

FINAL REPORT

November 2014



I-75 to MOUNTAIN PARKWAY CORRIDOR STUDY

Madison, Clark, Estill & Powell Counties

SUMMARY OF FINDINGS & RECOMMENDATIONS

Presented to:
Kentucky Transportation Cabinet
Division of Planning
District 7 & District 10



Presented by:
**PARSONS
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ACRONYMS

ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
BGADD	Bluegrass Area Development District
CCRF	Critical Crash Rate Factor
CSEPP	Chemical Stockpile Emergency Preparedness Plan
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HIS	Highway Information System
KYTC	Kentucky Transportation Cabinet
LOS	Level of Service
LO/S	Local Officials / Stakeholders
NRHP	National Register of Historic Places
PDT	Project Development Team
PIF	Project Identification Form
UNL	Unscheduled Needs List
UST	Underground Storage Tank

APPENDICES (on CD)

Appendix A: Study Area Emergency Evacuation Routes
Appendix B: Existing Corridor Routes Plan and Profile Sheets
Appendix C: Crash Records
Appendix D: Cultural Historic Overview
Appendix E: Threatened and Endangered Species List
Appendix F: Environmental Justice Overview
Appendix G: Local Officials and Stakeholder Meeting Materials
Appendix H: Project Development Team Meeting Minutes
Appendix I: Traffic Forecast Report and Bike / Ped Accommodation Assessment
Appendix J: Geotechnical Overview
Appendix K: Additional Cost Information

I-75 to Mountain Parkway Corridor Study – Executive Summary

INTRODUCTION

The consulting firm of Parsons Brinckerhoff was contracted by the Kentucky Transportation Cabinet (KYTC) to perform a study to examine ways to improve the route for travelers between I-75 and the Mountain Parkway. Issues such as safety, roadway geometrics, capacity, congestion, environmental and human impacts, in addition to local officials / stakeholders (LO/S) input were all evaluated and documented through the course of the study. Several options were considered as part of the study, ranging from no build (as a baseline for comparison), to improvement alternatives along the existing routes (KY 52 / KY 499 / KY 89 / KY 82), to a new connector route, or a combination of these. The boundary for the overall study area is shown in **Figure ES-1**. This also highlights the existing corridor which is being examined for improvements.

PURPOSE AND NEED

The purpose and need statement for this study was developed from issues identified in field reviews, through LO/S input, as well as from the analysis of deficiencies identified in the existing roadway conditions.

Purpose

The purpose of the I-75 to Mountain Parkway Corridor Study is to improve mobility, connectivity and safety, as well as to address roadway deficiencies between I-75 and the Mountain Parkway.

Need

Supporting the study purpose is the study need. Input was provided by the Project Development Team (PDT) which consisted of KYTC Central Office, District 7 and District 10 staff, Parsons Brinckerhoff, and the Bluegrass Area Development District (BGADD). The LO/S also provided input on the study purpose and need. This input, along with the initial technical analysis, has shown a documented need exists for transportation improvements in the study area. The supporting need is presented below.

Safety – Three intersections throughout the study area have a critical crash rate factor (CCRF) equal to or greater than 1.0. These include:

- KY 52 / US 25 (Eastern Bypass) – CCRF = 1.70 to 0.93
- KY 52 / KY 977 – CCRF = 1.55
- KY 52 / Drowning Creek Road – CCRF = 1.00

Roadway Deficiencies – KY 89 and KY 82 have noted vertical and horizontal deficiencies (52 locations total). Locations are depicted on **Figures ES-2**.

Travel Time Reliability – KY 89 and KY 82 are two lane roads with limited passing opportunities. Numerous deficient horizontal and vertical curves require drivers to slow down to negotiate.

Access – Multiple access points exist near some study area intersections creating a number of conflict points and sight distance issues for turning versus through vehicles.

Connectivity – Currently, the existing roadways in this corridor do not provide a direct southern connection between I-75 and Mountain Parkway. Therefore, there is a need to improve this connectivity by considering routes that are more direct than the existing roadways.

Emergency Management – The Chemical Stockpile Emergency Preparedness Program (CSEPP) was created when the Army was directed to dispose of its aging chemical weapons inventory. The Bluegrass Army Depot is one of five Army installations in the United States that currently stores chemical weapons. In the event of an incident, emergency evacuation plans have been prepared. One route follows the existing study area routes (KY 52 / KY 499 / KY 89 / KY 82).

Goals and Objectives

In accordance with KYTC's policy on purpose and need statements, the following goals and objectives were developed to balance environmental and community issues with transportation issues.

- Provide solutions to meet the purpose of the project while avoiding / minimizing / mitigating impacts to human and natural environmental features.
- Provide improvement options that address identified needs.

