meet the design speed. A majority of the vertical curves are short (less than 400-feet) and sit back-to-back. The horizontal and vertical curves that have design speeds less than 55 mph are shown in **Figure 4** and **Figure 5**. The detailed geometric analysis and standards for KY 86 are in **Appendix A**.

3.3 STRUCTURES

Four bridges and numerous culverts are located along the study corridor, shown in **Figure 6**. From the KYTC Bridge Data Miner, existing structure sufficiency ratings were identified during 2011 inspections. This rating assigns individual structures with a measure of "sufficiency" to remain in service. The higher sufficiency rating a bridge has, the better the condition of the bridge. Bridges considered structurally deficient or functionally obsolete with a sufficiency rating less than 50.0 are regularly considered for rehabilitation or replacement funding. Those considered functionally obsolete with a sufficiency rating of 80.0 or less are regularly considered for rehabilitation funding.

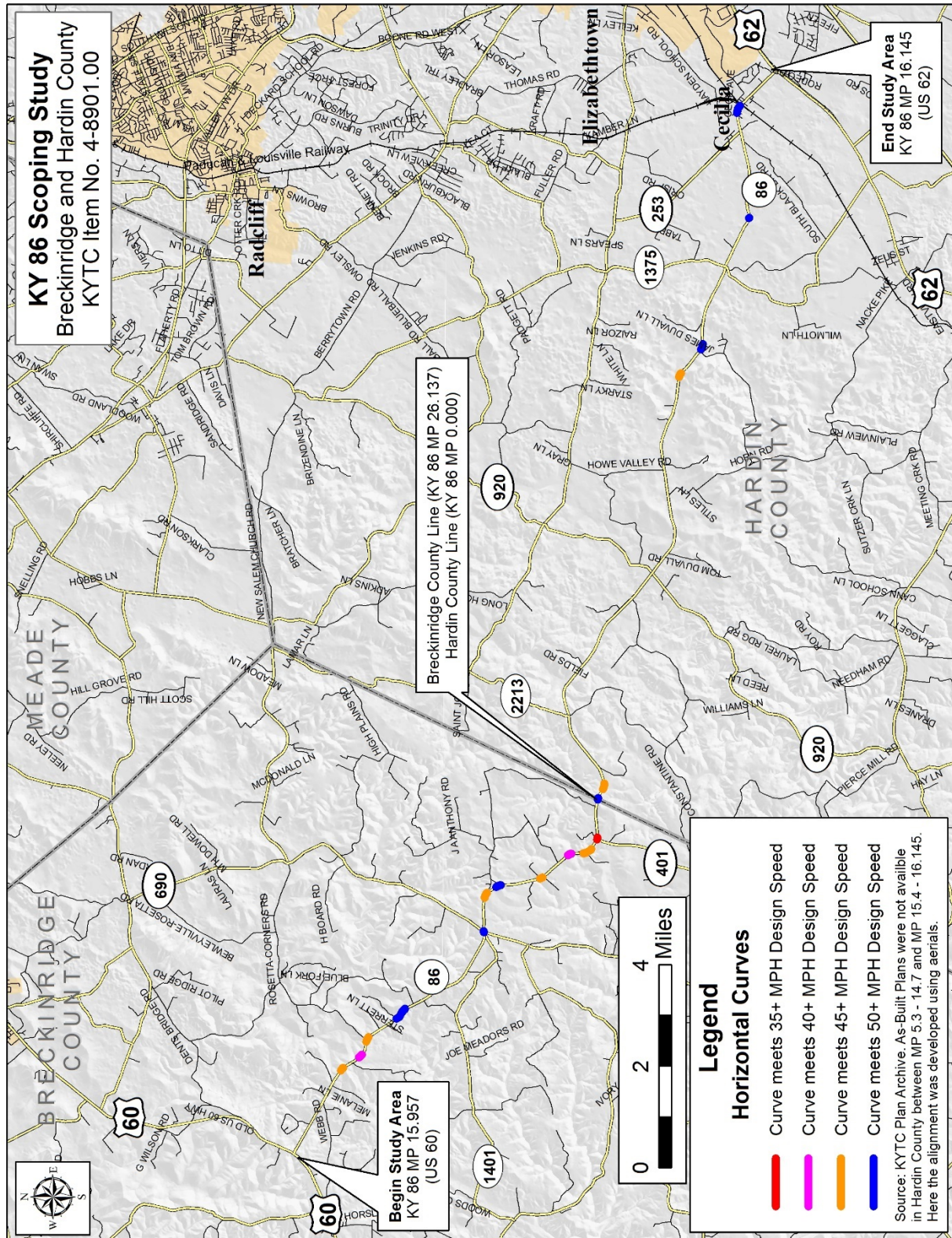


Figure 4: Horizontal Curves with Design Speeds Less than 55 MPH

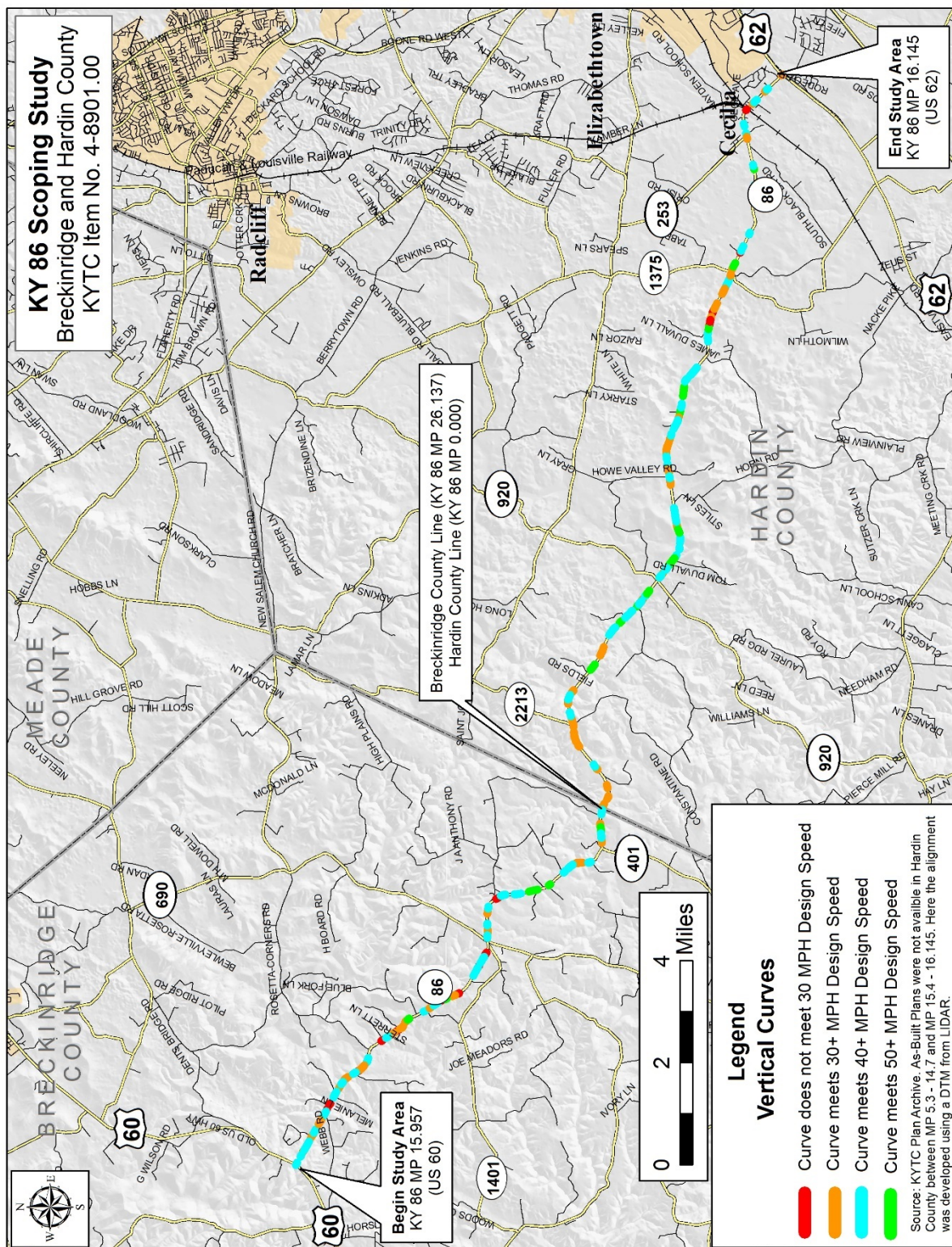


Figure 5: Vertical Curves with Design Speeds Less Than 55 MPH

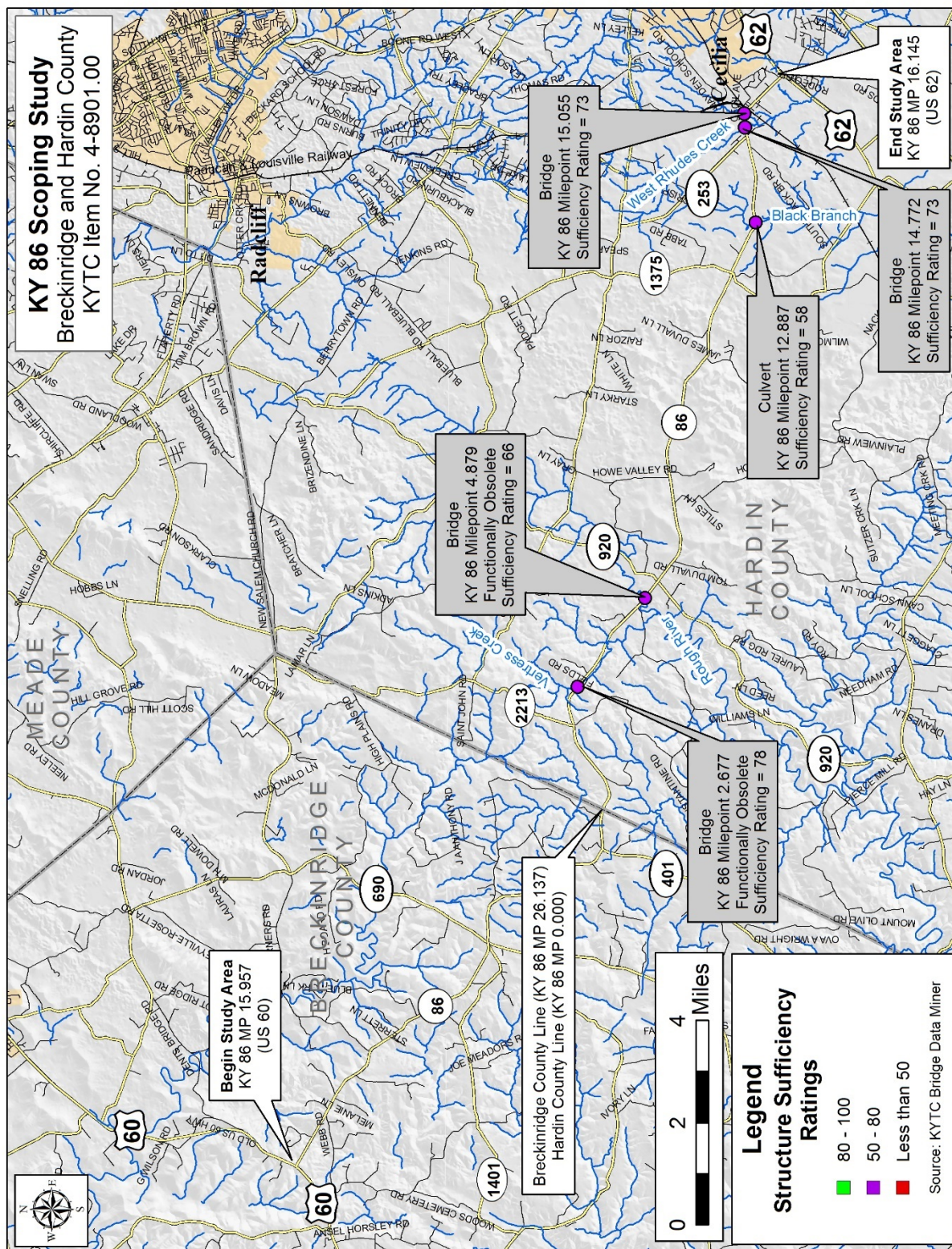


Figure 6: Structure Locations

Bridges are considered structurally deficient if significant load carrying elements are found to be in poor condition due to deterioration and/or damage, or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing overtopping with intolerable traffic interruptions. Bridges are considered functionally obsolete if they do not meet current geometric design standards (such as lane or shoulder widths).

The bridge over Vertress Creek near the Breckinridge County line in Hardin County (MP 2.677) has a sufficiency rating of 78.3 and is considered functionally obsolete. Near the KY 920 intersection, the bridge over Rough River (MP 4.879) has a sufficiency rating of 65.6 and is considered functionally obsolete. The two bridges near the eastern portion of the study area in Cecilia, the bridges over West Rhudes Creek (MP 14.772 and MP 15.055), both have sufficiency ratings of 73.2 and are considered functionally sufficient. There is one culvert identified in the KYTC Bridge Data Miner, the culvert over Black Branch (MP 12.887), which has a sufficiency rating of 57.6.



Rough River Bridge Crossing



Black Branch Culvert

3.4 OTHER MODAL USERS

There are no bike lanes or transit routes along the study area portion of KY 86. The only



Sidewalks in Cecilia

dedicated pedestrian facilities along the corridor include sidewalks in Cecilia. Breckinridge County and Hardin County do not have a bicycle or pedestrian master plan and there are no specific plans for bicycle or pedestrian improvements from the local government within the study area.

Looking at the STRAVA² Global Heat map, which shows the density of multimodal activity along a corridor, some sections of KY 86 show limited bicycle use. It appears these are generally short rides to connect to more north/south routes. As a result, the KYTC Pedestrian & Bicycle Consideration Review (included in **Appendix B**) recommends wider paved shoulders to accommodate bicycles in Breckinridge County between milepoints 21.71 and 22.10 in Custer near KY 690 and between milepoints 25.12 and 25.51 in Dyer near KY 401. Wider paved shoulders for bicycles were also recommended in Hardin County between milepoints 7.30 and 7.84 in Howe Valley near Howe Valley Road, between milepoints 11.62 and 12.02 in Franklin Cross Roads near KY 1375, and between milepoints 15.12 and 16.14 in Cecilia.

KY 86 in Breckinridge and Hardin Counties primarily serves residences and farmland. As a result, large farming equipment use KY 86, which adversely affects traffic operation. KY 86 is within 20 miles of the Meade County Riverport, with both US 60 and US 62 serving as primary arterial connections to the port. Since the study area is primarily agricultural, the port is a logical destination for some of the goods produced within the area.

KY 86 is not on the Kentucky or National Highway Freight Network and truck ADT is at most 180 vehicles per day (vpd) along the study area. Of that, 59 percent are single unit trucks and school buses rather than long-haul freight. Aside from Howe Valley Elementary School and Custer Elementary School, there are no large employers or manufacturing along the study portion of KY 86. There is a large industrial park at the eastern end of the corridor, at the intersection of KY 86 and US 62 in Hardin County. However, trucks originating from this area are more likely to use US 62 because it is a more efficient and reliable highway for freight transport.

3.5 EXISTING TRAFFIC ANALYSIS (YEAR 2016)

The most recent ADT volumes from KYTC's traffic count stations are shown on **Figure 7**. Based on the investigation of historical traffic volume trends, population trends, and the Hardin-Meade Travel Demand Model, a 0.5 percent annual growth was assumed along KY 86. Using this growth rate, the 2016 traffic volumes are estimated to range between 1,700 and 4,200 vehicles per day (vpd) with 2.5 to 11.0 percent trucks. It should be noted that the number of trucks remains relatively flat along KY 86 and the truck percentage varies due to the range in vehicles per day. The complete traffic forecast memorandum is included in **Appendix B**.

² <http://www.strava.com/>

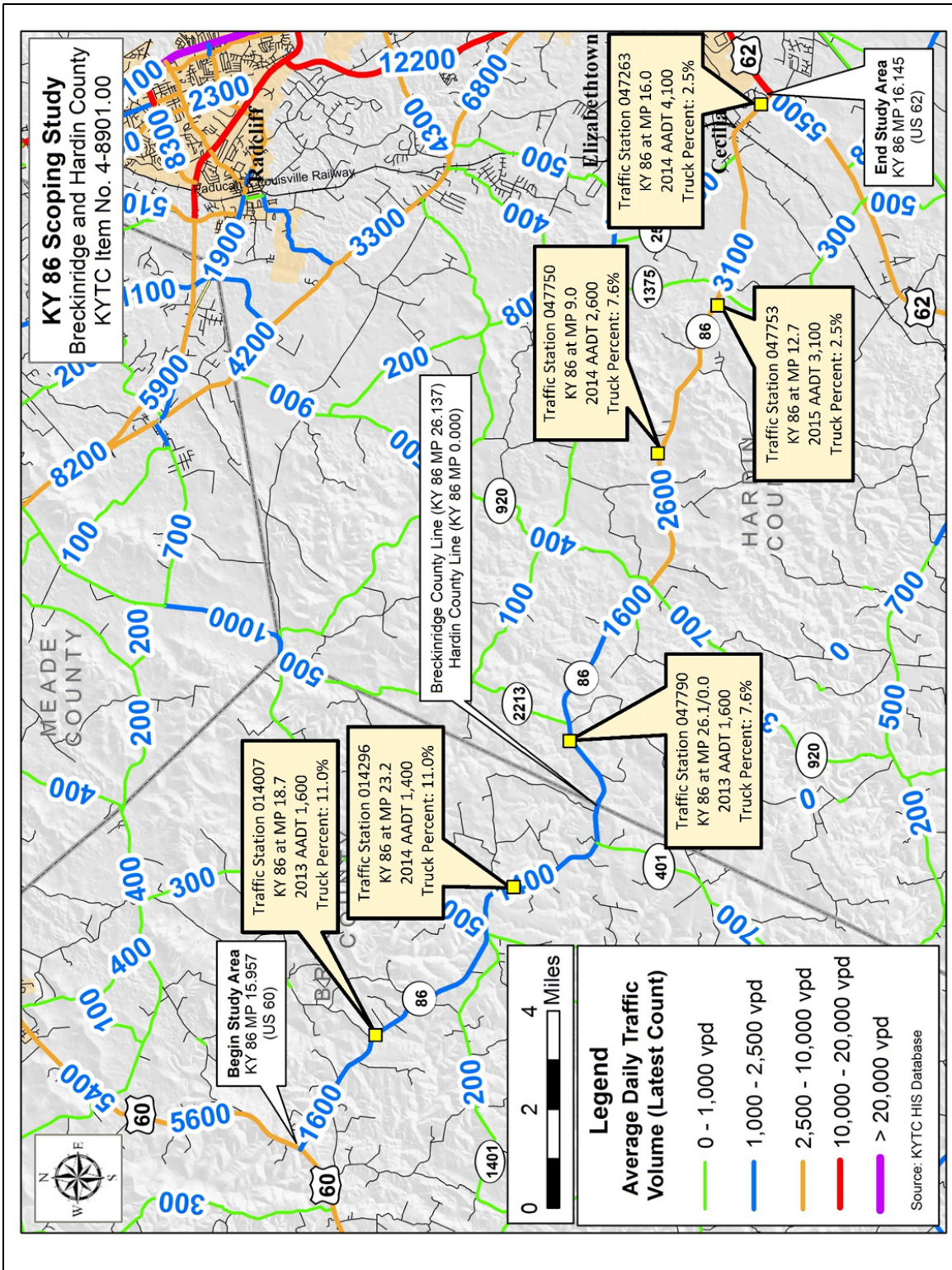


Figure 7: Current ADT Volumes from KYTC's Traffic Count Stations
(In vehicles per day, vpd)

To evaluate the adequacy of roadway segments, existing ADT volumes were compared to the road's theoretical capacity. This is the preferred KYTC methodology for evaluating the adequacy of roadway segments. A V/C ratio represents the proportion of traffic demand for using the roadway for the designated time period in relation to its capacity to serve the demand. A V/C equal to or greater than 0.9 in rural areas and 1.0 in urban areas indicates the road is congested (i.e., operating near or above its design capacity). V/C ratios were estimated along KY 86 based on the estimated 2016 daily traffic volumes. After performing a V/C analysis using the Highway Capacity Manual (HCM)

procedures, all roadway segments currently operate at less than capacity with a V/C no greater than 0.15, as shown in **Table 1**.

Existing Traffic Analysis

- Existing daily traffic volumes are between 1,700 and 4,200 vpd
- KY 86 currently operates at a LOS C or better with a V/C no greater than 0.15
- A two-lane road can adequately accommodate the existing traffic demand







The **Volume to Capacity (V/C) Ratio** reflects the percentage of a road's carrying capacity that is currently utilized.

<1.0

A **V/C ratio over 1.0** indicates that the roadway is carrying more traffic than it is designed to carry.

>1.0

What is **Level of Service (LOS)**?
A measure of traveler satisfaction.

A		Free-Flowing
B		Uncongested
C		Acceptable
D		Moderately Congested
E		Congested
F		Severely Congested

Level of Service (LOS) is a qualitative measure describing operational conditions within a traffic stream, based on factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. For two-lane highways serving moderately developed areas, such as KY 86 in Cecilia, LOS is determined based on the percentage of the average travel speed compared to the free flow speed. For two-lane highways serving as intercity routes or primary connectors, such as KY 86 west of Cecilia to US 60 in Breckinridge County, LOS is determined based on two parameters – average travel speed and percent time spent following in a platoon.

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In rural areas, LOS C or better is desirable and in urban areas LOS D or better is desirable. The urban portion of KY 86 in Cecilia operates at LOS C. While there are no signalized intersections on this portion of KY 86, there is a railroad crossing that decreases the percent of vehicles traveling at free-flow speed. West of Cecilia, KY 86 operates with uninterrupted flow, which allows for higher average travel speeds. This rural portion of KY 86 operates at LOS B and C. Therefore, all sections of KY 86 in the study area currently operate at an acceptable LOS.

The results of the V/C and LOS analysis indicate KY 86 can adequately accommodate the existing traffic demand. **Table 1** presents the estimated 2016 ADT, truck percentage, LOS, and V/C for each segment of KY 86.



School Buses Stopping at KY 86 Railroad Crossing in Cecilia

Table 1: 2016 Traffic Analysis Summary

Description	Begin MP	End MP	Existing (2016)			
			ADT	Truck %	LOS	V/C
US 60 to Hardin County Line ¹	15.957	26.137	1,700	11.00%	B	0.05
Breckinridge County Line to KY 920 ¹	0	5.287	1,700	7.60%	B	0.05
KY 920 to KY 1375 ¹	5.287	11.79	2,600	7.60%	C	0.10
KY 1375 to KY 253 ¹	11.79	14.601	3,100	2.50%	C	0.12
KY 253 to US 62 ²	14.601	16.145	4,100	2.50%	C	0.15

¹ Rural Arterial

² Urban Arterial

3.6 CRASH HISTORY

To quantify safety concerns, a crash analysis was performed for the study portion of KY 86. Historical crash data from the Kentucky State Police collision database were collected along the study area for a ten-year period between July 1, 2006, and June 30, 2016. The crash records and locations are included in **Appendix C**.

3.6.1 Crash Severity

Over the analysis period, there were 398 reported crashes along the 26.325-mile-long corridor. Of these, six resulted in fatalities and 105 resulted in injuries. **Figure 8** summarizes the distribution of crashes by severity.

The percentages of fatal and injury collisions along KY 86 are slightly higher than similar roads in Kentucky. Based on the most recent statewide crash data compiled in the Kentucky Transportation Center research report *Analysis of Traffic Crash Data in Kentucky (2011-2015)*³, injury crashes along rural minor arterials generally comprise 20.8 percent of total crashes; along the study portion of KY 86, injury crashes comprise 26.4 percent of the total reported crashes. Fatal crashes along rural minor arterials generally comprise 1.0 percent of total crashes; along the study portion of KY 86, fatal crashes comprise 1.5 percent of the total reported crashes.

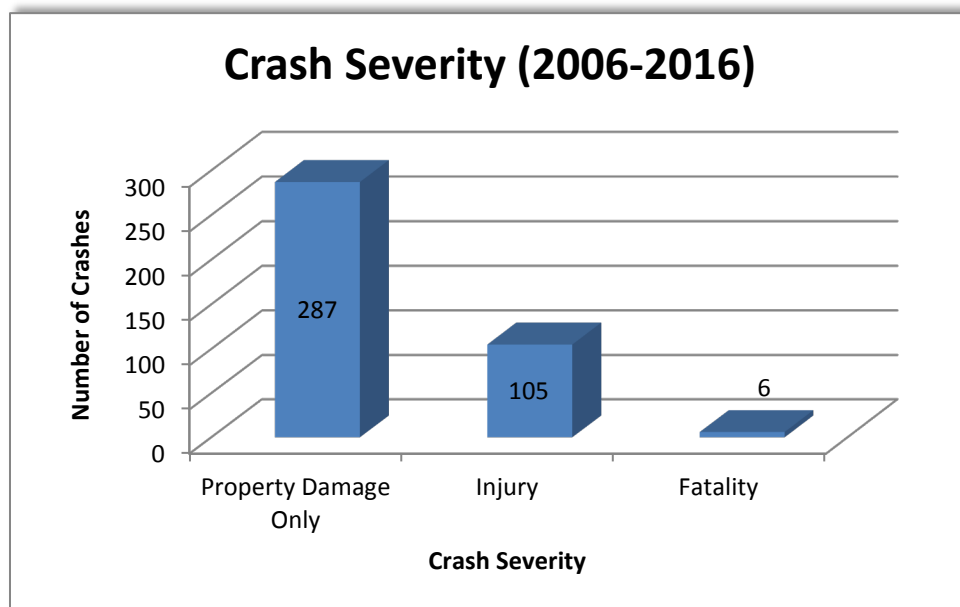


Figure 8: Distribution of KY 86 Crashes by Severity

³ Green, Eric R., Kenneth R. Agent, and Jerry G. Pigman. "Analysis of Traffic Crash Data in Kentucky (2011-2015)." (2016).

3.6.2 Crash Type

To better understand the crash history along this corridor, the crash types were examined. **Figure 9** and **Figure 10** demonstrate the distribution of crashes by crash type. Single vehicle crashes were the most commonly reported crash type (224 crashes, 56.3 percent) and are predominately run-off-the-road collisions. Rear end crashes were the second most commonly reported crash type (58 crashes, 14.6 percent) and were predominately characterized as “rear end in traffic with both vehicles moving”. Other common types of crashes included sideswipe (49 crashes, 12.3 percent) and angle crashes (40 crashes, 10.1 percent).

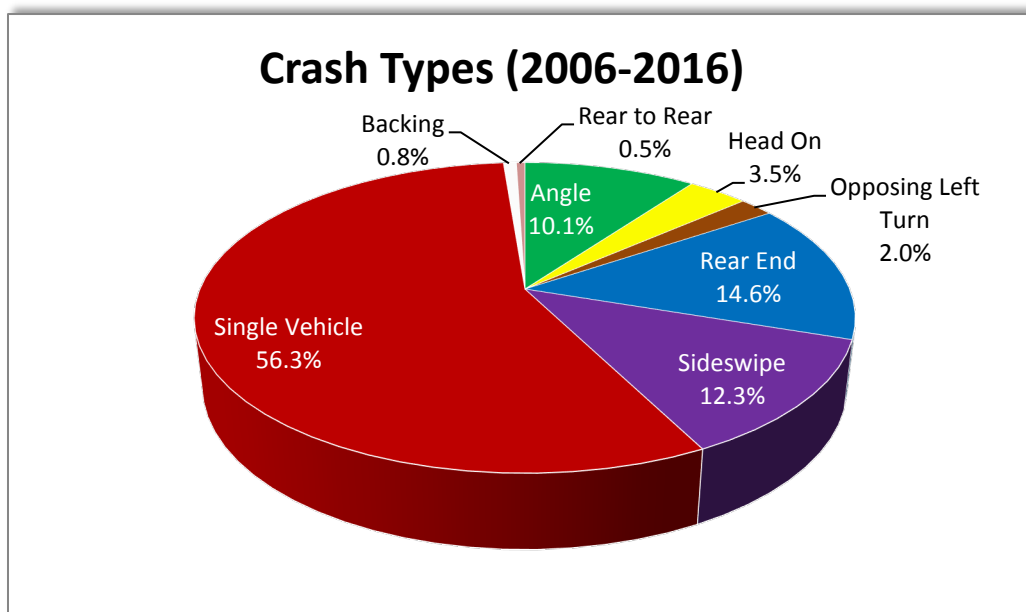


Figure 9: Distribution of KY 86 Crashes by Type

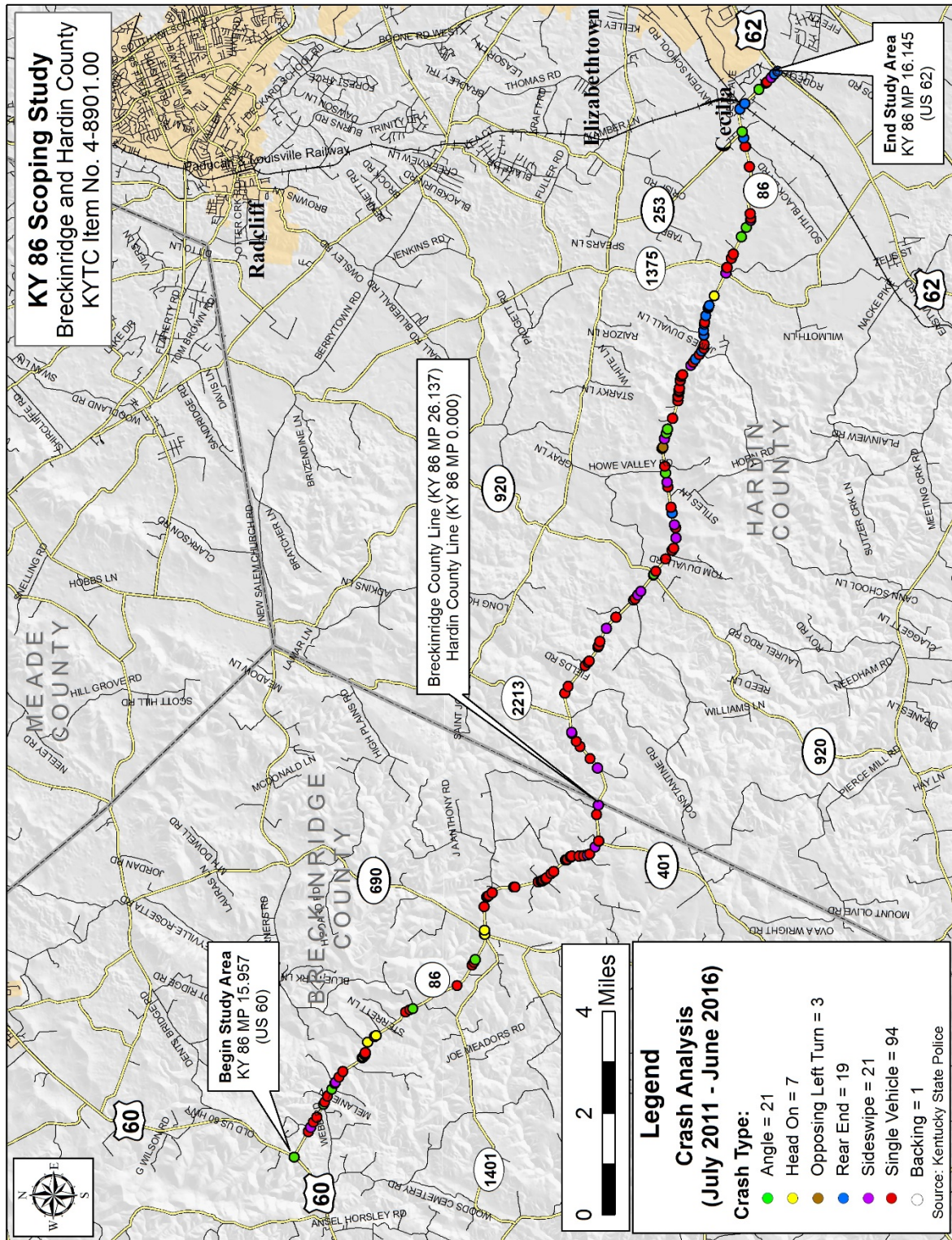


Figure 10: Distribution of Crash Type by Location

Vehicle type was also examined. Passenger vehicles were by far the most common vehicle type collision during the crash analysis period. There were also seven crashes involving single-unit trucks (1.8 percent), seven crashes involving semi-trucks (1.8 percent), four crashes involving school buses (one percent), and two crashes involving farm equipment (0.5 percent).

3.6.3 Critical Rate Factor

Historical crash data from the Kentucky State Police collision database were also collected along the study area for a five-year period between July 1, 2011, and June 30, 2016. Crashes over this five-year period were geospatially referenced and compared to statewide data to

High Crash Spots

- CRF > 1.0 indicates crashes are likely not occurring at random
- 19 High Crash Spots were identified along KY 86 with CRF > 1.0

identify locations experiencing above average crash rates. The methodology is defined in the Kentucky Transportation Center research report *Analysis of Traffic Crash Data in Kentucky* (2011-2015). When analyzing crashes, typically two different lengths of roadway sections are evaluated - segments and spot locations. As defined in the methodology report, roadway segments vary in length and are divided where geometry or traffic volumes change. For each segment, the number of crashes, traffic volume, rural/urban classification, number

of lanes, and segment length were evaluated to determine the critical rate factor (CRF). The CRF is one measure of the safety of a road, expressed as a ratio of the crash rate at the location compared to the critical crash rate for similar roadways throughout the state. A CRF of 1.00 or greater may indicate that crashes are occurring due to circumstances not attributed to random occurrence.

Analysts also conducted a spot analysis along KY 86. Spots were defined by observing 0.3-mile sections where crashes were concentrated. Crashes were again geospatially referenced and compared to statewide data to identify locations experiencing above average crash rates. The CRF was again used as a measure of the safety of a particular spot.



East of Lyons Daughtery Road (CRF = 2.49)

Analysis along KY 86 did not indicate any segment with a CRF over the 1.0 threshold. However, analysis indicated nineteen 0.3-mile-long spot locations with a CRF greater than 1.0, as shown in detail on **Table 2** and **Figure 11**. Given the location and types of crashes (primarily single vehicle collisions), it appears that the roadway geometrics could be a contributing factor.

Table 2: KY 86 High Crash Spots

Spot	County	Begin MP	End MP	Number of Crashes	Critical Rate Factor	Crash Types					
						Angle	Head On	Opposing Left Turn	Rear End	Sideswipe	Single Vehicle
1	Breckinridge	16.523	16.823	4	1.24	0	0	0	0	1	3
2	Breckinridge	16.931	17.231	4	1.24	2	0	1	0	0	1
3	Breckinridge	17.317	17.617	4	1.24	1	1	0	1	0	1
4	Breckinridge	17.639	17.939	4	1.24	0	0	0	0	2	2
5	Breckinridge	18.300	18.600	6	1.86	0	1	1	0	0	4
6	Breckinridge	18.612	18.912	4	1.24	0	2	0	1	0	1
7	Breckinridge	22.600	22.900	7	2.29	1	0	0	0	0	6
8	Breckinridge	23.800	24.100	6	1.96	1	1	0	0	0	4
9	Breckinridge	24.500	24.800	8	2.49	0	0	0	0	1	7
10	Breckinridge	25.837	26.137	4	1.25	0	0	0	0	1	3
11	Hardin	1.300	1.600	4	1.25	0	0	1	0	1	2
12	Hardin	3.300	3.600	5	1.21	1	0	0	0	1	3
13	Hardin	5.150	5.450	7	1.70	4	0	1	0	0	2
14	Hardin	9.000	9.300	5	1.21	0	0	1	0	0	4
15	Hardin	9.300	9.600	7	1.70	0	0	0	0	2	5
16	Hardin	9.900	10.200	5	1.21	0	0	0	2	0	3
17	Hardin	10.758	11.058	5	1.21	0	0	0	2	0	3
18	Hardin	11.600	11.900	6	1.37	3	0	0	1	1	1
19	Hardin	14.200	14.500	7	1.51	0	0	0	2	0	5

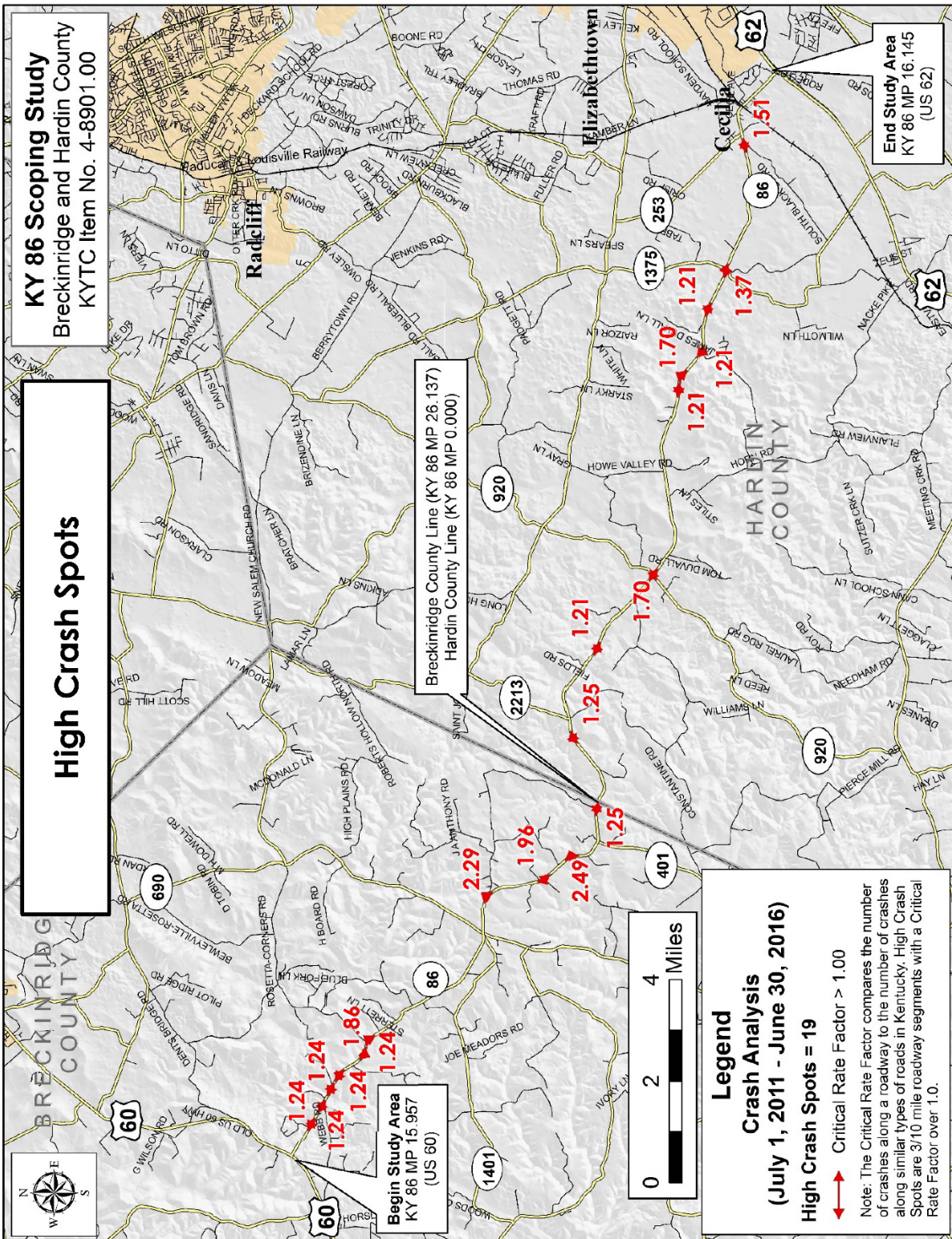


Figure 11: KY 86 High Crash Spots

4.0 ENVIRONMENTAL OVERVIEW

An environmental overview was performed to identify environmental resources of significance, potential jurisdictional features, and other environmental areas of concern that should be considered during project development. Natural and human environment resources within the study area were identified from a literature/database review, as well as a windshield survey. The study area for the environmental overview is a 2,000-foot-wide corridor centered on KY 86. The study area includes KY 86 between US 60, near Hardinsburg in Breckinridge County, and US 62, near Elizabethtown and I-65 in Hardin County. The entire document is included in **Appendix D**.

More detailed environmental studies may be required as the project is further developed. If a future project is federally-funded, the National Environmental Policy Act (NEPA) requires that potential environmental impacts regarding jurisdictional wetlands, archaeological sites, cultural historic sites, and federally endangered species must be avoided if possible. If not, then minimization efforts are required. Mitigation for the unavoidable impacts may also be necessary.

4.1 NATURAL ENVIRONMENT

Natural environment resources include: surface streams; floodplains; wetlands; ponds; groundwater; threatened, endangered, and special concern species and habitat; woodland and terrestrial areas; and parks. Through a literature/database review and field reconnaissance, potentially sensitive resources that affect the natural environment were identified in the study area, are discussed in the following sections, and presented in **Figure 12** and **Figure 13**.

USGS Streams

Rough River, Vertrees Creek, West Rhudes Creek, and 32 United States Geological Survey (USGS) unnamed streams are located within the study area. None of these streams are designated as Special Use Waters as defined by the Kentucky Division of Water (KDOW).

There is one watershed of concern in the study area, Sinking Creek at Hardinsburg. This watershed is designated as a KDOW designated Priority Watershed.

The study area lies within one Source Water Assessment and Protection Program (SWAPP) area; the Hardin County Water District #2 (Upper Green River watershed) covers the study area east of Howe Valley.



Vertrees Creek at KY 86 Bridge

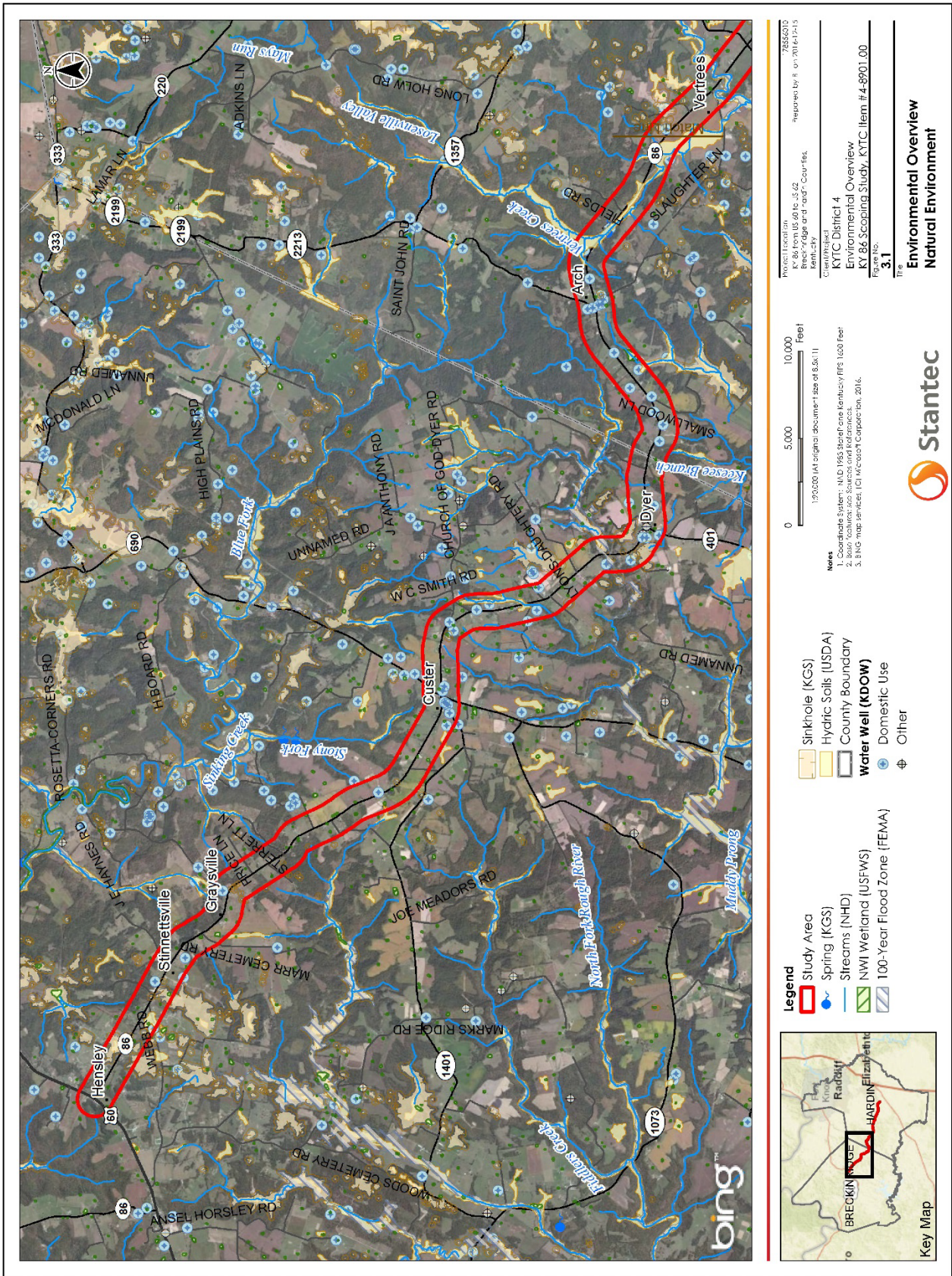


Figure 12: Natural Environment Part 1 (West)

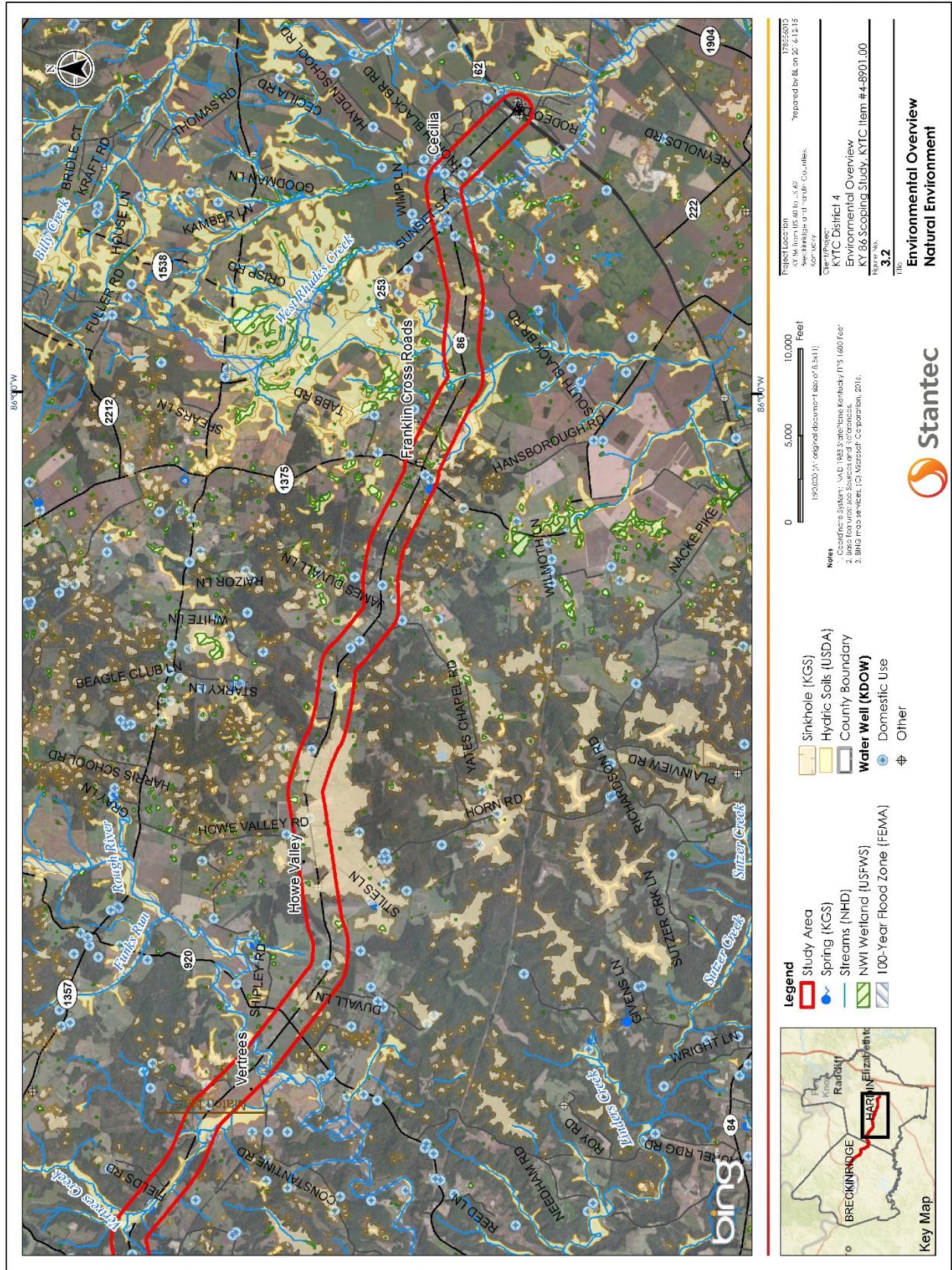


Figure 13: Natural Environment Part 2 (East)

Other Streams

There are nine additional streams mapped in the study area due to the karst plain features of the area, including sinkholes, sinking creeks, and caverns.

Wetlands

There are 158 National Wetlands Inventory (NWI) wetlands mapped in the study area including 133 ponds, 17 emergent, six sinkhole basins, and two aquatic beds. No additional wetland complexes are present in the study area.