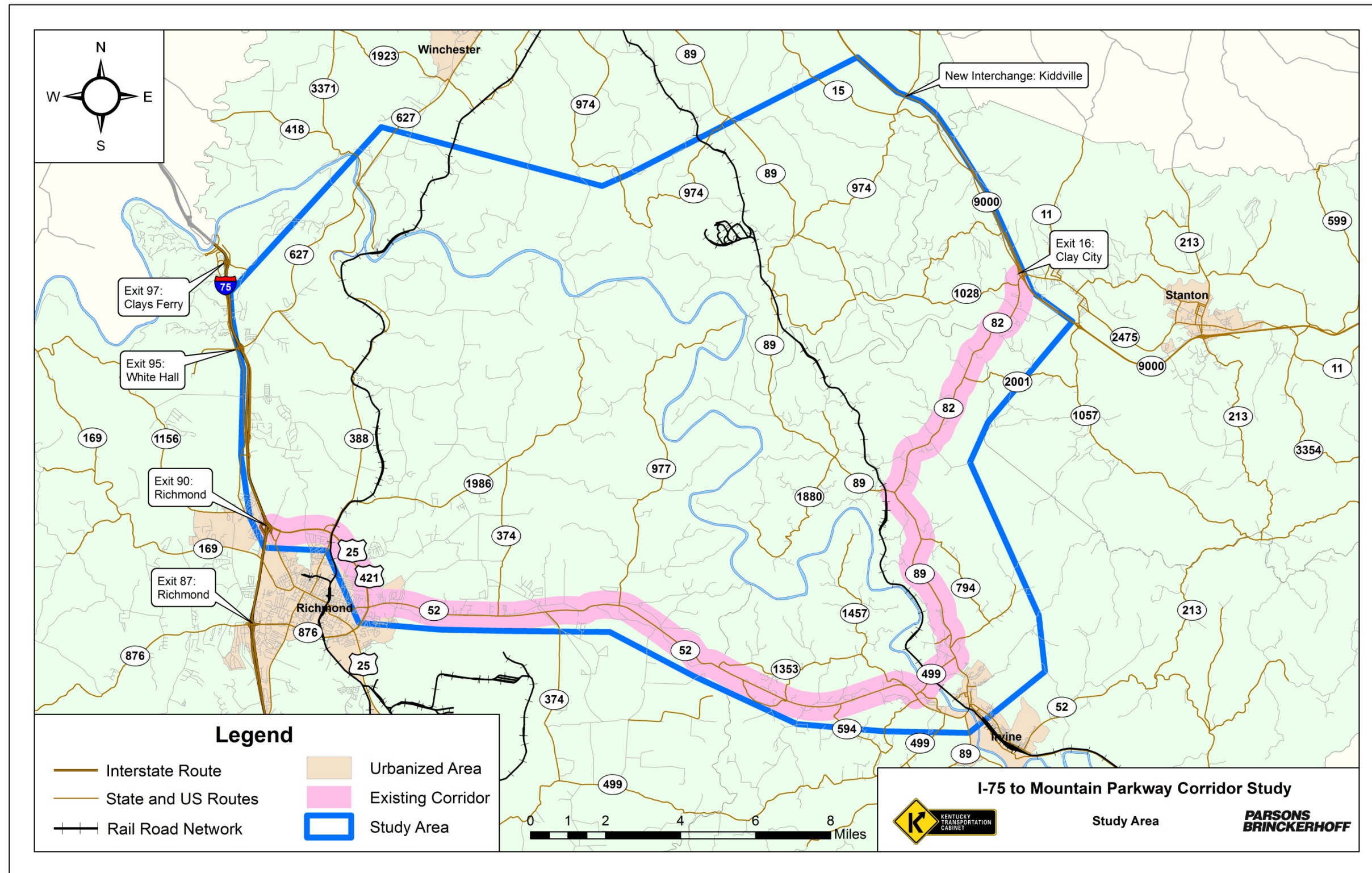
EXISTING CONDITIONS

A detailed inventory was completed to examine existing roadway characteristics, current and future traffic volumes, level of service (LOS), capacity, crash rates, multimodal facilities and environmental features. A summary of key points is as follows:

- The majority of the length of the existing corridor routes (KY 52 / KY 499 / KY 89 / KY 82) is classified as a rural minor arterial or rural major collector. The routes are primarily two-lane facilities with narrow shoulders and a posted speed limit of 55 mph.
- There are a total of 56 locations along the existing routes that have horizontal and vertical curves that do not meet current design standards.
- The existing corridor routes have traffic volumes (average daily traffic) ranging from 18,300 (near Richmond, Kentucky) to 3,000 (on KY 82 between Irvine and the Mountain Parkway). These traffic volumes increase to 27,400 and 4,500, respectively, in the year 2040.
- All segments evaluated along the existing corridor routes are under capacity (a volume to capacity (v/c) ratio of 1.0 is considered capacity). The issue with traffic operations that results in a poor LOS (LOS E) for some sections (primarily segments of KY 52 near KY 499 and KY 82) is the lack of passing opportunities.