Hydric soils occur across approximately five percent of the study area, concentrated in the Vertrees Creek/Rough River Valley and the heavily karst terrain between Cecilia and Franklin Cross Roads to the east. This soil type indicates the potential for additional non-NWI mapped wetlands to be present in the study area.



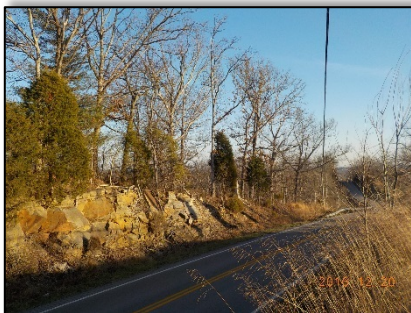
Wetland Adjacent to KY 86

Ponds

There are 133 ponds mapped (based on NWI data) within the study area. Several appear to be intermittent, occurring in sinkhole depressions and do not appear to hold water permanently, while several others appear to have been constructed for aquaculture or recreational fishing opportunities.

USFWS Species List

The United States Fish and Wildlife Service (USFWS) species lists indicates Indiana bat (endangered), gray bat (endangered), and northern long-eared bat (threatened) are known to occur in Breckinridge and Hardin Counties. Eight endangered mussels (clubshell, fanshell, fat pocketbook, orangefoot pimpleback, pink mucket, ring pink, rough pigtoe, and sheepsnose) and one candidate insect (rattlesnake-master borer moth), are potentially in the area.



Potential Indiana Bat and Northern Long-Eared Bat Foraging Habitat along KY 86

The majority of the study area, except for Cecilia, lies within a known habitat designated area for the Indiana and northern long-eared bats. There is a sensitive area located near the community of Dyer. Potential summer roost and foraging habitat for the Indiana bat and northern long-eared bat (woodlots and riparian woodlands) is present in extensive woodlots throughout the study area from Franklin Cross Roads and to the west.

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Of the eight federally-listed mussel species included in the Information for Planning and Conservation (IPaC) report for the study area, only clubshell and fanshell have potentially suitable habitat present in Rough River, Vertrees Creek, and West Rhudes Creek as these are considered small- to medium-sized creeks. Habitat for gray bats may be present as several cave entrances are known in the study area vicinity and the entire project area is in areas of moderate to major karst development potential.

KDFWR Species List

The Kentucky Department of Fish and Wildlife Resources (KDFWR) lists 53 additional State-Threatened, Endangered, and Special Concern species (beyond the 12 species listed by USFWS, above) as occurring (either recently or historically) in Breckinridge and/or Hardin Counties. These include:

- 13 state-endangered species – one amphibian, six birds, one mussel, four insects, and one mammal;
- 12 state-threatened species – six birds, three mussels, one mammal, and two reptiles;
- 28 state-special concern species – six fish, one amphibian, 11 birds, one mussel, one gastropod, one insect, two crustaceans, three mammals, and two reptiles.



**Rough River – Potential
Habitat for Clubshell and
Fanshell Mussels**

KSNPC Species Database

The Kentucky State Nature Preserves Commission (KSNPC) provided 19 records for 13 federal or state-endangered, threatened, or special concern listed species within one mile of the study area. These include:

- Four plants (three state-endangered and one state-species of concern);
- One crustacean (state-species of concern);
- One fish (federal-species of management concern);
- One amphibian (state-species of concern);
- Two reptiles (One each state-threatened and state-species of concern);
- Three birds (One each federal-species of management concern, state-threatened, and state species of concern); and
- One mammal (federal-endangered).

Occurrence records for the fish and crustacean species related to cave-dwelling species. Additional federal-listed species known within five miles include federal-endangered Indiana bat and gray myotis (Gray bat), federal-threatened northern long-eared bat, and federal-candidate rattlesnake-master borer moth.

The KSNPC data response specifically highlights that the project lies close to known hibernacula for federal-listed Indiana bat, gray myotis (bat) and northern long-eared bat. The ghost crayfish, a state-special concern, and cave-obligate species, is known within one mile of the study area. Seven bird species protected under the Migratory Bird Treaty Act are known to occur within 10 miles of the study area. Additional concerns include large forest blocks (specifically fragmentation of such) and three unique ecological communities known in the study area.

Groundwater

There are 117 water wells mapped within the study area, including: 73 domestic use, 28 monitoring use, two remediation and 14 of unknown use. Domestic use water wells are located throughout the extent of the study area and are prevalent in the surrounding areas. One wellhead protection area occurs in the study area, associated with the Hardin County No. 1 water system, located between Cecilia and KY 920 in the eastern portion. Two springs are mapped within the study area, neither of which are named features or used as a source water supply. One spring is located immediately adjacent to the existing KY 86 alignment near the Vertrees Creek crossing, while the other is located just south of Franklin Cross Roads along KY 1375.

Karst

The project area is underlain by bedrock with moderate to high potential for karst. Eighty-four sinkholes are mapped underlying the study area, accounting for approximately eight percent of the area. Sinkholes are most prominent between Franklin Cross Roads and KY 920 in Hardin County, with a second concentration between Graysville and US 60 in Breckinridge County. Six cave entrances are known within study area, with an additional four entrances within 100-feet of the boundary. Due to the sensitive nature of this resource, location information and mapping of locations are not included in this report. KYTC has a policy for use of specific drainage designs (such as grass swales and detention basins) in roadway improvement projects.



Spring from Karst Window

Floodplain

Federal Emergency Management Agency (FEMA) 100-Year floodplains cross the study area at three locations: an unnamed tributary to Muddy Fork (west of KY 401), Rough River, and West Rhudes Creek. At each location, the floodplain is relatively narrow, ranging from 200 to 600 feet in width.

Floodway

There is no FEMA designated floodway in the study area or vicinity.

Farmland

"Prime Farmland" soils (including soils classified "prime farmland if drained") occur across 42 percent of the project area principally associated with valley bottoms and drainage features. "Farmland of Statewide Importance" soils occur across an additional 27 percent of the study area, associated with narrow ridgetops, shoulders, and lower portions of slopes.



Active Farmland along KY 86

Oil and Gas Wells

One oil/gas well is mapped within the study area, a producing gas well located south of KY 86 just east of the Breckinridge/Hardin County border. An additional 10 wells are located within 0.5 miles of the study area, five producing oil or gas, and all are located in Hardin County.

Section 4(f)

No Section 4(f) resources were identified in the study area through secondary source information or during field survey. No public use recreational facilities are present in the study area.

Section 6(f)

Based on current Land and Water Conservation Fund records, there are no Section 6(f) resources in the study area.

Air Quality

The study area is not located in a non-attainment area for 8-hour ozone (2008 standard), or a maintenance area for particulate matter (PM_{2.5}) for the transportation-related criteria pollutants for which the EPA has established National Ambient Air Quality Standards. Two US EPA permitted air emissions facilities are located within the study area, evenly spaced along the length of the project alignment, both being cellular transmission towers.

Noise

Noise sensitive land use areas are present in the city of Cecilia, as well as scattered through the study area (Activity Category “B” and “C” land uses – consisting of several single-family residences, four schools and 11 houses of worship). The study area is primarily rural and dominated by agricultural land uses, with commercial land uses concentrated in Cecilia at the east end of the study area.

4.2 HUMAN ENVIRONMENT

Human environment is defined as what we live in and around and what we have built. Through a literature/database review and field reconnaissance, potentially sensitive resources that affect the human environment were identified and are discussed in the following sections and presented in **Figure 14** and **Figure 15**. The complete document is included in **Appendix D**.

Hazardous Materials

A database review shows 26 sites of potential concern occur within the study area, including seven Resource Conservation and Recovery Act (RCRA) records, two AIRS air emission records (radiotelephone communication sites), 21 underground storage tank (UST) sites, and one leaking underground storage tank (LUST) site. An additional three RCRA records are mapped within 0.25 miles of the study area, concentrated around Cecilia at the east end. The Howe Valley Landfill Superfund Site (National Priority List record) is located less than one mile south of the KY 86 and KY 920 intersection in Howe Valley.

Field survey indicated six additional potential hazardous materials concern sites, including: two automotive service businesses, one former commercial site, one unlisted UST site, and two electrical substations. Multiple UST records within the study area report removal of tanks more than 15 years ago. Sites of potential concern are concentrated in Cecilia and at major crossroads along KY 86.



**Custer General Store
UST, LUST & RCRA Records**

Socioeconomic Study

Socioeconomic issues pertaining to minority, elderly, disability, and low income (persons living in poverty) populations in the project study area were evaluated and documented by the Lincoln Trail Area Development District (LTADD) in a Socioeconomic Study completed in January 2017. A copy of the report is found in **Appendix E**. The study area includes portions of Census Tracts 9601, 9605.01, 9605.02 in Breckinridge County, and Census tract 17 in Hardin County.

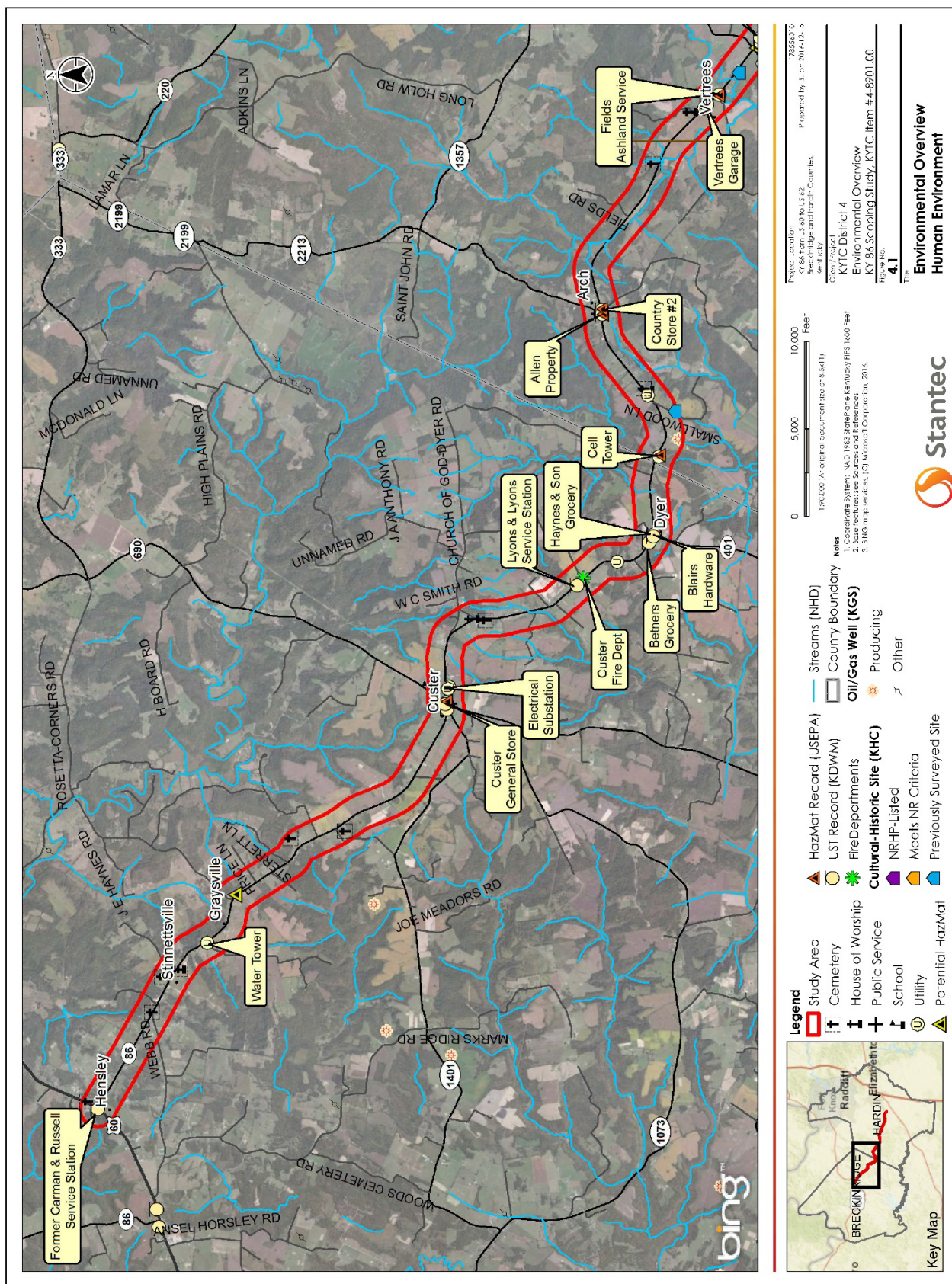


Figure 14: Human Environment Part 1 (West)

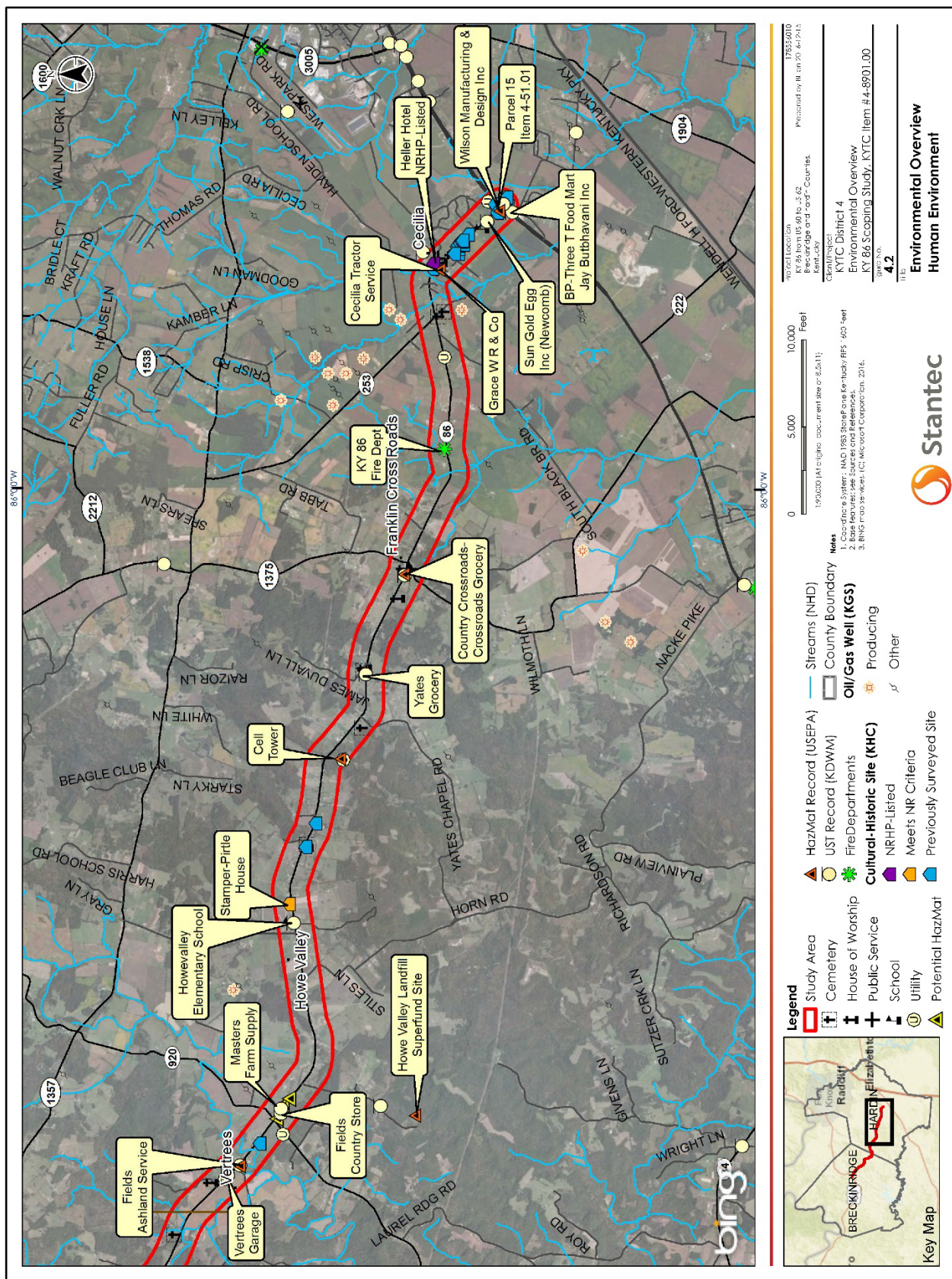


Figure 15: Human Environment Part 2 (East)

Based on the most recent U.S. Census (2010) and American Community Survey (ACS; 2011-2015) data available, one tract in Breckinridge County has a minority population percentage (4.9 percent) greater than the county average (4.2 percent), but less than the state average (11.9 percent). A different tract in Breckinridge County has a low-income population percentage (22.3 percent) greater than the county average (19.2 percent), though all three tracts in Breckinridge County exceed the state average of 18.5 percent.

During future phases of project development, a more detailed and robust analysis would be required for the NEPA documentation when assessing the potential for adverse and disproportionate impacts to poverty status, and minority populations. Environmental justice issues will be addressed further in accordance with KYTC policy during Phase 1 Design.

Archaeology

Based on a review of National Register of Historic Places (NRHP) and Office of State Archaeology (OSA) records, no archaeological sites listed on the NRHP are located in the study area. However, five previous archaeological surveys conducted in or adjacent to the study area have recorded six archaeological sites within the study area. Of the six sites, one was not assessed for NRHP listing, two were not recorded for NRHP eligibility and three were determined to be ineligible for NRHP. Only a minimal amount of the study area has been previously surveyed for archaeological resources. The full report is included in **Appendix E**. Further study may be required once any recommended improvements are more defined.

Historic Resources

The Kentucky Heritage Council (KHC) database search indicated the following resources were identified in the study area vicinity:

- One NRHP-listed structure - Heller Hotel, in Cecilia;
- One structure that meets NR Criteria (not currently listed) - Stamper-Pirtle House, in Howe Valley;
- 40 additional structures with undetermined NRHP status.

Of the 42 previously recorded resources, 22 included sufficient location information for mapping. The majority of these are generally concentrated along Main Street (KY 86) in Cecilia. Due to the presence of these resources and the significant number of rural agricultural properties in the study area vicinity, additional cultural historic properties with large potential boundaries are likely to be present. Existing historic properties should be avoided and additional cultural historic investigations are recommended for any proposed project activities.



**Heller Hotel in Cecilia
NRHP-Listed Cultural-Historic Resource**

Churches

There are 11 houses of worship (church, mosque, synagogue, etc.) located within the study area.

Schools

There are four primary schools within the study area: Custer Elementary and Howe Valley Elementary (located in their communities), Cecilia Elementary (under construction), and St. Ambrose School in Cecilia.

Cemeteries

There are 14 cemeteries located within the study area. Most are either small family plots or are associated with an adjacent church. Several cemeteries are located immediately adjacent to the existing KY 86 alignment.

Public Services

Public service and utility facilities located within the study area include:

- Paducah and Louisville Railroad at-grade crossing in Cecilia;
- Two post offices, in Cecilia and Custer;
- Two electric substations: on KY 920 in Howe Valley and on KY 86 in Custer;
- Two fire department stations: KY 86 Fire Dept. west of Cecilia and Custer Fire Dept. south of Custer;
- Two Masonic Lodges: #212 in Franklin Cross Roads and #624 in Custer;
- Four cellular towers: three in Hardin County, one in Breckinridge County;
- Three powerline crossings in the central portion of the study area;
- One pipeline crossing just west of Cecilia; and
- One water tower near Graysville, owned by Hardinsburg Municipal Utilities.



**Howe Valley Cemetery
Adjacent to KY 86**



**Hardinsburg Municipal Utilities
Water Tower Adjacent to KY 86**

Residences and Businesses

Residential land use in the study area includes single-family homes in Cecilia and scattered rural residential homes along KY 86 with small concentrations present in the rural communities along the alignment. No suburban-style residential developments, mobile home parks or apartment complexes were identified. Commercial businesses are concentrated in Cecilia at the eastern end of the study area. Individual business structures are scattered along the KY 86 corridor.

4.3 GEOTECHNICAL

A geotechnical overview of the study area was completed based upon research of available published data and experience with highway design and construction within the region. The purpose of this overview was to provide a general summary of the bedrock, soil, and geomorphic features likely to be encountered within the proposed alignment and to identify geotechnical features that may have an adverse impact on roadway improvements. The complete document is included in **Appendix F**. The overview included:

- Geotechnical drilling will be needed for replacement or widened culverts, bridges and retaining walls. It is anticipated that the conventional spread footing and/or foundation systems can be utilized for these structures.
- Because a portion of this project may be a widening project, information on pavement structure should be obtained to assist the team on pavement structure and California Bearing Ratio (CBR) information. It should be anticipated that chemically or mechanically stabilized roadbed will be required because CBR values are expected to be six or less.
- Once alignment and sections are identified, then open-faced logging of exposed cuts and/or drilling should be performed. Depending on the project alignment and grade, additional geotechnical information may be desired near the fault systems. Sampling of foundation soils should be performed for embankment situations of sufficient height to evaluate stability.
- Several oil and gas wells have been drilled near/along the proposed corridor. Many have reportedly been abandoned. Future design efforts should inventory and survey active wells early in the process. Additional costs could be incurred if proposed alignment(s) disturbs a well site.



Rock Cut Along KY 86

5.0 TRAFFIC FORECAST (YEAR 2040)

To estimate future traffic volumes along the study corridor, the project team examined historical traffic volumes along KY 86, the Hardin-Meade Travel Demand Model, and Census projections for Breckinridge and Hardin Counties. Based on the Kentucky State Data Center forecasts, an annual population growth rate of -0.3 percent in Breckinridge County and 1.0 percent in Hardin County is expected over the next 20 years. For this project, an annual traffic growth rate of 0.5 percent was used. The future year volumes were calculated by increasing current traffic volumes at 0.5 percent per year from 2016 to 2040. An annual growth rate of 0.25 percent was used for the truck volumes.

Appendix B includes the Traffic Forecast Report, which provides additional detail on the traffic forecast assumptions and findings. Based on these findings, the 2040 ADT is projected to be between 1,900 to 4,700 vpd with a truck percentage between 2.7 and 11.7 percent.

To evaluate the adequacy of roadway segments, 2040 design hour volumes were compared to the road's theoretical capacity. After performing a V/C analysis using Highway Capacity Manual procedures, all roadway segments are anticipated to operate at less than full capacity in 2040 with a V/C no greater than 0.17.

For two-lane highways serving moderately developed areas, such as KY 86 in Cecilia, LOS is determined based on the percent of free-flow speed. For two-lane highways serving as intercity routes or primary connectors, such as KY 86 between Hardinsburg and Cecilia, LOS is determined based on two parameters – average travel speed and percent time spent following in a platoon. In rural areas, LOS C or better is desirable and in urban areas, LOS D or better is desirable. By 2040, if no roadway improvements are made, KY 86 is expected to operate at LOS C in the urban portion of Cecilia and a LOS B in the rural portion west of Cecilia.

The results of the LOS and V/C analyses indicate the two-lanes on KY 86 can adequately accommodate the future traffic demand. **Table 3** presents current and 2040 ADT, truck percentage, LOS, and V/C for each segment.

2040 Traffic Forecast

- Future daily traffic volumes are between 1,900 and 4,700 vpd
- KY 86 will operate at a LOS C or better with a V/C no greater than 0.17
- A two-lane road can adequately accommodate the 2040 traffic demand

Table 3: 2040 Traffic Analysis Summary

Description	Begin MP	End MP	No Build (2040)			
			ADT	Truck %	LOS	V/C
US 60 to Hardin County Line ¹	15.957	26.137	1,900	11.70%	B	0.06
Breckinridge County Line to KY 920 ¹	0	5.287	1,900	8.10%	B	0.06
KY 920 to KY 1375 ¹	5.287	11.79	3,000	8.10%	C	0.12
KY 1375 to KY 253 ¹	11.79	14.601	3,500	2.70%	C	0.13
KY 253 to US 62 ²	14.601	16.145	4,700	2.70%	C	0.17

¹ Rural Arterial² Urban Arterial

6.0 FIRST ROUND OF PUBLIC INVOLVEMENT

The project team for the KY 86 Scoping Study consisted of representatives of the KYTC Central Office, KYTC District 4 Office, Lincoln Trail Area Development District (LTADD), and the consultant Stantec. Over the course of the study, the project team held three meetings to coordinate key issues. The project team also reached out to stakeholders, local officials, and the public. Detailed summaries of each meeting are presented in **Appendix G**.

6.1 PROJECT TEAM MEETING NO. 1

The project team first met at Franklin Crossroads Baptist Church in Cecilia, Kentucky, on the morning of January 31, 2017. The purpose of the meeting was to discuss the project purpose and history, the results of the existing conditions analysis, design considerations, and to get feedback from the project team before developing improvement alternatives. Key discussion items included the following:

- The project team approved the draft Purpose and Need Statement. The purpose of the KY 86 Improvement Project is to enhance regional mobility and to provide a safer east/west corridor across Breckinridge and Hardin Counties.
- The study was to examine two initial improvement concepts in addition to the No-Build option: complete reconstruction and spot improvements. Complete Reconstruction includes widening lanes



and shoulders to bring roadway geometrics to a 55-mph design speed. Spot improvements are lower cost safety improvements focused on locations with high crash rates and less than desirable roadway geometry.

- There was an open discussion about “deficiency” versus “need.” A need is more than a deficiency. The intention for this project should be to improve the roadway to meet driver expectations rather than bring it up to “desirable” Green Book Standards. Curves without a crash history that fit the context of the road do not necessarily “need” to be addressed.



“Deficiency” Versus “Need”

- It was noted that the intersection of KY 86 and KY 253 has a sight distance problem. Consideration should also be given to the intersection of KY 86 and KY 1375 due to a high number of crashes.

6.2 LOCAL OFFICIALS/STAKEHOLDERS MEETING NO. 1

The project team reached out to local government representatives and other community groups early in the planning process. The first local officials/stakeholders meeting was held the afternoon of January 31, 2017. In addition to the project team, the Breckinridge and Hardin County Judge Executives attended along with representatives from the Kentucky State Police, the Breckinridge County Board of Education, State Legislature, the Hardin County Road Department, Hardin County Emergency Services, and Breckinridge County Emergency Management. The purpose of the meeting was to discuss the project purpose and history, the results of the existing conditions analysis, design considerations, and to solicit input on the need for improvement alternatives. Attendees were asked to identify locations with current safety concerns or areas where improvements should be considered. The following locations were identified and are summarized in **Figure 16**:

- KY 86 is too narrow at the box culvert between KY 253 (Bethlehem Academy Road) and KY 1375 (Long Grove Road).
- The KY 86 intersection with KY 1764 (Franklin Crossroads) has limited sight distance and issues with speeding.
- The curve between KY 1355 (Yates Chapel Road) and Wright Lane has horizontal and vertical curve issues.
- The city of Cecilia has several issues and would benefit from a three-lane widening.

KY 86 SCOPING STUDY – FINAL REPORT

- The KY 86 and KY 920 (Salt River Road) intersection has commercial parking lots just off the road.
- KY 86 between Fields Road and N. Grandview Church Road has a steep hill and areas where trees fall into the road.
- KY 86 between Jesse Priest Road and east of Marr Cemetery has several vertical and horizontal curve issues.
- KY 86 between Merle Allen Road and Lonnie Haynes Road has several curves with vertical and horizontal issues.
- The KY 86 curve at Allgood Road has vertical and horizontal curve issues and the intersection is skewed.
- The KY 86 and US 60 intersection has poor sight distance.

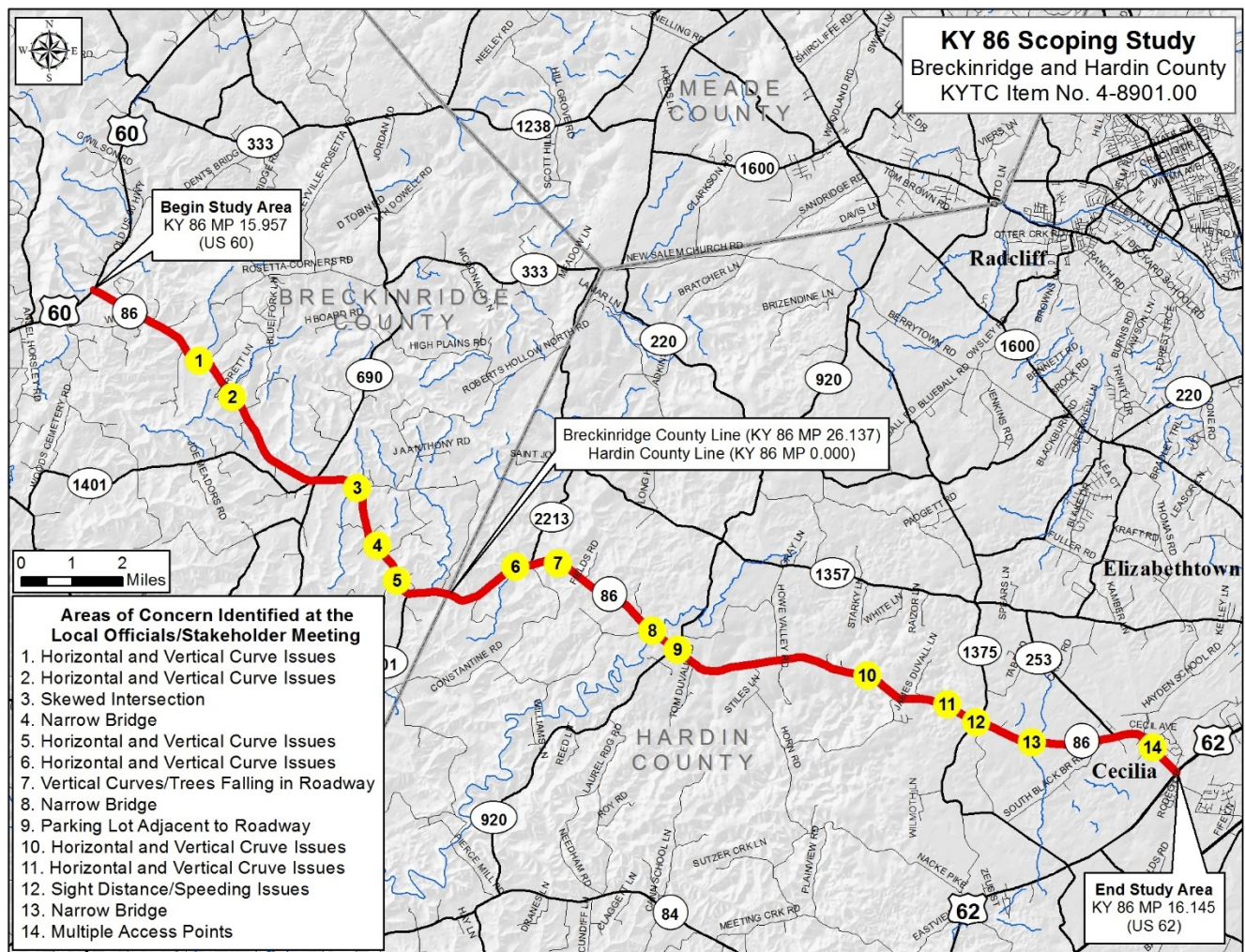


Figure 16: Areas of Concern Identified at Local Officials/Stakeholders Meeting #1

7.0 ALTERNATIVE DEVELOPMENT

A range of concepts was developed based on the existing conditions analysis and input received from the project team and local officials/stakeholders. As noted in the Purpose and Need, safety is the primary concern along KY 86. Conceptual projects were identified that improve safety along the study corridor. Along with the No-Build Alternative, this study examined two types of improvement concepts: (1) Complete Reconstruction and (2) Spot Improvements.

No-Build: Although the No-Build Alternative does not meet the project purpose, it was carried forward as a baseline for comparison between other alternatives.

Alternatives Considered

- No Build
- Complete Reconstruction
- Spot Improvements

7.1 COMPLETE RECONSTRUCTION

Complete reconstruction consists of widening driving lanes and shoulders along the study portion of KY 86 and bringing roadway geometrics to a 55-mph design speed. Assuming \$5 to \$6 million per mile, the total cost of this improvement concept would be approximately \$160 million. The high cost would likely make such an undertaking infeasible as it would have to compete against other statewide projects for funding. The project team decided the complete reconstruction alternative was not a viable improvement concept and thus a more detailed analysis was not warranted. The complete reconstruction alternative and the preliminary cost estimate were presented to the local officials/stakeholders and general public as an option.

Complete Reconstruction Alternative

- Brings roadway geometrics to a 55-mph design speed
- Total Cost = \$160 million
- Project team decided this alternative was not viable and should not be carried forward in the alternative development process



7.2 SPOT IMPROVEMENTS

Spot Improvements generally include relatively low cost improvements that can be implemented individually as solutions to address existing safety issues. Nineteen locations were identified as candidate spot improvements based on local input and high crash spot locations, as shown in **Figure 17**. The purpose of this study was not to design the improvements that may be needed at each location. Rather, the project team identified typical types of improvements that may be considered, as discussed in the following pages.

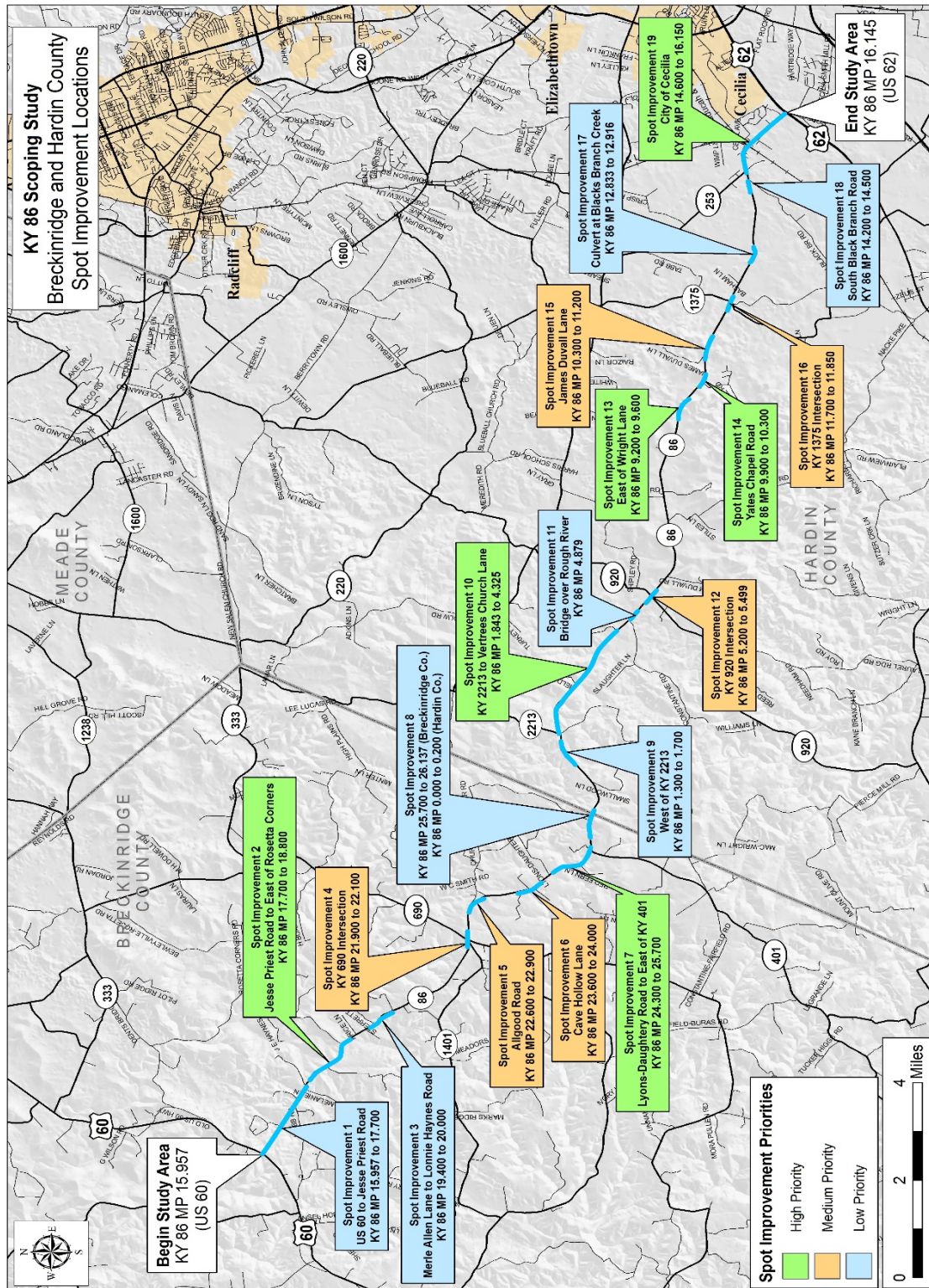


Figure 17: Spot Improvements

- Spot Improvement 1 – US 60 to Jesse Priest Road (MP 15.957-17.700):** This spot improvement includes KY 86 between US 60 and Jesse Priest Road in Breckinridge County (MP 15.957 to MP 17.700). This portion of the route includes three high crash spots, each with a CRF of 1.24. Of the 29 reported crashes over the past 10 years, 15 were injury collisions. Fourteen of those crashes (48 percent) were single vehicle crashes including vehicles that ran off the road. One improvement option is to widen the shoulders along this portion of KY 86. The narrow shoulders and shoulder breaks provide less than desirable recovery opportunity for vehicles leaving the travel way. Additional improvements along this portion of KY 86 include improving the clear zone at a steep roadside ditch and paving the minor approaches to KY 86 at Wee Springs Road and Lucas-Moore Lane. The study area for Spot Improvement 1 is shown in **Figure 18**.

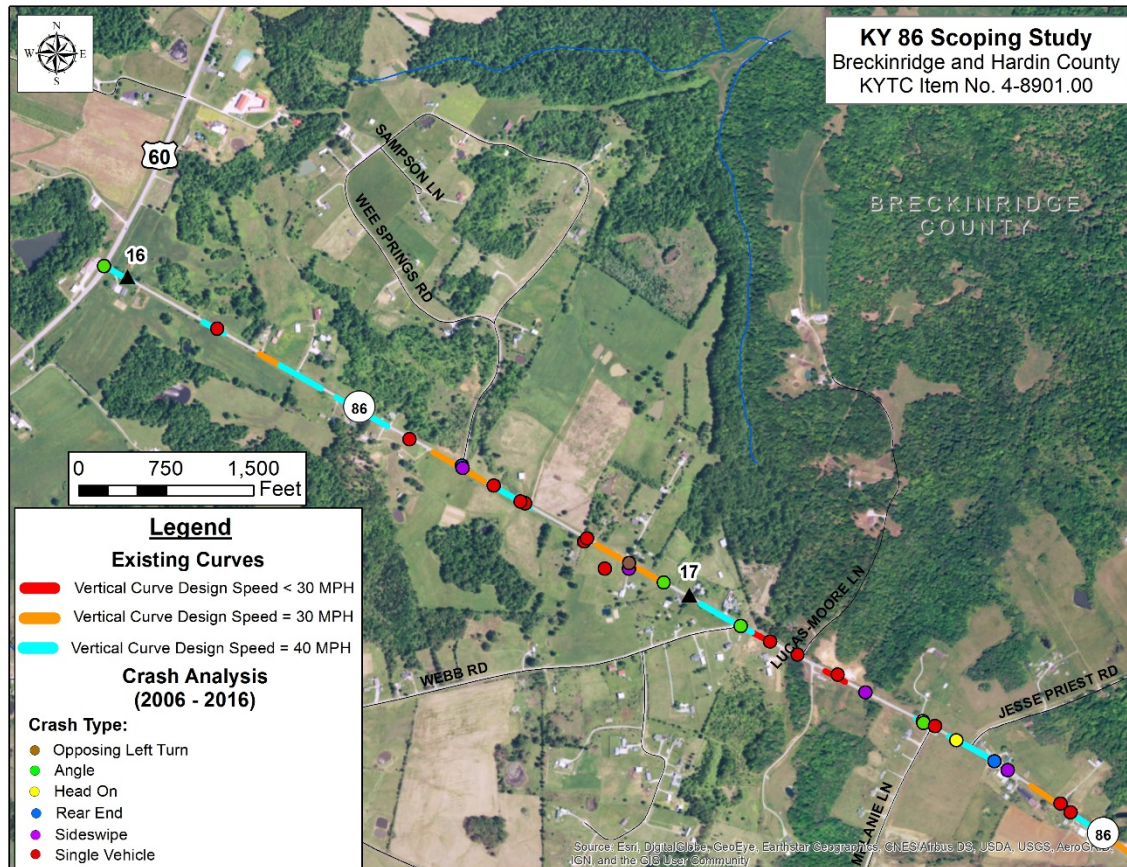


Figure 18: Spot Improvement 1 – US 60 to Jesse Priest Road

- Spot Improvement 2 – Jesse Priest Road to east of Rosetta Corners Road (MP 17.700-18.800):** This spot improvement includes KY 86 from Jesse Priest Road to east of Rosetta Corners in Breckinridge County (MP 17.700 to MP 18.800). This portion of the route includes three high crash spots with CRFs ranging from 1.24 to 1.86. Of the 21 reported crashes over the past 10 years, one was a fatal collision and eight were injury collisions. This portion of the route includes a combination of sharp curves and poor stopping sight distance. Short-term improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the three horizontal curves. A long-term improvement option is to realign the segment, replacing three of the horizontal curves with a single curve. This location is on KYTC's Unscheduled Needs list as PIF 04 014 D0086 4.10. The study area for Spot Improvement 2 is shown in **Figure 19**.

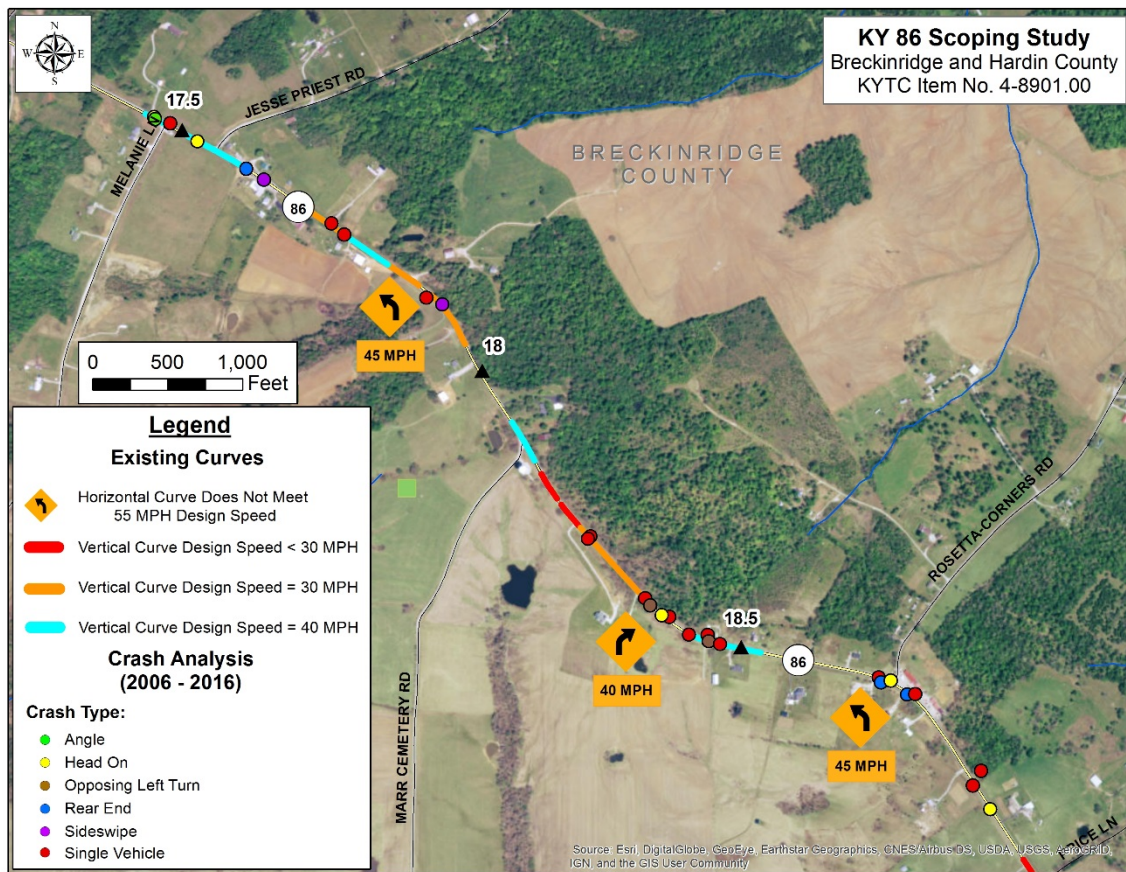


Figure 19: Spot Improvement 2 – Jesse Priest Road to east of Rosetta Corners Road

- Spot Improvement 3 – Merle Allen Lane to Lonnie Haynes Road (MP 19.400-20.00):** This spot improvement includes KY 86 between Merle Allen Lane and Lonnie Haynes Road in Breckinridge County (MP 19.400 to MP 20.000). This location was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the seven reported crashes over the past 10 years, two were injury collisions. Five of those crashes (71 percent) were single vehicle crashes. This portion of the route includes reverse curves. Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the two horizontal curves. The study area for Spot Improvement 3 is shown in **Figure 20**.

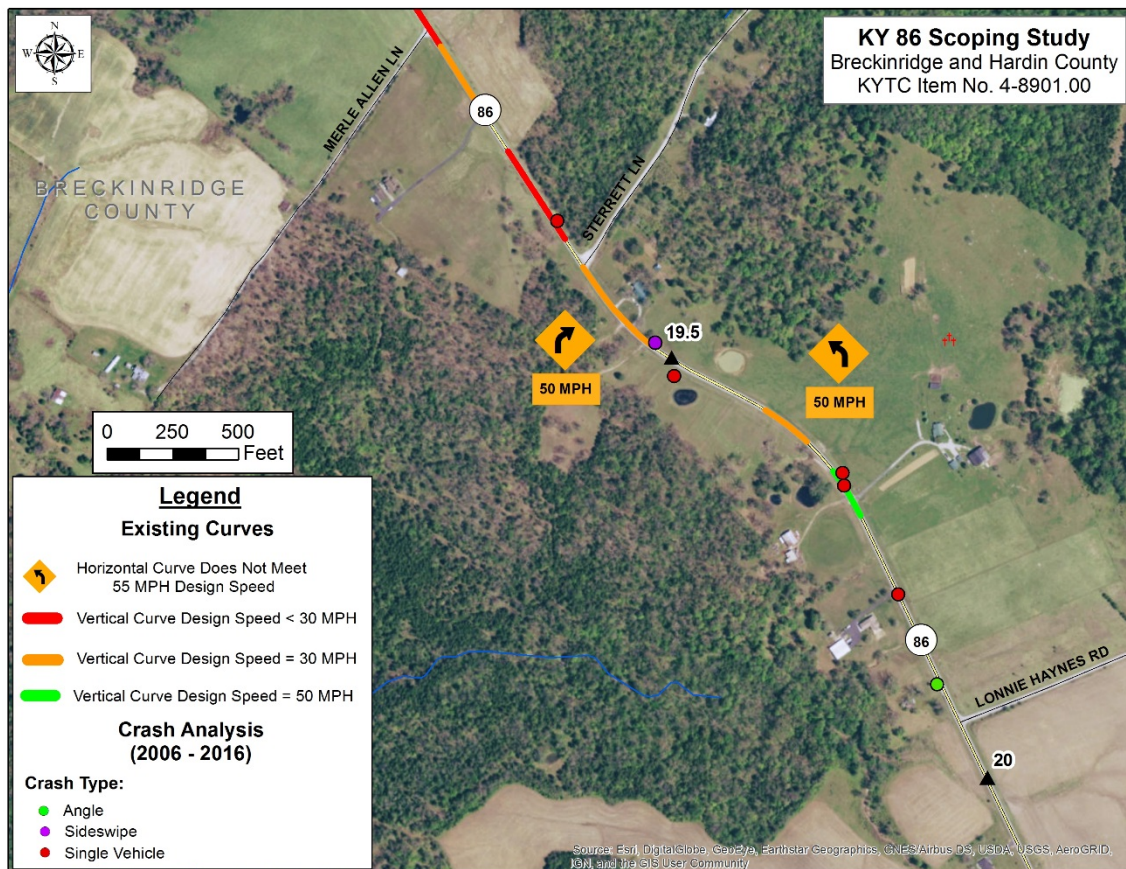


Figure 20: Spot Improvement 3 – Merle Allen Lane to Lonnie Haynes Road

- Spot Improvement 4 – KY 690 Intersection (MP 21.900-22.100):** This spot improvement includes the KY 86 intersections with KY 1401 and KY 690 in Breckinridge County (MP 21.900 to MP 22.100). Of the five reported crashes over the past 10 years, one was an injury collision. The five reported crashes include two head on collisions, one angle collision, one rear end collision, and one backing collision. There is a general store and a post office located at the KY 690 intersection, and access is poorly defined. One improvement option is to realign the skewed intersections at KY 690 and KY 1401 to the north and implement access management improvements in front of the Custer General Store. Wider paved shoulders should also be considered to accommodate bicycles in Custer. An additional improvement includes installing a flashing intersection beacon at KY 690. The study area for Spot Improvement 4 is shown in **Figure 21**.

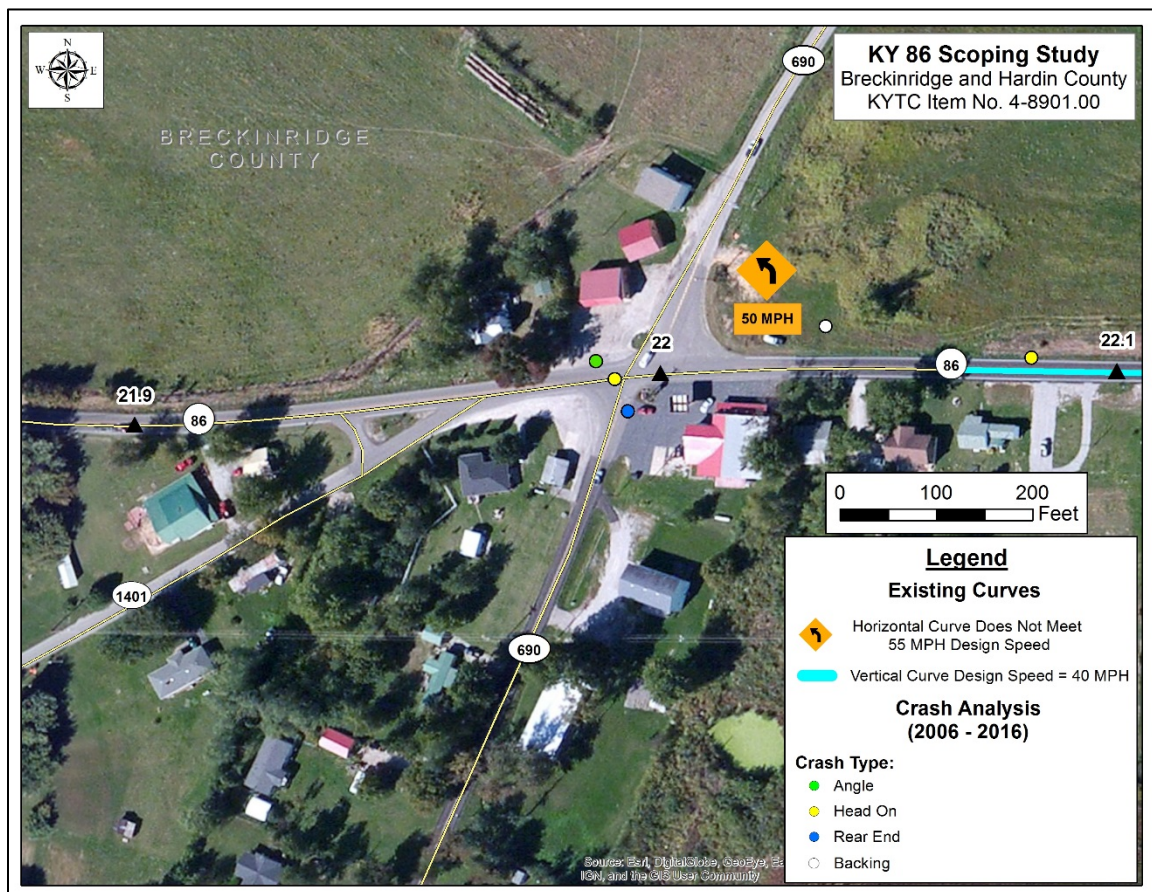


Figure 21: Spot Improvement 4 – KY 690 Intersection

- Spot Improvement 5 – Allgood Road (MP 22.600-22.900):** This spot improvement includes KY 86 near Allgood Road in Breckinridge County (MP 22.600 to MP 22.900). This location is a high crash spot with a CRF of 2.29 and was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the nine reported crashes over the past 10 years, three were injury collisions (33 percent). Eight of those crashes (89 percent) were single vehicle crashes. This portion of the route includes a 45-mph horizontal curve with a skewed intersection at Allgood Road. Improvement options include removing vegetation to improve the clear zone and sight-lines, widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. Allgood Road is connected to Conder-St. John Road, and the Allgood Road approach to KY 86 is skewed. Removing the direct connection from Allgood to KY 86 would improve safety at the horizontal curve. Access to KY 86 would be maintained at Conder-St. Johns Road, a more perpendicular intersection located immediately to the east. The study area for Spot Improvement 5 is shown in **Figure 22**.

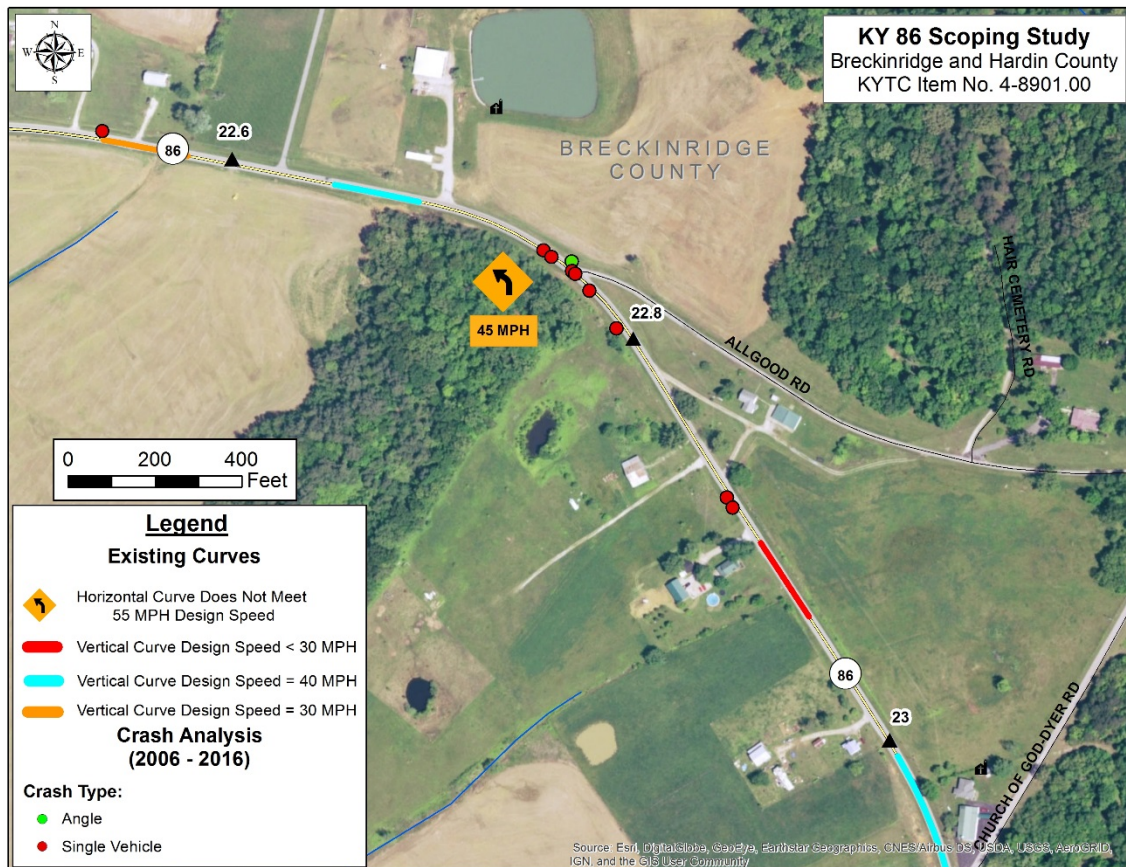


Figure 22: Spot Improvement 5 – Allgood Road

- Spot Improvement 6 – Cave Hollow Lane (MP 23.600-24.000):** This spot improvement includes KY 86 near Cave Hollow Lane in Breckinridge County (MP 23.600 to MP 24.000). This location is a high crash spot with a CRF of 1.96 and was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the six reported crashes over the past ten years, three (50 percent) were injury collisions and four (67 percent) were single vehicle crashes. This portion of the route includes a 45-mph horizontal curve. Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. An additional improvement along this portion of KY 86 includes lengthening the culvert west of J.R. Alexander Road and improving the clear zone. The study area for Spot Improvement 6 is shown in **Figure 23**.



Figure 23: Spot Improvement 6 – Cave Hollow Lane

- Spot Improvement 7 – Lyons-Daughterly Road to east of KY 401 (MP 24.300-25.700):** This spot improvement includes KY 86 from Lyons-Daughterly Road to east of KY 401 in Breckinridge County (MP 24.300 to MP 25.700). This location is a high crash spot with a CRF of 2.49 and was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the 27 reported crashes over the past ten years, one was a fatal collision and nine (33 percent) were injury collisions. This portion of the route includes a combination of sharp curves and poor stopping sight distance. Short-term improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the four horizontal curves. Wider paved shoulders should also be considered to accommodate bicycles in Dyer. A long-term improvement option is realigning the route to eliminate many of the curves. KY 401 would likely need to be extended to the realignment. An additional improvement option along this portion of KY 86 includes paving the intersection approaches at Lyons-Daughterly Road and Dyer Cemetery Road. There is a local firehouse at the corner of Lyons-Daughterly Road and KY 86. Larger radii should be considered at this intersection as part of repaving the approach to better accommodate fire trucks. The study area for Spot Improvement 7 is shown in **Figure 24**.

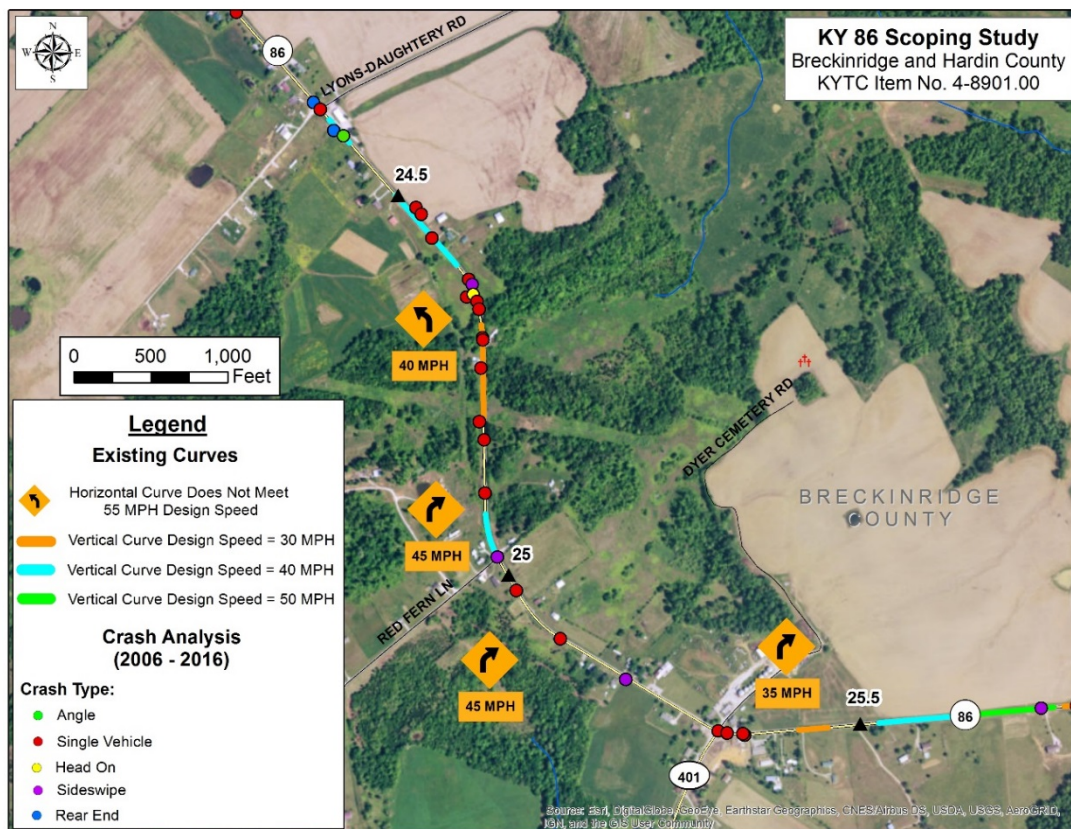


Figure 24: Spot Improvement 7 – Lyons-Daughterly Road to East of KY 401

- Spot Improvement 8 – West of Breckinridge County Line (MP 25.700-26.137) to east of Hardin County Line (MP 0.00-0.200):** This spot improvement includes KY 86 at the Breckinridge and Hardin County Line. This location is a high crash spot with a CRF of 1.25. Of the 13 reported crashes over the past ten years, two were fatal collisions and four were injury collisions. The two fatal collisions included a driver under the influence and a collision with a deer. Nine of the crashes (69 percent) were single vehicle. This portion of the route includes a 50-mph horizontal curve. Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. An additional improvement along this portion of KY 86 is to lengthen the culvert and improve the clear zone. The study area for Spot Improvement 8 is shown in **Figure 25**.

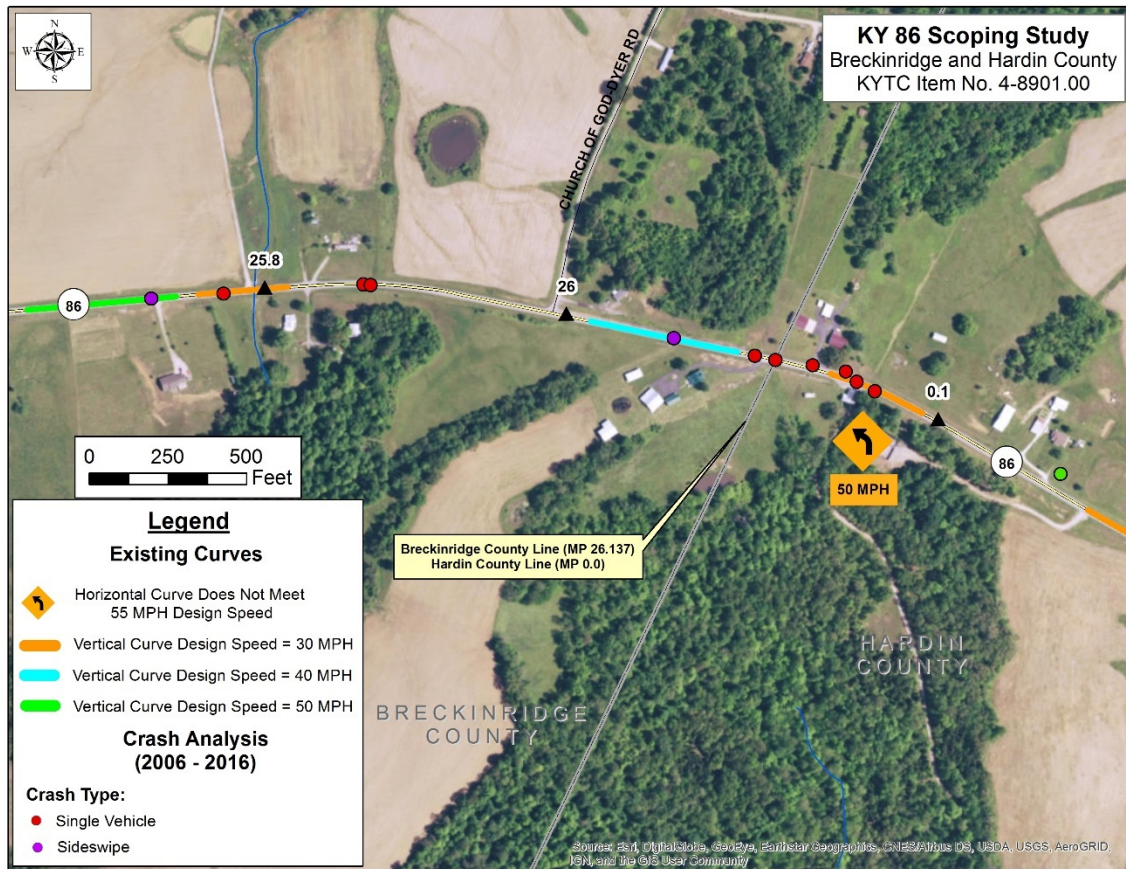


Figure 25: Spot Improvement 8 – Breckinridge and Hardin County Line

- Spot Improvement 9 – West of KY 2213 (MP 1.300-1.700):** This spot improvement includes KY 86 west of Grandview Church Road in Hardin County (MP 1.300 to MP 1.700). This location is a high crash spot with a CRF of 1.25 and was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the nine reported crashes over the past 10 years, three were injury collisions (33 percent). Six of the crashes (67 percent) were single vehicle crashes. Improvements include removing vegetation to improve the clear zone and sight-lines and widening shoulders where guardrail is needed at the horizontal curve. The study area for Spot Improvement 9 is shown in **Figure 26**.

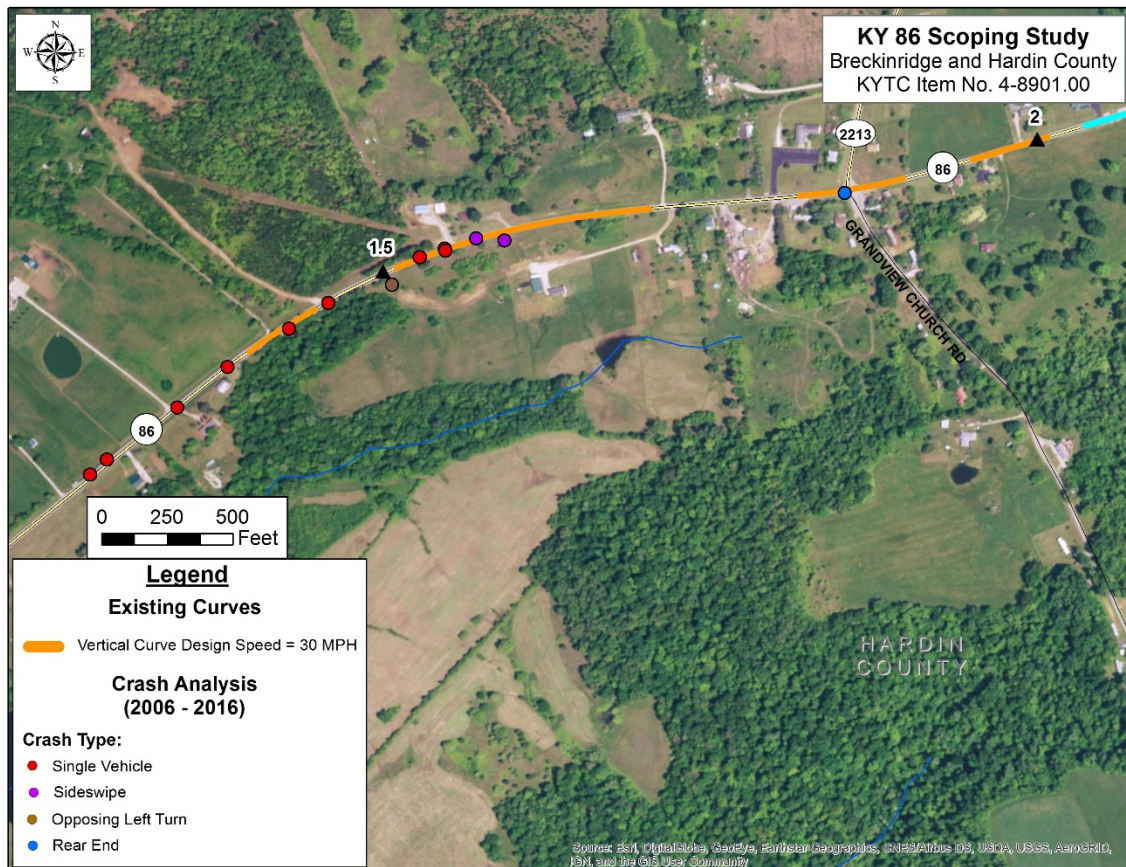


Figure 26: Spot Improvement 9 – West of KY 2213

- Spot Improvement 10 – KY 2213 to Vertrees Church Lane (MP 1.843-4.325):** This spot improvement includes KY 86 between KY 2213 and Vertrees Church Lane in Hardin County (MP 1.843 to MP 4.325). This location was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the 22 reported crashes over the past 10 years, five were injury collisions (23 percent). Fifteen of the crashes (68 percent) were single vehicle crashes including vehicles that ran-off the road and hit a fixed object such as guardrail. This portion of KY 86 has minimal clear zone between the roadway and adjacent trees, guardrail, culverts, and bridge. Improvement options include removing vegetation and the tree canopy to improve sight-lines, widening shoulders where guardrail is needed, replacing the bridge, and lengthening the culvert and improving the clear zone. Another improvement option includes adding a passing lane at Arch Hill. The study area for Spot Improvement 10 is shown in **Figure 27**.

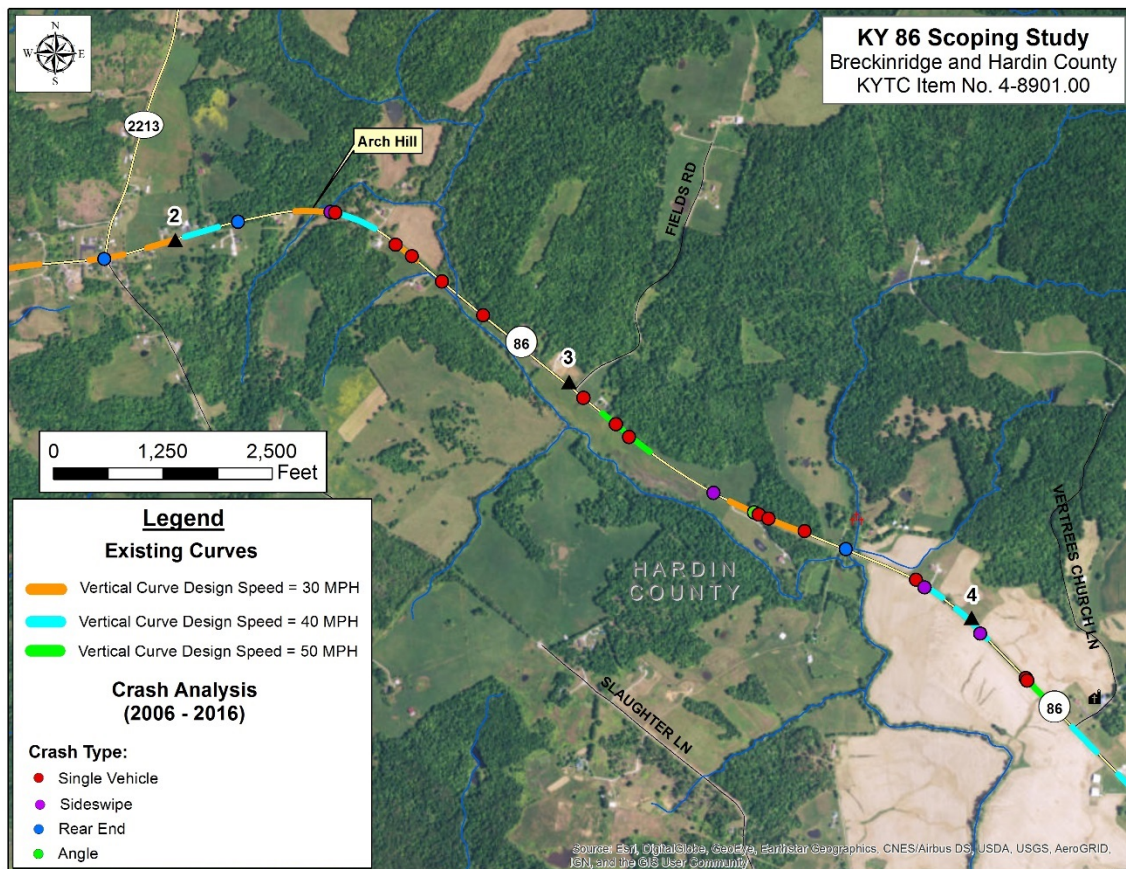


Figure 27: Spot Improvement 10 – KY 2213 to Vertrees Church Lane

- Spot Improvement 11 – Bridge over Rough River (MP 4.879):** This spot improvement includes the KY 86 bridge over Rough River in Hardin County (MP 4.879). The narrow 20-foot-wide bridge has a sufficiency rating of 65.6 and was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Over the past 10 years, there was one sideswipe crash on the bridge. A short-term improvement is to remove vegetation to improve the clear zone and sight-lines on the approaches. A long-term improvement is to replace the bridge. The study area for Spot Improvement 11 is shown in **Figure 28**.

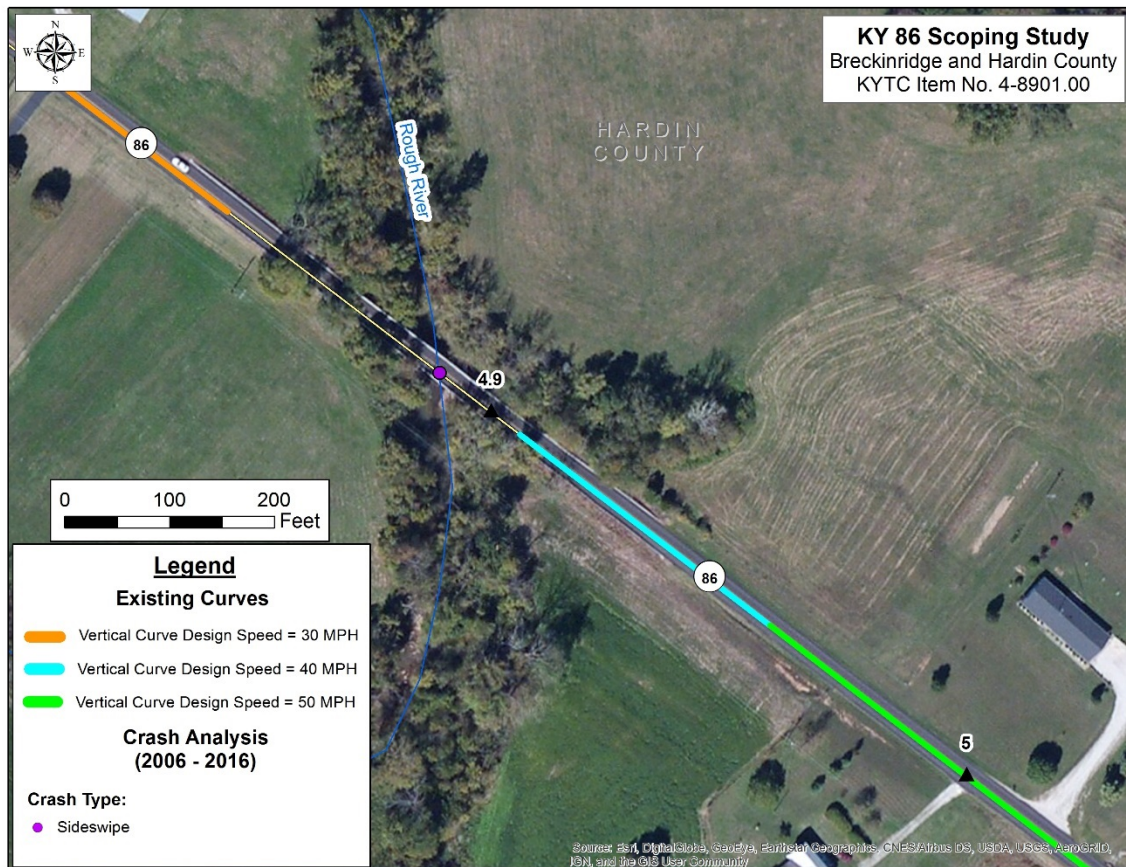


Figure 28: Spot Improvement 11 – Bridge over Rough River

- Spot Improvement 12 – KY 920 Intersection (MP 5.200-5.499):** This spot improvement includes the KY 86 intersection with KY 920 in Hardin County (MP 5.200 to MP 5.499). This location is a high crash spot with a CRF of 1.70 and the multiple access points were identified as an area of concern at the first Local Officials/Stakeholders Meeting. A flashing caution light is present at the intersection. Of the 15 reported crashes near this intersection over the past 10 years, five were injury collisions (33 percent). Eight of the crashes (53 percent) were angle crashes. Field's Grocery is located at this busy intersection and access is poorly defined. One option is to implement access management improvements to better define access. An additional improvement is to move the passing permitted striping away from the intersection. The study area for Spot Improvement 12 is shown in **Figure 29**.

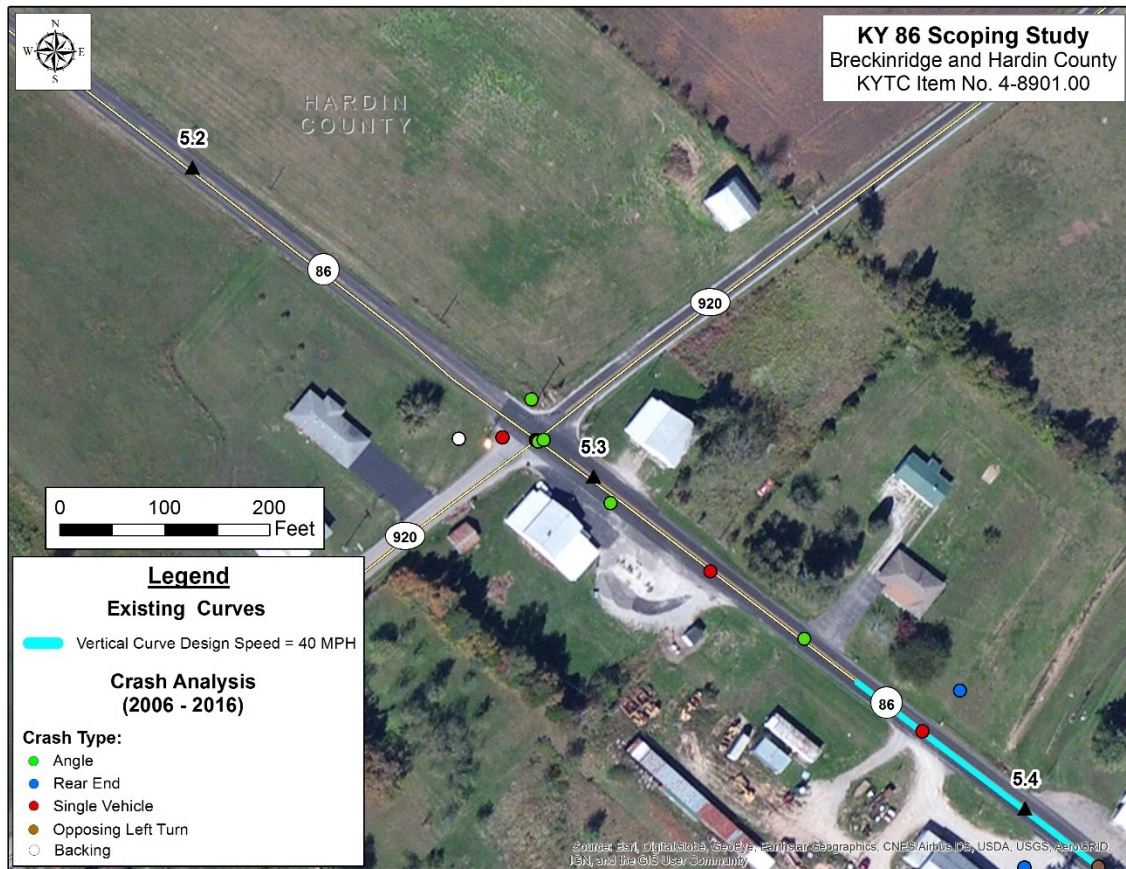
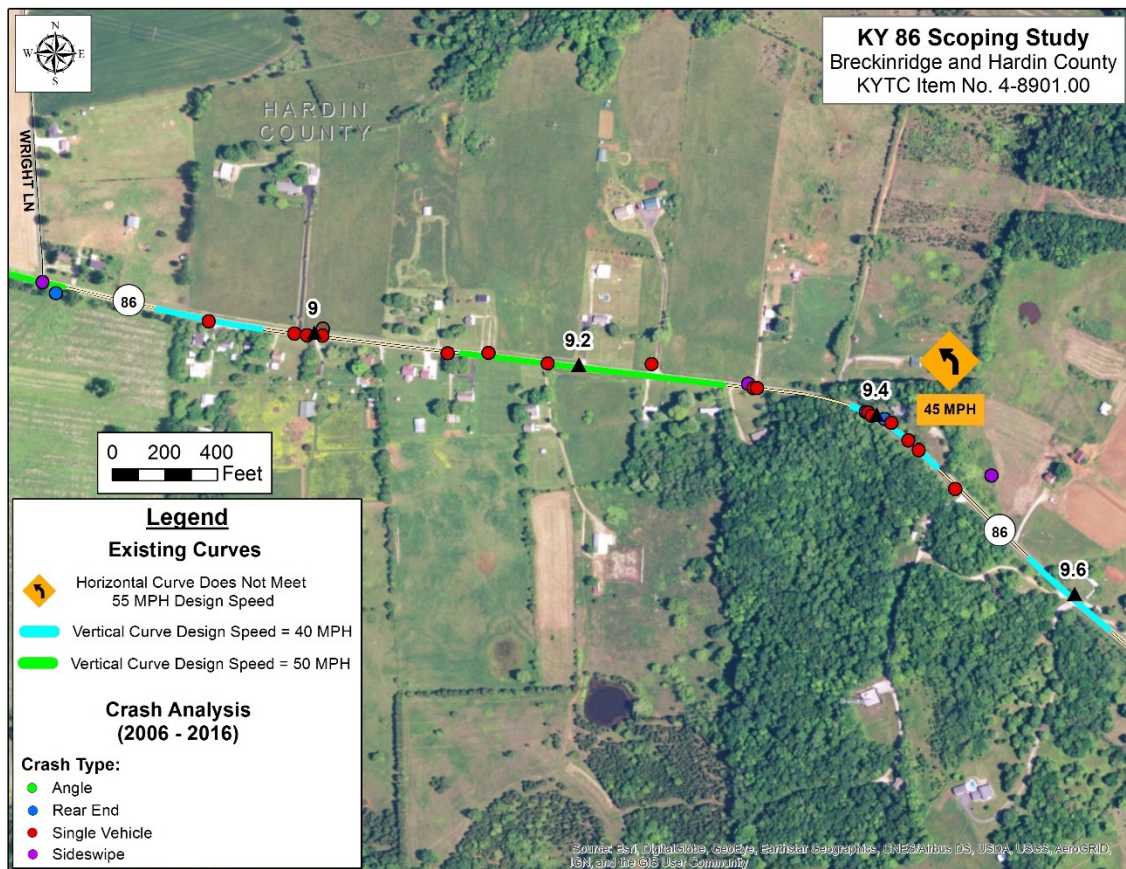


Figure 29: Spot Improvement 12 – KY 920 Intersection

- Spot Improvement 13 – East of Wright Lane (MP 9.200-9.600):** This spot improvement includes KY 86 east of Wright Lane in Hardin County (MP 9.200 to MP 9.600). This portion of the route includes a 45-mph horizontal curve with poor stopping sight distance. This portion of the route includes two high crash spots with CRFs ranging from 1.21 to 1.70 and was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the 13 reported crashes over the past 10 years, three were injury collisions (23 percent). Nine of the crashes (69 percent) were single vehicle crashes including vehicles that ran-off the road. Improvement options include removing vegetation to improve the clear zone and sight-lines, widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. An additional improvement option includes realigning KY 86. The study area for Spot Improvement 13 is shown in **Figure 30**.



**Figure 30: Spot Improvement 13 – East of Wright Lane
(Cherry Tree Coon Hunters Club)**

- Spot Improvement 14 – Yates Chapel Road (MP 9.900-10.300):** This spot improvement includes KY 86 near Yates Chapel Road in Hardin County (MP 9.900 to MP 10.300). This portion of the route includes a 50-mph horizontal curve and is a high crash spot with a CRF of 1.21. Of the 14 reported crashes over the past 10 years, one was a fatal collision and seven were injury collisions (50 percent). The fatal collision was a head-on collision in the horizontal curve. Ten of the crashes (71 percent) were single vehicle crashes. Improvement options include widening shoulders, adding flexible delineators, and the application of a high-friction pavement surface at the horizontal curve. The study area for Spot Improvement 14 is shown in **Figure 31**.

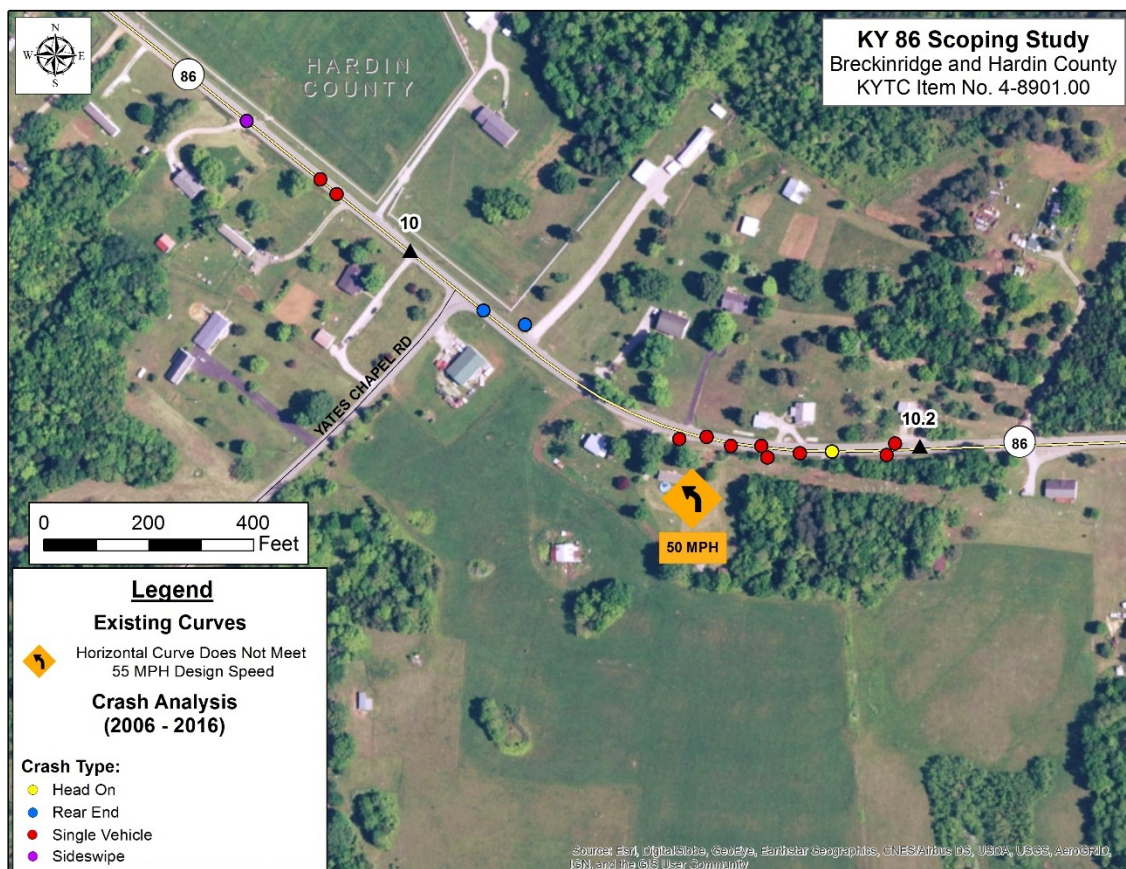


Figure 31: Spot Improvement 14 – Yates Chapel Road

- Spot Improvement 15 – James Duvall Lane (MP 10.300-11.200):** This spot improvement includes KY 86 near James Duvall Lane in Hardin County (MP 10.300 to MP 11.200). This portion of the route has a combination of multiple driveways and vertical curves with poor stopping sight distance. The segment is a high crash spot with a CRF of 1.21. Of the 16 reported crashes over the past 10 years, five were injury collisions (31 percent). Nine of the crashes (56 percent) were rear end collisions. Short-term improvement options include addressing drainage issues and removing vegetation along the vertical curves to improve the clear zone and sight-lines. A long-term improvement includes realigning the vertical curves to improve the stopping sight distance. The study area for Spot Improvement 15 is shown in **Figure 32**.

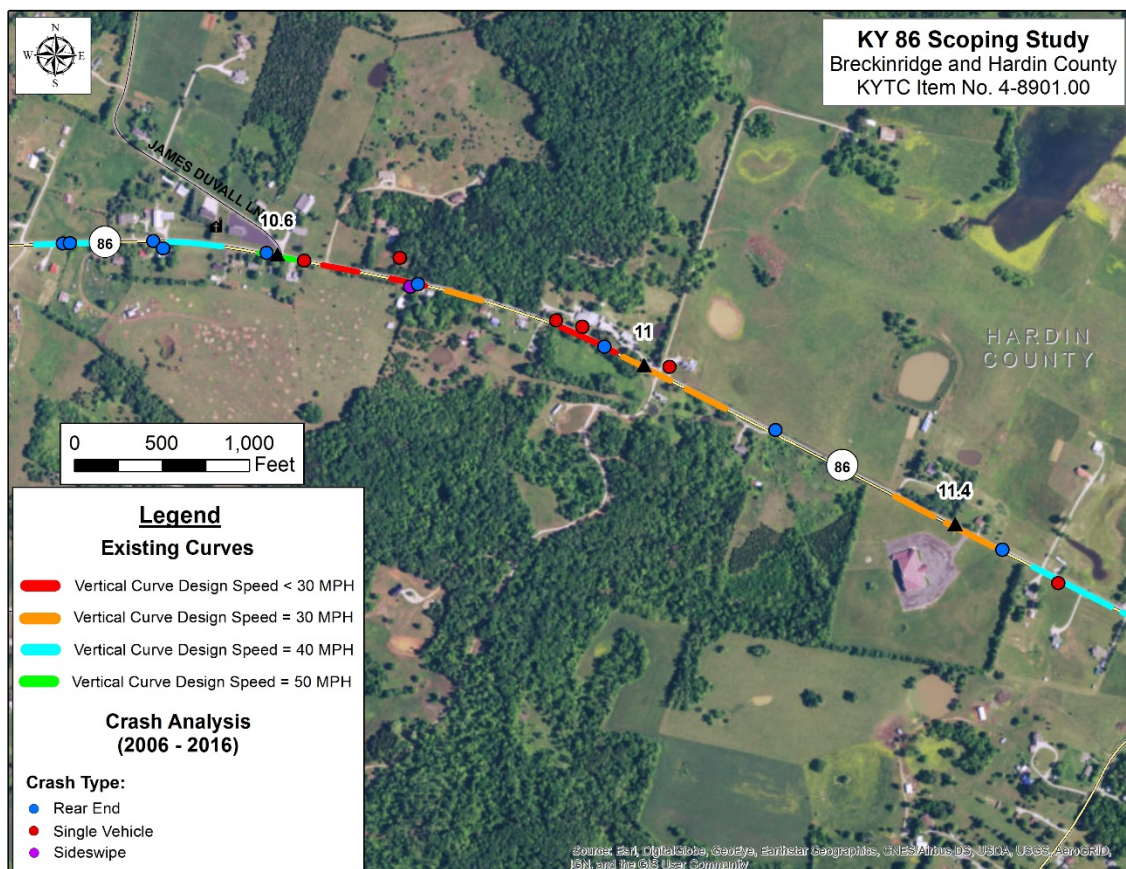


Figure 32: Spot Improvement 15 – James Duvall Lane

- Spot Improvement 16 – KY 1375 Intersection (MP 11.700-11.850):** This spot improvement includes the KY 86 intersection with KY 1375 in Hardin County (MP 11.700 to MP 11.850). This location is a high crash spot with a CRF of 1.37 and the poor sight distance was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Of the nine reported crashes near this intersection over the past 10 years, one was a fatal collision. Five of the crashes (56 percent) were angle crashes. A short-term improvement option includes removing vegetation east of KY 1375 to improve the sight-lines at the intersection. A long-term improvement option is to realign the vertical curves west of KY 1375 to improve the stopping sight distance. Wider paved shoulders should also be considered as part of the realignment to accommodate bicycles in Franklin Cross Roads. The study area for Spot Improvement 16 is shown in **Figure 33**.

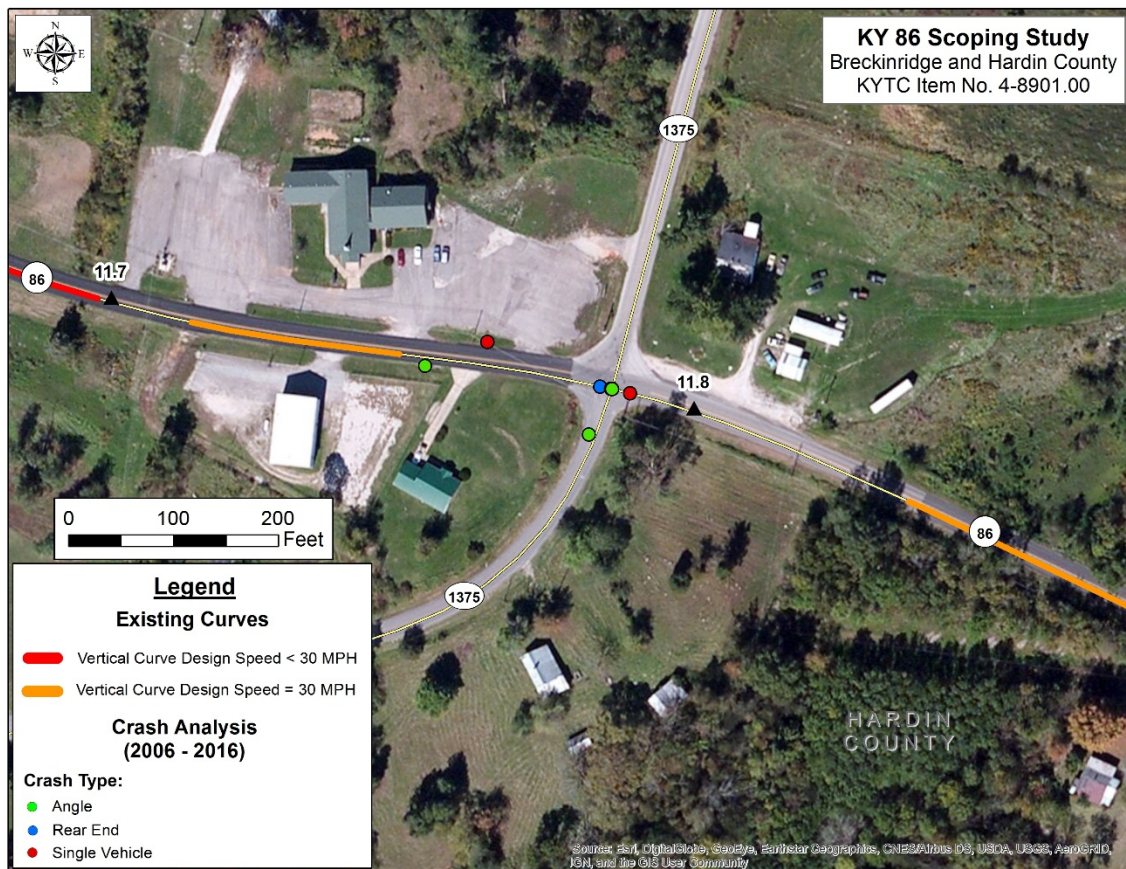


Figure 33: Spot Improvement 16 – KY 1375 Intersection

- Spot Improvement 17 – Culvert at Blacks Branch Creek (MP 12.833-12.916):** This spot improvement includes the KY 86 culvert for Blacks Branch Creek in Hardin County (MP 12.833 to MP 12.916). The narrow culvert was identified as an area of concern at the first Local Officials/Stakeholders Meeting. Over the past 10 years, six single vehicle collisions, one sideswipe collision, and one rear end collision occurred near the culvert. An Improvement option includes lengthening the culvert and improving the clear zone. The study area for Spot Improvement 17 is shown in **Figure 34**.



Figure 34: Spot Improvement 17 – Culvert at Blacks Branch Creek

- Spot Improvement 18 – South Black Branch Road (MP 14.200-14.500):** This spot improvement includes KY 86 near South Black Branch Road in Hardin County (MP 14.200 to MP 14.500). This location is a high crash spot with a CRF of 1.51. Of the eight reported crashes at this intersection over the past 10 years, two were injury collisions (25 percent). Six of the crashes (75 percent) were single vehicle crashes. Of the six single vehicle collisions, two were collisions with an animal and one was a collision with a bicyclist. Improvement options include widening shoulders and improving the clear zone and relocating the utility pole at South Black Branch Road. The study area for Spot Improvement 18 is shown in **Figure 35**.

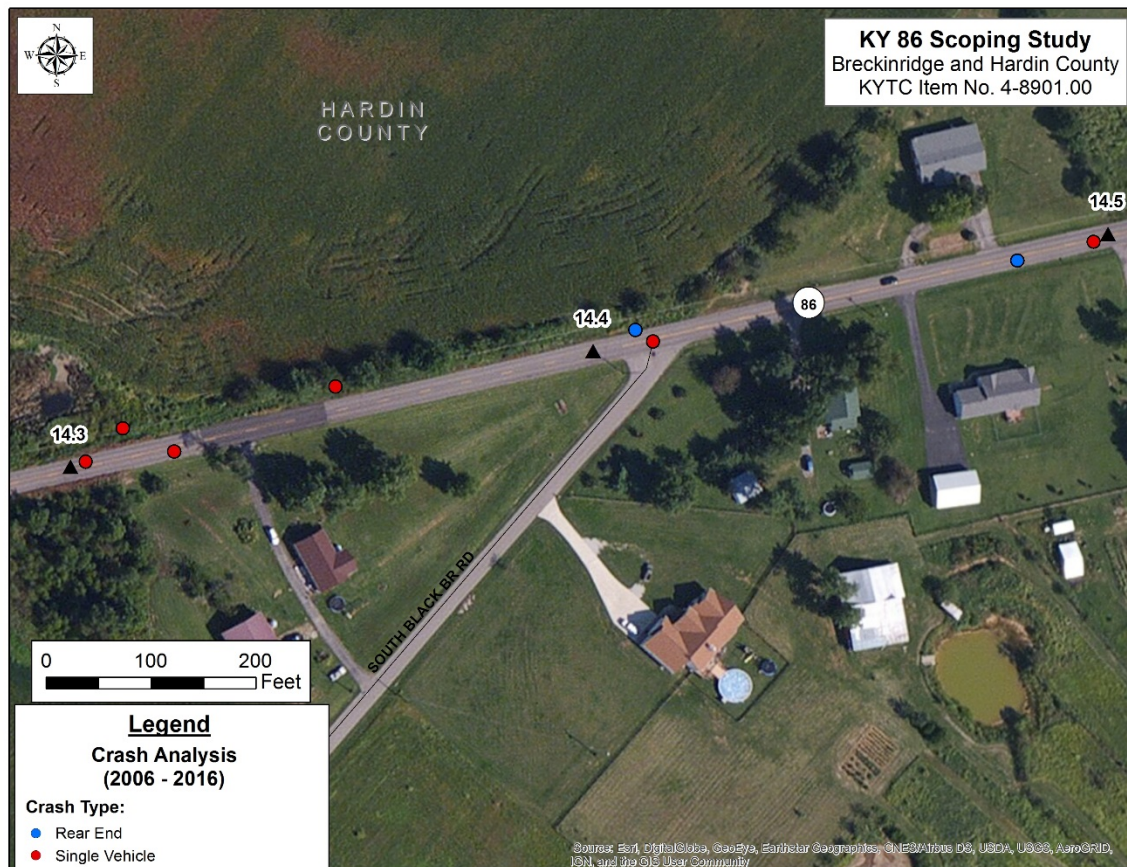


Figure 35: Spot Improvement 18 – South Black Branch Road

- Spot Improvement 19 – City of Cecilia (MP 14.600-16.150):** This spot improvement includes KY 86 through the city of Cecilia in Hardin County (MP 14.600 to MP 16.150). This location was identified as an area of concern at the first Local Officials/Stakeholders Meeting. There were 31 crashes on this portion of KY 86 between 2006 and 2016, 15 (48 percent) of which were rear end collisions. One improvement option is to widen KY 86 to three lanes through Cecilia in Hardin County to include a center two-way left turn lane and bike lanes. A center two-way left turn lane would reduce these types of crashes and reduce congestion. Additional improvements include realigning the vertical alignment on KY 86 at the KY 253/Lewis Lane intersection to improve stopping sight distance, drainage improvements to reduce flooding on KY 86, and adding signal ahead warning signage prior to KY 86/US 62 intersection to improve intersection and traffic signal conspicuity. The study area for Spot Improvement 19 is shown in in **Figure 36**.

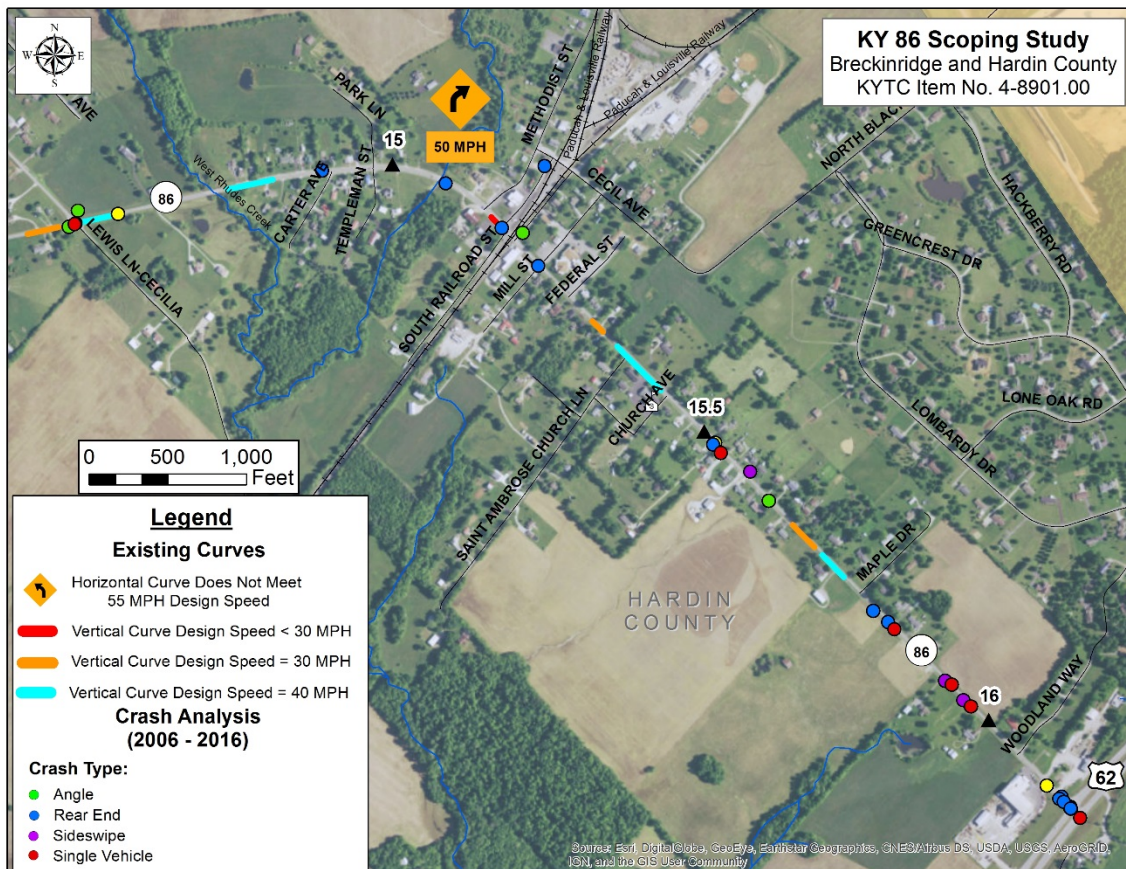


Figure 36: Spot Improvement 19 – City of Cecilia

8.0 SECOND ROUND OF PUBLIC INVOLVEMENT

Following the development of the initial improvement concepts, the project team met with local officials, stakeholders, and interested members of the public. During the meetings, improvement concepts were presented and attendees were asked to provide feedback regarding their concerns and priorities. Summaries for all meetings are found in **Appendix G**.

8.1 PROJECT TEAM MEETING NO. 2

The project team met at the KYTC District 4 Office in Elizabethtown, Kentucky on May 3, 2017. The purpose of the meeting was to discuss the initial improvement concepts. The meeting summary is included in **Appendix G**. Key discussion items included the following:

- The initial spot improvements were identified because they had a high crash rate and/or they were identified based on feedback at the first local officials/stakeholders meeting as areas of concern.
- The project team decided the intent was not to bring each location to a 55-mph design speed when so much of the existing road does not accommodate high speeds. Instead, solutions which could be implemented in the near term were identified based on the site-specific crash history. Where geometrics do not appear to meet driver expectations, roadway realignment was also considered.
- The project team suggested two possible additions to Spot Improvement 5: removing vegetation to improve the clear zone and removing the direct connection from Allgood Road to KY 86 to improve safety at the horizontal curve. These improvements were added to the spot improvement.
- As part of this project, wider shoulders, flexible delineators, and the application of a high-friction pavement surface at the horizontal curve were recently completed at Spot Improvement 6, near Cave Hollow Lane Field's Grocery at Spot improvement 12, the intersection of KY 86 and KY 920, has poorly defined access.
- Access management is not a significant issue at Spot Improvement 16, the intersection of KY 86 and KY 1375. This spot improvement should focus on improving sight-lines at the intersection and realigning vertical curves.



8.2 SECOND ROUND OF LOCAL OFFICIAL/STAKEHOLDER MEETINGS

Following the development of the revised Spot Improvements, the project team again met with local officials and stakeholders. The second round of local official/stakeholder meetings were held in Hardin County on June 12, 2017, at the Franklin Crossroads Baptist Church and in Breckinridge County on June 19, 2017, at Custer Elementary School. Excluding the project team, there were five attendees at the Hardin County Meeting and seven in Breckinridge County. The purpose of the meetings was to provide a brief overview of the study, elicit conversation, and share information that would be presented at the public meetings later each evening to identified officials and stakeholders. Exhibits showing the spot improvement projects were provided and surveys handed out. One survey was returned at the Hardin County meeting and four in Breckinridge County.

All five respondents indicated improvements were needed, but the Hardin County respondent chose spot improvements as the preferred alternative while all four Breckinridge County respondents chose the complete reconstruction alternative.

Local Official/Stakeholder Meetings	
➤	Hardin County
○	5 attendees
○	1 survey returned
○	Spot Improvement 19 was top priority
➤	Breckinridge County
○	7 attendees
○	4 surveys returned
○	Spot Improvement 2 was top priority

Question 7 asked respondents to choose their top Spot Improvements. Spot Improvements 15, 16, and 19 were selected in Hardin County while Spot Improvements 2 and 3 were selected in Breckinridge County. The only suggestion for additional Spot Improvements along KY 86 was a truck passing lane on Arch Hill, which was subsequently added to Spot Improvement 10. Complete results are shown in **Appendix G**.

8.3 PUBLIC MEETINGS

After meeting with key stakeholders and local officials, the project team held public meetings in Hardin County on June 12, 2017, at Franklin Crossroads Baptist Church in Hardinsburg, KY and in Breckinridge County on June 19, 2017, at Custer Elementary School in Custer, KY. The purpose of these meetings was to provide information about the study and the projects under consideration, discuss conceptual alternatives, and solicit input from the public. The meetings were held in an open house format that included a formal presentation to explain the project. Attendees were provided a project information brochure and a survey. All this information, including the presentation, was made available on the project website⁴.

⁴ http://transportation.ky.gov/District-4/Pages/ky86_improvements.aspx

KY 86 SCOPING STUDY – FINAL REPORT

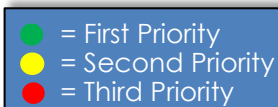
Seventy members of the public attended each of the public meetings. There were 25 surveys returned from the Hardin County Meeting and 39 surveys returned from the Breckinridge County Meeting.

Only three respondents indicated improvements are not needed along KY 86, and the majority of respondents favored spot improvements over complete reconstruction.

Question 7 asked respondents to choose their top three Spot Improvements. Spot Improvements 10, 13, and 19 received the most votes in Hardin County while Spot Improvements 2, 4, and 6 received the most votes in Breckinridge County.

There were several suggestions for additional Spot Improvements along KY 86 in both counties. In Hardin County, two suggestions were provided: flattening the vertical curve near the Cherry Tree Coon Hunters Club was added to Spot Improvement 13 and fixing the ponding east of James Duvall Lane was added to Spot Improvement 15. In Breckinridge County, four suggestions were provided: widening KY 86 and improving pavement conditions near the Custer General Store was added to Spot Improvement 4; improving sight distance and adding a truck passing lane at Arch Hill was added to Spot Improvement 10; horizontal realignment near the Coon Hunters Club was added to Spot Improvement 13; and addressing the drainage concerns at the KY 1375 intersection was added to Spot Improvement 16.

At each public meeting, attendees were also asked to place stickers on exhibit boards to indicate which Spot Improvements should be considered as the highest priority for implementation



with the KY 86 Scoping Study. Each attendee was provided one green (top priority), one yellow (second priority) and one red (third priority) sticker. A total of 298 stickers were placed on the boards, with priority point values assigned to each color. Green stickers were worth three points, yellow two points, and red one point. In Hardin County, Spot Improvements 19 (30 stickers, 82 points), 10 (33 stickers, 61 points), and 13 (22 stickers, 45 points) received the highest total number of stickers and the highest weighted scores. In Breckinridge County, Spot Improvements 2 (41

Public Meetings

- **Hardin County**
 - 70 attendees
 - 25 surveys returned
 - Spot Improvements 10, 13, and 19 received the most votes
- **Breckinridge County**
 - 70 attendees
 - 39 surveys returned
 - Spot Improvements 2, 4, and 6 received the most votes



stickers, 102 points), 4 (37 stickers, 69 points), and 6 (20 stickers, 41 points) received the highest total number of stickers and the highest weighted scores. The complete results from the sticker exercise from both Hardin and Breckinridge Counties are displayed on **Figure 37**.

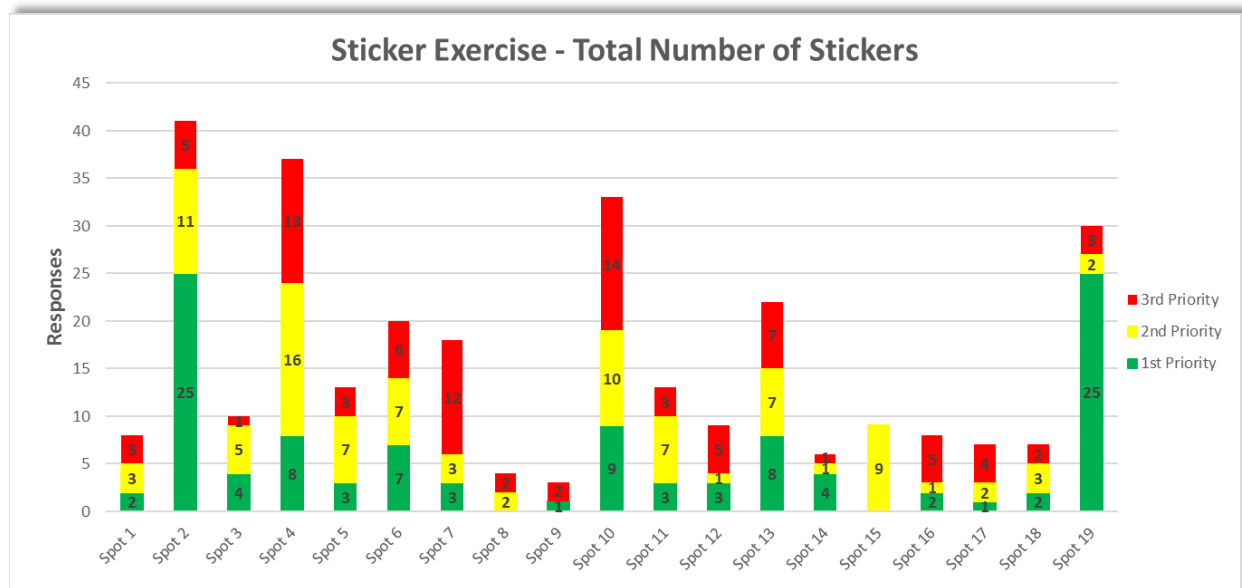


Figure 37: Sticker Exercise Results (Total Number of Stickers)

8.4 RESOURCE AGENCY MAILING

Early in the project development process, the KYTC Division of Planning sent letters to several agencies asking for input and comments on the Scoping Study to address any concerns. Responses were received from 23 agencies and their comments are included in **Appendix H**. A summary of the responses, in the order they were received, follows:

- Kentucky Heritage Council – Many of the proposed projects will invoke the Section 106 process because of federal funding.
- Breckinridge County Emergency Management Agency – Spot Improvements 2, 3, and 5 are most critical with locations 6 and 7, the next most important.
- Kentucky Department of Military Affairs – No major concerns with the project.
- Kentucky Airport Zoning Commission – Any new structure exceeding the existing structures in height in the area would require a permit.
- Breckinridge County Judge Executive – Spot Improvements 2, 3, and 5 are most critical with locations 6 and 7, the next most important.

- United States Fish and Wildlife Service – Obtain species lists from the United States Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) system and an official letter on USFWS letterhead. Additional coordination with the Kentucky Field Office (KFO) may be necessary to ensure compliance.
- Kentucky Department of Education – No impacts are anticipated, but additional consultation with the Breckinridge and Hardin County School Districts is recommended.
- Scenic Kentucky – It is requested that this project be considered for Scenic Byway designation. A plan for the open spaces and commercial aspects of the corridor would accommodate growth yet preserve the scenic beauty of the areas these improvements affect. It is also suggested that this corridor be designated as a billboard free corridor.
- United States Coast Guard – A Coast Guard bridge permit is not required for this project.
- Kentucky State Police Post 4 – Most of the roadway is narrow and has low shoulders. Widening the road and adding adequate shoulders would significantly improve driving conditions. The following sections of roadway are particularly problematic: “Arch Hill” near Grandview Church, the curves east of Franklin Crossroads, the curves near Howeallevy Elementary School.
- Kentucky State Police – Some commercial vehicles are restricted from using KY 86 in the study area due to roadway classification. If the roadway is widened, commercial traffic will increase.
- Kentucky Division of Forestry – No impacts are anticipated.
- United States Department of Health and Human Services – The new school under construction near the KY 86 intersection with US 62 is intended to house students from Howeallevy Elementary School as well as West Hardin Middle School in Stephensburg, KY. The new school is scheduled to have sewer but no current plans include the City of Cecilia, which does not have city sewer.
- Kentucky Education and Workforce Development Cabinet – No major concerns with the proposed project.



Resource Agency Mailing

- Responses were received from 23 agencies
- Breckinridge County EMA: Spot Improvements 2, 3, and 5 are most critical
- Kentucky State Police: widening the road and adding adequate shoulders would significantly improve driving conditions. Arch Hill near Grandview Church, the curves east of Franklin Crossroads, and the curves near Howeallevy Elementary School are particularly problematic

- Kentucky Division of Waste Management – All solid waste generated must be disposed at a permitted facility. Underground storage tanks (USTs), asbestos, lead paint, and/or other contaminants that are encountered must be properly addressed. There are no hazardous waste TSDs (Treatment, Storage, and Disposal) sites in the subject area. Several active USTs are located in the study area: Custer General Store, Fields County Store, and Jay Butbhavani Inc. Three Superfund properties are listed within a 0.5-mile buffer of the study area: Howe Valley Elementary School, Bits and Pieces Grocery, and the Royce Kerfoot Property.
- Kentucky Division for Air Quality – 401 KAR 63:101: no person shall cause, suffer, or allow any material to be handled, processed, transported, or stored without taking reasonable precaution to prevent particulate matter from becoming airborne. 401 KAR 63:005: Open burning shall be prohibited except as specifically provided.
- United States Environmental Protection Agency Region 4 – No known conservation or development plans within the project area.
- Breckinridge County Schools – The section from US 60 to Custer is the main priority.
- Kentucky Department for Environmental Protection:
 - Division of Water – Best management practices (BMPs) should be utilized to minimize runoff to nearby waters. Stony Fork is designated as a Cold-Water Aquatic Habitat. Fiddlers Creek is designated as an Outstanding State Resource Water.
 - Division of Waste Management – All solid waste generated must be disposed at a permitted facility. If underground storage tanks, asbestos, lead paint, or other contaminants are encountered, they must be properly addressed.
 - Division of Air Quality – The Division offered suggestions on how this project can maintain compliance with the National Ambient Air Quality Standards, including the use of alternatively fueled equipment, emission controls, and reduced idling time.
- Kentucky Cabinet for Economic Development – Sites in the affected area include the Hughes Center of Commerce and Industry, the T.J. Patterson Industrial Park, and the Breckinridge County Commerce Park.

Resource Agency Mailing

- Breckinridge County Schools: The section from US 60 to Custer is the main priority
- Kentucky Cabinet for Economic Development: Sites in the affected area include the Hughes Center of Commerce and Industry, the T.J. Patterson Industrial Park, and the Breckinridge County Commerce Park

- Kentucky Department for Natural Resources (Kentucky Division of Conservation) – Erosion and sedimentation should be controlled if proposed improvements proceed to construction. Best Management Practices should be utilized to prevent nonpoint source water pollution.
- Kentucky Cabinet for Health and Family Services – No issues of concern.
- United States Department of Agriculture – No anticipated impacts.

9.0 REVISED IMPROVEMENT CONCEPTS

After the second round of public involvement, the project team revised the 19 spot improvements based on feedback received. Detailed project sheets for each spot improvements can be found in **Appendix I**.

9.1 REVISED SPOT IMPROVEMENTS

At the local officials/stakeholders and public meetings, attendees were asked to fill out a survey. Question 9 asked if the respondent had any suggestions for additional spot improvements along KY 86. The following improvement options were added to the previously developed 19 spot improvements:

- Spot Improvement 4 – Widen KY 86 to the north of the Custer General Store and improve pavement conditions
- Spot Improvement 10 – Add truck passing lane on Arch Hill
- Spot Improvement 13 – Address vertical and horizontal realignment
- Spot Improvement 15 – Address drainage concerns
- Spot Improvement 16 – Remove ponding at the KY 1375 intersection

9.2 COST ESTIMATES

Construction cost estimates were prepared for the revised spot improvements, shown in **Table 4**, based on average KYTC unit costs plus additional costs for special features such as culverts and bridges.



Table 4: Construction Cost Estimates

Revised Spot Improvements	Project Length (miles)	Improvement Options	2017 Construction Cost Estimate
Spot Improvement 1 US 60 to Jesse Priest Rd	1.743	Widen Shoulders and Improve Clear Zone	\$1,200,000
		Pave Intersection Approach	\$100,000
Spot Improvement 2 Jesse Priest Rd to East of Rosetta Corners	1.100	Widen Shoulders	\$500,000
		Flexible Delineators	
		High-Friction Pavement Surface	
		Realignment	\$3,800,000
Spot Improvement 3 Merle Allen Ln to Lonnie Haynes Rd	0.600	Widen Shoulders	\$500,000
		Flexible Delineators	
		High-Friction Pavement Surface	
Spot Improvement 4 KY 690 Intersection	0.200	Flashing Intersection Beacon	\$100,000
		Realignment and Access Management	\$1,900,000
Spot Improvement 5 Allgood Road	0.300	Remove Vegetation	\$350,000
		Widen Shoulders and Improve Clear Zone	
		Flexible Delineators	
		High-Friction Pavement Surface	
		Remove Allgood Rd Connection to KY 86	
Spot Improvement 6 Cave Hollow Lane	0.400	Widen Shoulders	\$100,000
		Flexible Delineators	
		High-Friction Pavement Surface	
		Lengthen Culvert and Improve Clear Zone	\$100,000
Spot Improvement 7 Lyons-Daughtery to East of KY 401	1.400	Widen Shoulders	\$600,000
		Flexible Delineators	
		High-Friction Pavement Surface	
		Pave Intersection Approach	
		Realignment	\$3,700,000
Spot Improvement 8 Breckinridge & Hardin County Line	0.637	Widen Shoulders	\$200,000
		Flexible Delineators	
		High-Friction Pavement Surface	
		Lengthen Culvert and Improve Clear Zone	\$100,000
Spot Improvement 9 West of KY 2213	0.400	Remove Vegetation	\$200,000
		Widen Shoulders	

Table 4: Construction Cost Estimates (Continued)

Revised Spot Improvements	Project Length (miles)	Improvement Options	2017 Construction Cost Estimate
Spot Improvement 10 KY 2213 to Vertrees Church Lane	2.482	Remove Vegetation	\$500,000
		Widen Shoulders	
		Replace Bridge	\$700,000
		Lengthen Culvert and Improve Clear Zone	\$100,000
		Passing Lane	\$2,800,000
Spot Improvement 11 Bridge over Rough River	0.100	Remove Vegetation	\$900,000
		Replace Bridge	
Spot Improvement 12 KY 920 Intersection	0.299	Access Management	\$50,000
		Remove Passing Permitted Striping	
Spot Improvement 13 East of Wright Lane (Coon Hunters Club)	0.400	Remove Vegetation	\$250,000
		Widen Shoulders	
		Flexible Delineators	
		High-Friction Pavement Surface	
		Realignment	\$800,000
Spot Improvement 14 Yates Chapel Road	0.400	Widen Shoulders	\$250,000
		Flexible Delineators	
		High-Friction Pavement Surface	
Spot Improvement 15 James Duvall Lane	0.900	Remove Vegetation	\$30,000
		Drainage Improvements	\$100,000
		Realignment	\$1,600,000
Spot Improvement 16 KY 1375 Intersection	0.150	Remove Vegetation	\$20,000
		Vertical Realignment	\$600,000
Spot Improvement 17 Culvert at Blacks Branch Road	0.083	Lengthen Culvert and Improve Clear Zone	\$100,000
Spot Improvement 18 South Black Branch Road	0.300	Widen Shoulders and Improve Clear Zone	\$100,000
		Relocate Utility Pole	\$15,000
Spot Improvement 19 City of Cecilia	1.550	Vertical Realignment	\$600,000
		Drainage Improvements	\$500,000
		Signal Ahead Warning Sign	\$250
		Widen to 3-Lanes with Center TWLTL	\$3,000,000

9.3 BENEFIT-TO-COST ANALYSIS

To assist in prioritizing the spot improvements, the project team conducted a benefit-to-cost analysis. This analysis provided a means for determining which improvements have the greatest benefit and are the most economical. Considering that congestion is not an issue on KY 86, the benefit-to-cost analysis was conducted based on the expected crash reductions from each improvement. The Crash Modifications Clearinghouse⁵ was used to estimate the crash reduction by improvement type. Based on the *2015 Kentucky Traffic Collision Facts Report*⁶, there are two different costs associated with collisions: economic and comprehensive. Economic costs include wage loss, medical expense, administration costs, property damage, and employer costs. Comprehensive costs include economic costs plus a measure of the value of lost quality of life associated with deaths and injuries. Crash costs by crash severity from the 2015 Kentucky Traffic Collision Facts Report are listed in **Table 5**.

Table 5: 2015 Kentucky Crash Costs by Severity

Crash Severity	Economic Cost	Comprehensive Cost
Fatality	\$1,500,000	\$9,900,000
Incapacitating Injury	\$88,500	\$1,100,000
Non-Incapacitating Injury	\$25,600	\$298,000
Possible Injuries	\$21,000	\$138,000
Property Damage Only	\$4,200	\$8,400

To address the cost of injury collisions, a weighted average of incapacitating, non-incapacitating, and possible injuries was calculated based on the number of collisions and the accompanying costs shown in **Table 5**. Using this weighted average of \$28,560 for economic injury collisions along with the values for fatal and property damage only collisions shown in **Table 6**, five spot improvement locations were found to have a benefit-to-cost ratio greater than one. A summary of the economic benefit-to-cost analysis is shown in **Table 7**. It was noted that fatal collisions make a drastic difference on the benefit-to-cost ratio. This is evident at Spot Improvement 8, which is shown with and without two fatal collisions because one collision was alcohol-related and the second was an animal collision, crash types that likely would not be preventable through countermeasures.



⁵ Crash Modification Factors Clearinghouse
<http://www.cmfclearinghouse.org/>

⁶ 2015 Kentucky Traffic Collision Fact Report

http://transportation.ky.gov/Highway-Safety/Documents/2015_KY_Traffic_Collision_Facts.pdf

Table 6: Economic Costs by Crash Severity used in B/C Analysis

Economic Cost*	
Crash Severity	Cost Per
Fatal	\$1,500,000
Injury	\$28,560
PDO	\$4,200

Table 7: Economic Benefit-to-Cost Analysis Summary

Improvement Concept	Construction Cost	10 Year Savings from Anticipated Crash Reduction*	Benefit-to-Cost Ratio
Spot 1			
Widen Shoulders & Improve Clear Zone	\$1,300,000	\$60,000	0.05
Pave Intersection Approach			
Spot 2			
Widen Shoulders at Horizontal Curves	\$500,000	\$1,010,000	2.02
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves☑			
Realignment	\$3,800,000	\$880,000	0.23
Spot 3			
Widen Shoulders at Horizontal Curves	\$500,000	\$40,000	0.08
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves☑			
Spot 4			
Install Flashing Caution Light at KY 690 Intersection	\$2,000,000	\$20,000	0.01
Realignment and Access Management in front of Custer General Store			
Spot 5			
Remove Vegetation at Horizontal Curve	\$350,000	\$90,000	0.26
Widen Shoulders at Horizontal Curves			
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves☑			
Remove Allgood Road Connection to KY 86			
Spot 6			
Widen Shoulders at Horizontal Curves	\$100,000	\$60,000	0.60
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves☑			
Lengthen Culvert and Improve Clear Zone	\$100,000	\$5,000	0.05
Spot 7			
Widen Shoulders at Horizontal Curves	\$600,000	\$1,240,000	2.07
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves☑			
Pave Intersection Approach			
Realignment	\$3,700,000	\$2,570,000	0.69
Spot 8			
Widen Shoulders at Horizontal Curves	\$200,000	\$940,000 (\$80,000**)	4.70 (0.40**)
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves☑			
Lengthen Culvert and Improve Clear Zone	\$100,000	\$200,000 (\$5,000**)	2.00 (0.05**)
Spot 9			
Remove Vegetation at Horizontal Curve	\$200,000	\$30,000	0.15
Widen Shoulders at Horizontal Curves			

Table 7: Economic Benefit-to-Cost Analysis Summary (Continued)

Improvement Concept	Construction Cost	10 Year Savings from Anticipated Crash Reduction*	Benefit-to-Cost Ratio
Spot 10			
Remove Vegetation and Tree Canopy	\$500,000	\$50,000	0.10
Widen Shoulders at Horizontal Curve and Lengthen Culvert			
Replace Bridge	\$700,000	\$150,000	0.21
Lengthen Culvert and Improve Clear Zone	\$100,000	\$30,000	0.30
Passing Lane at Arch Hill	\$2,800,000	\$60,000	0.02
Spot 11			
Remove Vegetation	\$900,000	\$3,000	0.00
Replace Bridge			
Spot 12			
Access Management at Fields Grocery	\$50,000	\$40,000	0.80
Remove Passing Permitted Striping			
Spot 13			
Remove Vegetation at Horizontal Curve	\$250,000	\$80,000	0.32
Widen Shoulders at Horizontal Curve			
Flexible Delineators at Horizontal Curve			
High-Friction Pavement Surface at Horizontal Curve			
Realignment	\$800,000	\$70,000	0.09
Spot 14			
Widen Shoulders at Horizontal Curve	\$250,000	\$980,000	3.92
Flexible Delineators at Horizontal Curve			
High-Friction Pavement Surface at Horizontal Curve			
Spot 15			
Remove Vegetation	\$30,000	\$5,000	0.17
Fix Ponding in front of 5462 Hardinsburg Road Cecilia	\$100,000	\$60,000	0.60
Realignment	\$1,600,000	\$70,000	0.04
Spot 16			
Remove Vegetation	\$20,000	\$600	0.03
Vertical Realignment	\$600,000	\$710,000	1.18
Spot 17			
Lengthen Culvert and Improve Clear Zone	\$100,000	\$30,000	0.30
Spot 18			
Widen Shoulders/Improve Clear Zone	\$100,000	\$30,000	0.30
Relocate Utility Pole	\$15,000	\$4,000	0.27
Spot 19			
Realign Vertical Alignment on KY 86 at KY 253 Intersection	\$600,000	\$90,000	0.15
Drainage Improvements	\$500,000	\$90,000	0.18
Signal Ahead Warning Sign	\$250	Not Available	Not Available
Widen KY 86 to 3-Lanes with Center Two-Way Left-Turn Lane	\$3,000,000	\$100,000	0.03

* Source: Crash Modification Factors Clearinghouse - <http://www.cmfclearinghouse.org/>

** Removes the two fatal collisions. One was alcohol related and the second was an animal collision.

Using a weighted average of \$277,156 for comprehensive injury collisions along with the values for fatal and property damage only collisions shown in **Table 8**, 15 spot improvement locations were found to have a benefit-to-cost ratio greater than one. A summary of the comprehensive benefit-to-cost analysis is shown in **Table 9**. Spot 8 is once again shown with and without the two fatal collisions.

Table 8: Comprehensive Costs by Crash Severity

Comprehensive Cost*	
Crash Severity	Cost Per
Fatal	\$9,900,000
Injury	\$277,156
PDO	\$8,400

Table 9: Comprehensive Benefit-to-Cost Analysis Summary

Improvement Concept	Construction Cost	10 Year Savings from Anticipated Crash Reduction*	Benefit-to-Cost Ratio
Spot 1			
Widen Shoulders & Improve Clear Zone	\$1,300,000	\$580,000	0.45
Pave Intersection Approach			
Spot 2			
Widen Shoulders at Horizontal Curves	\$500,000	\$6,960,000	13.92
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves			
Realignment	\$3,800,000	\$6,180,000	1.63
Spot 3			
Widen Shoulders at Horizontal Curves	\$500,000	\$340,000	0.68
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves			
Spot 4			
Install Flashing Caution Light at KY 690 Intersection	\$2,000,000	\$120,000	0.06
Realignment and Access Management in front of Custer General Store			
Spot 5			
Remove Vegetation at Horizontal Curve	\$350,000	\$670,000	1.91
Widen Shoulders at Horizontal Curves			
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves			
Remove Allgood Road Connection to KY 86			
Spot 6			
Widen Shoulders at Horizontal Curves	\$100,000	\$490,000	4.90
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves			
Lengthen Culvert and Improve Clear Zone	\$100,000	\$40,000	0.40
Spot 7			
Widen Shoulders at Horizontal Curves	\$600,000	\$9,370,000	15.62
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves			
Pave Intersection Approach			
Realignment	\$3,700,000	\$18,100,000	4.89
Spot 8			
Widen Shoulders at Horizontal Curves	\$200,000	\$6,300,000 (\$660,000**)	31.50 (3.30**)
Flexible Delineators at Horizontal Curves			
High-Friction Pavement Surface at Horizontal Curves			
Lengthen Culvert and Improve Clear Zone	\$100,000	\$1,320,000 (\$40,000**)	13.20 (0.40**)
Spot 9			
Remove Vegetation at Horizontal Curve	\$200,000	\$220,000	1.10
Widen Shoulders at Horizontal Curves			

Table 9: Comprehensive Benefit-to-Cost Analysis Summary (Continued)

Improvement Concept	Construction Cost	10 Year Savings from Anticipated Crash Reduction*	Benefit-to-Cost Ratio
Spot 10			
Remove Vegetation and Tree Canopy	\$500,000	\$390,000	0.78
Widen Shoulders at Horizontal Curve and Lengthen Culvert			
Replace Bridge	\$700,000	\$1,050,000	1.50
Lengthen Culvert and Improve Clear Zone	\$100,000	\$200,000	2.00
Passing Lane at Arch Hill	\$2,800,000	\$380,000	0.14
Spot 11			
Remove Vegetation	\$900,000	\$6,000	0.01
Replace Bridge			
Spot 12			
Access Management at Fields Grocery	\$50,000	\$330,000	6.60
Remove Passing Permitted Striping			
Spot 13			
Remove Vegetation at Horizontal Curve	\$250,000	\$550,000	2.20
Widen Shoulders at Horizontal Curve			
Flexible Delineators at Horizontal Curve			
High-Friction Pavement Surface at Horizontal Curve			
Realignment	\$800,000	\$620,000	0.78
Spot 14			
Widen Shoulders at Horizontal Curve	\$250,000	\$6,770,000	27.08
Flexible Delineators at Horizontal Curve			
High-Friction Pavement Surface at Horizontal Curve			
Spot 15			
Remove Vegetation	\$30,000	\$40,000	1.33
Fix Ponding in front of 5462 Hardinsburg Road Cecilia	\$100,000	\$470,000	4.70
Realignment	\$1,600,000	\$660,000	0.41
Spot 16			
Remove Vegetation	\$20,000	\$1,000	0.05
Vertical Realignment	\$600,000	\$4,660,000	7.77
Spot 17			
Lengthen Culvert and Improve Clear Zone	\$100,000	\$180,000	1.80
Spot 18			
Widen Shoulders/Improve Clear Zone	\$100,000	\$180,000	1.80
Relocate Utility Pole	\$15,000	\$7,000	0.47
Spot 19			
Realign Vertical Alignment on KY 86 at KY 253 Intersection	\$600,000	\$800,000	1.33
Drainage Improvements	\$500,000	\$600,000	1.20
Signal Ahead Warning Sign	\$250	Not Available	Not Available
Widen KY 86 to 3-Lanes with Center Two-Way Left-Turn Lane	\$3,000,000	\$670,000	0.22

* Source: Crash Modification Factors Clearinghouse - <http://www.cmfclearinghouse.org/>

** Removes the two fatal collisions. One was alcohol related and the second was an animal collision.

9.4 EVALUATION MATRIX

The improvement concepts were reviewed for potential “red flags” to help with the evaluation process and provide KYTC with information that will be used to make final recommendations regarding alternative(s) to be carried forward for future development.

- The Complete Reconstruction Alternative has the highest cost and the highest right-of-way and environmental impacts.
- Spot Improvements 2, 7, and 14 have the highest comprehensive benefit-to-cost ratios.
- All improvement concepts meet the Purpose and Need of the project.
- Of the spot improvements under consideration, Spot Improvements 1, 2, 7, 10, and 19 have the highest number of recorded crashes between 2006 and 2016.
- Spot Improvement 2 has the highest number of high crash spots (three).
- Spot Improvements 2, 3, and 7 have the highest number of horizontal curves that do not satisfy a 55-mph design speed.
- Spot Improvements 1, 2, 10, and 15 have the highest number of vertical curves that do not satisfy a 55-mph design speed.
- All improvement concepts have acceptable 2040 V/C ratios and 2040 LOS.
- Spot Improvement 2 received the most number of stickers and had the highest weighted score at the public meeting.



A summary of the complete evaluation matrix is shown in **Table 10**.

Table 10: Evaluation Matrix

Improvement Concept	Project Length (miles)	Improvement Options	Environmental Impacts	Right-of-Way Impacts	2017 Construction Cost Estimate	Comprehensive B/C Ratio	Does the concept meet the Purpose & Need?	Critical Crash Rate Factor	Total number of crashes (2006-2016)	Horizontal Curves Not Meeting 55 mph	Vertical Curves Not Meeting 55 mph	2040 V/C	2040 LOS	Public Meeting Total # of Stickers (Overall Ranking)	Public Meeting Weighted Score (Overall Ranking)
No Build	26.325	No Build	Low	Low	\$0	N/A	No	0.00-2.49	398	18	160	0.06-0.17	B/C	N/A	N/A
Complete Reconstruction	26.325	Realignment/Widen Lanes and Shoulders	High	High	\$160,000,000	0.59	Yes	0.00-2.49	398	18	160	0.06-0.17	B/C	N/A	N/A
Spot Improvement 1 US 60 to Jesse Priest Rd	1.743	Widen Shoulders and Improve Clear Zone	Low	Low	\$1,200,000	0.45	Yes	1.24	29	0	14	0.06	B	8 (13 th)	15 (13 th)
		Pave Intersection Approach	Low	Low	\$100,000										
Spot Improvement 2 Jesse Priest Rd to West of Rosetta Corners	1.100	Widen Shoulders	Low	Low	\$500,000	13.92	Yes	1.24-1.86	21	3	9	0.06	B	41 (1 st)	102 (1 st)
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low	\$3,800,000	1.63									
		Realignment	High	High											
Spot Improvement 3 Merle Allen Ln to Lonnie Haynes Rd	0.600	Widen Shoulders	Low	Low	\$500,000	0.68	Yes	0	7	2	3	0.06	B	10 (10 th)	23 (10 th)
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low											
Spot Improvement 4 KY 690 Intersection	0.200	Flashing Intersection Beacon	Low	Low	\$100,000	0.06	Yes	0	5	1	1	0.06	B	37 (2 nd)	69 (3 rd)
		Realignment and Access Management	Medium	High	\$1,900,000										
Spot Improvement 5 Allgood Road	0.300	Remove Vegetation	Low	Low	\$350,000	1.91	Yes	2.29	9	1	1	0.06	B	13 (8 th)	26 (8 th)
		Widen Shoulders and Improve Clear Zone	Low	Low											
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low											
		Remove Allgood Rd Connection to KY 86	Low	Low											
Spot Improvement 6 Cave Hollow Lane	0.400	Widen Shoulders	Low	Low	\$100,000	4.90	Yes	1.96	6	1	3	0.06	B	20 (6 th)	41 (6 th)
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low											
		Lengthen Culvert and Improve Clear Zone	Medium	Low	\$100,000	0.40									
Spot Improvement 7 Lyons-Daughtery to East of KY 401	1.400	Widen Shoulders	Low	Low	\$600,000	15.62	Yes	2.49	27	4	6	0.06	B	18 (7 th)	27 (7 th)
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low											
		Pave Intersection Approach	Low	Low											
		Realignment	High	High	\$3,700,000	4.89									
Spot Improvement 8 Breckinridge & Hardin County Line	0.637	Widen Shoulders	Low	Low	\$200,000	31.50 (3.30**)	Yes	1.25	13	1	4	0.06	B	4 (18 th)	6 (18 th)
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low											
		Lengthen Culvert and Improve Clear Zone	Medium	Low	\$100,000	13.20 (0.40**)									
Spot Improvement 9 West of KY 2213	0.400	Remove Vegetation	Low	Low	\$200,000	1.10	Yes	1.25	9	0	3	0.06	B	3 (19 th)	5 (19 th)
		Widen Shoulders	Low	Low											
Spot Improvement 10 KY 2213 to Vertrees Church Lane	2.482	Remove Vegetation	Low	Low	\$500,000	0.78	Yes	1.21	22	0	13	0.06	B	33 (3 rd)	61 (4 th)
		Widen Shoulders	Low	Low											
		Replace Bridge	High	Low	\$700,000	1.50									
		Lengthen Culvert and Improve Clear Zone	Medium	Low	\$100,000	2.00									
		Passing Lane	Medium	Medium	\$2,800,000	0.14									
Spot Improvement 11 Bridge over Rough River	0.100	Remove Vegetation	Low	Low	\$900,000	0.01	Yes	0	1	0	0	0.06	B	13 (8 th)	26 (8 th)
		Replace Bridge	High	Low											
Spot Improvement 12 KY 920 Intersection	0.299	Access Management	Low	Low	\$50,000	6.60	Yes	1.7	15	0	2	0.12	C	9 (11 th)	16 (12 th)
		Remove Passing Permitted Striping	Low	Low											
Spot Improvement 13 East of Wright Lane (Coon Hunters Club)	0.400	Remove Vegetation	Low	Low	\$250,000	2.20	Yes	1.21-1.70	13	1	2	0.12	C	22 (5 th)	45 (5 th)
		Widen Shoulders	Low	Low											
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low											
		Realignment	High	High	\$800,000	0.78									
Spot Improvement 14 Yates Chapel Road	0.400	Widen Shoulders	Low	Low	\$250,000	27.08	Yes	1.21	14	1	0	0.12	C	6 (17 th)	15 (13 th)
		Flexible Delineators	Low	Low											
		High-Friction Pavement Surface	Low	Low											
Spot Improvement 15 James Duvall Lane	0.900	Remove Vegetation	Low	Low	\$30,000	1.33	Yes	1.21	16	0	10	0.12	C	9 (11 th)	18 (11 th)
		Drainage Improvements	Low	Low	\$100,000	4.70									
		Realignment	High	High	\$1,600,000	0.41									
Spot Improvement 16 KY 1375 Intersection	0.150	Remove Vegetation	Low	Low	\$20,000	0.05	Yes	1.37	9	0	2	0.13	C	8 (13 th)	13 (16 th)
		Vertical Realignment	High	Medium	\$600,000	7.77									
Spot Improvement 17 Culvert at Blacks Branch Road	0.083	Lengthen Culvert and Improve Clear Zone	Medium	Low	\$100,000	1.80	Yes	0	8	1	0	0.13	C	7 (15 th)	11 (17 th)
Spot Improvement 18 South Black Branch Road	0.300	Widen Shoulders and Improve Clear Zone	Low	Low	\$100,000	1.80	Yes	1.51	8	0	0	0.13	C	7 (15 th)	14 (15 th)
		Relocate Utility Pole	Low	Low	\$15,000	0.47									
Spot Improvement 19 City of Cecilia	1.550	Vertical Realignment	Low	Medium	\$600,000	1.33	Yes	0	31	0	2	0.17	C	30 (4 th)	82 (2 nd)
		Drainage Improvements	Medium	Medium	\$500,000	1.20									
		Signal Ahead Warning Sign	Low	Low	\$250	Not Available									
		Widen to 3-Lanes with Center TWLTL	High	High	\$3,000,000	0.22									

10.0 CONCLUSIONS AND RECOMMENDATIONS

This section provides the recommendations for the KY 86 Scoping Study based on their ability to meet the Purpose and Need, the existing conditions analysis, the input received, and the alternative development process detailed in this report.

10.1 PROJECT TEAM MEETING NO. 3

The project team met for a final meeting at the District 4 Office in Elizabethtown, Kentucky on September 1, 2017. The purpose of the meeting was to discuss findings from the local official/stakeholder and public meetings, review the results from the benefit-to-cost analysis, and prioritize the proposed improvement concepts. A detailed summary of the final project team meeting is included in **Appendix G**.

Key discussion items included the following:

- Spot Improvements 1 and 2 could be combined into a single project.
- Many of the “widen shoulder” improvements could be combined into a single Highway Safety Improvement Program project.
- The priority of Spot Improvement 19 should be improving the drainage along KY 86 and improving the sight distance at the KY 253 intersection. Widening KY 86 through Cecilia to three-lanes is not considered a high priority. The PIF for Spot Improvement 19 will address safety and drainage.
- There were concerns about not having a turn lane at the new elementary school in Cecilia. A turn lane is not required because KYTC and Hardin County Schools developed an internal traffic management plan similar to the one implemented on KY 1357 for G.C. Burkhead Elementary. That plan was very successful and both agencies feel that this plan will also work for the new school when it is open.
- PIFs will be created for each of the six high priority spot improvements. Right-of-way and utility cost estimates are provided for the six high priority projects. Right-of-Way and Utility Relocation costs were developed by KYTC District 4.
- The benefit-to-cost analysis will only include construction costs.

10.2 RECOMMENDATIONS

The project team decided the focus of the KY 86 Scoping Study would be to identify Spot Improvement projects that can be implemented quickly and independently. In light of the technical data, comments from local officials/stakeholders and the public, results of the public

meeting survey, and results from the benefit-to-cost analysis, the project team prioritized each of the individual Spot Improvements. Project sheets for each project are included in **Appendix I**.

High Priority (in no particular order)

- Spot Improvement 2 – Jesse Priest Road to east of Rosetta Corners Road
- Spot Improvement 7 – Lyons-Daughtery Road to east of KY 401
- Spot Improvement 10 – KY 2213 to Vertrees Church Lane
- Spot Improvement 13 – East of Wright Lane (Cherry Tree Coon Hunters Club)
- Spot Improvement 14 – Yates Chapel Road
- Spot Improvement 19 – City of Cecilia



Medium Priority (in no particular order)

- Spot Improvement 4 – KY 690 Intersection
- Spot Improvement 5 – Allgood Road
- Spot Improvement 6 – Cave Hollow Lane (Note: as part of this project wider shoulders, flexible delineators, and the application of a high-friction pavement surface at the horizontal curve were recently completed.)
- Spot Improvement 12 – KY 920 Intersection
- Spot Improvement 15 – James Duvall Lane
- Spot Improvement 16 – KY 1375 Intersection

Low Priority (in no particular order)

- Spot Improvement 1 – US 60 to Jesse Priest Road
- Spot Improvement 3 – Merle Allen Lane to Lonnie Haynes Road
- Spot Improvement 8 – Breckinridge and Hardin County Line
- Spot Improvement 9 – West of KY 2213
- Spot Improvement 11 – Bridge over Rough River
- Spot Improvement 17 – Culvert at Blacks Branch Creek
- Spot Improvement 18 – South Black Branch Road

No Priority (not recommended)

- Complete Reconstruction

10.3 HIGH PRIORITY COST ESTIMATES

KYTC District 4 provided approximate right-of-way and utility cost estimates for the six high priority improvement concepts. **Table 11** summarizes the design, right-of-way, utility, and construction cost estimates for the six high priority projects.

Table 11: High Priority Project Cost Estimates

High Priority Spot Improvements	Project Length (miles)	Improvement Options	2017 Cost Estimates			
			Design	Right-of-Way	Utility	Construction
Spot Improvement 2 Jesse Priest Rd to West of Rosetta Corners	1.100	Widen Shoulders	\$50,000	\$0	\$0	\$500,000
		Flexible Delineators				
		High-Friction Pavement Surface				
		Realignment	\$570,000	\$1,000,000	\$1,000,000	\$3,800,000
Spot Improvement 7 Lyons-Daughtery to East of KY 401	1.400	Widen Shoulders	\$60,000	\$0	\$0	\$600,000
		Flexible Delineators				
		High-Friction Pavement Surface				
		Pave Intersection Approach				
		Realignment	\$560,000	\$750,000	\$1,000,000	\$3,700,000
Spot Improvement 10 KY 2213 to Vertrees Church Lane	2.482	Remove Vegetation	\$50,000	\$0	\$0	\$500,000
		Widen Shoulders				
		Replace Bridge	\$110,000	\$150,000	\$50,000	\$700,000
		Lengthen Culvert and Improve Clear Zone	\$20,000	\$0	\$0	\$100,000
		Passing Lane	\$420,000	\$350,000	\$100,000	\$2,800,000
Spot Improvement 13 East of Wright Lane (Coon Hunters Club)	0.400	Remove Vegetation	\$30,000	\$0	\$0	\$250,000
		Widen Shoulders				
		Flexible Delineators				
		High-Friction Pavement Surface				
		Realignment	\$120,000	\$200,000	\$100,000	\$800,000
Spot Improvement 14 Yates Chapel Road	0.400	Widen Shoulders	\$30,000	\$0	\$0	\$250,000
		Flexible Delineators				
		High-Friction Pavement Surface				
Spot Improvement 19 City of Cecilia	1.550	Vertical Realignment	\$90,000	\$100,000	\$100,000	\$600,000
		Drainage Improvements	\$80,000	\$100,000	\$100,000	\$500,000
		Signal Ahead Warning Sign	\$0	\$0	\$0	\$250
		Widen to 3-Lanes with Center TWLTL	\$450,000	\$1,500,000	\$2,000,000	\$3,000,000

10.4 NEXT STEPS

The next phase for the project would be Phase 1 Design (Preliminary Engineering and Environmental Analysis) to further evaluate the high priority projects. The 2016 Highway Plan includes \$500,000 for the planning phase. This Scoping Study did not spend the entire planning budget, leaving some money for preliminary design of one or more improvement projects. Additional phases of the project are not funded in the 2016 Highway Plan.

11.0 CONTACTS/ADDITIONAL INFORMATION

Written requests for additional information should be sent to John Moore, Director, KYTC Division of Planning, 200 Mero Street, Frankfort, KY 40622. Additional information regarding this study can also be obtained from the District 4 Project Manager, Charlie Allen, at (270) 766-5066 (email at CharlieA.Allen@ky.gov).