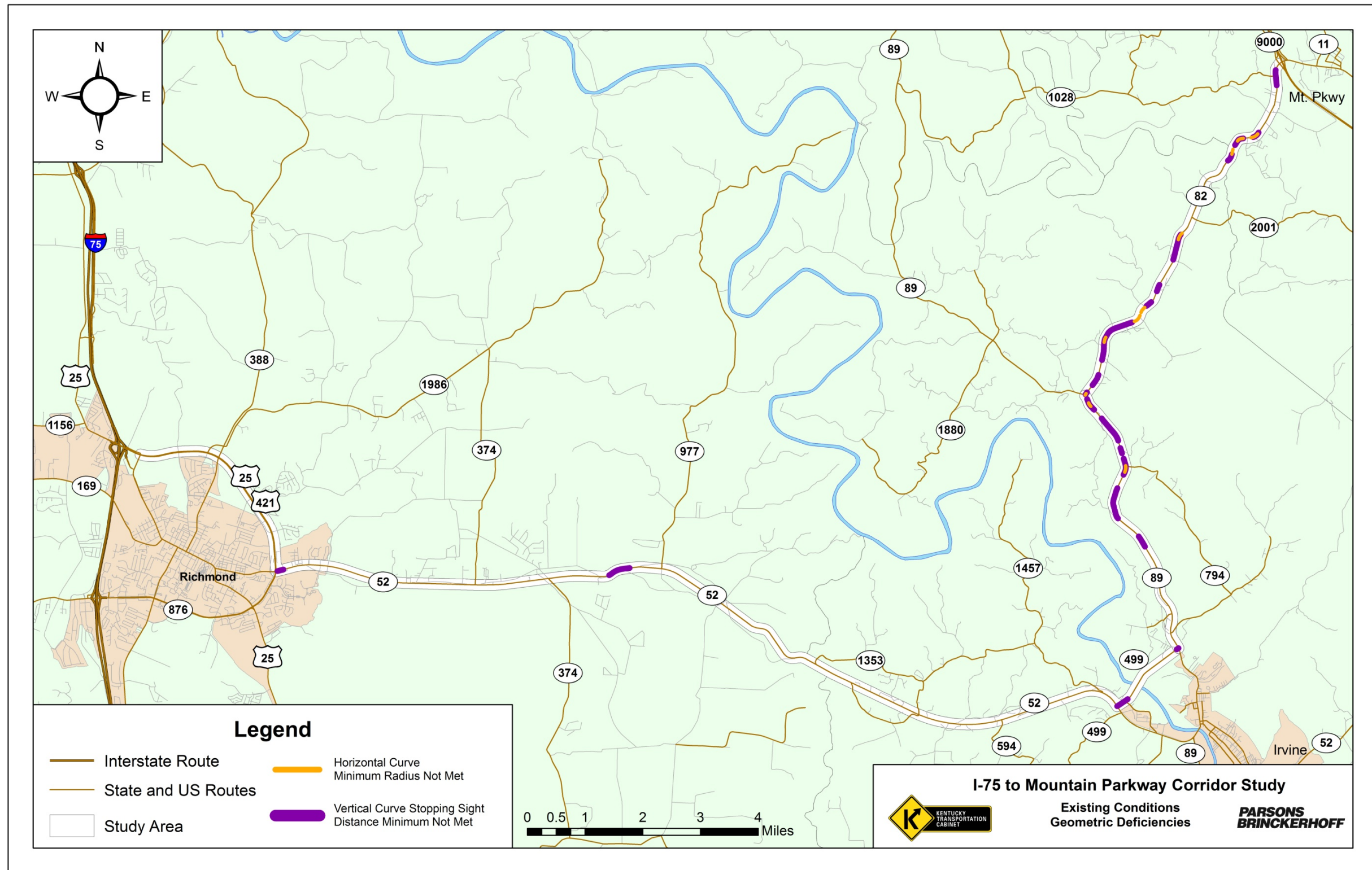
I-75 to Mountain Parkway Corridor Study - Executive Summary

Figure ES-1: Study Area



I-75 to Mountain Parkway Corridor Study - Executive Summary

Figure ES-2: Existing Geometric Deficiencies



I-75 to Mountain Parkway Corridor Study – Executive Summary

- Ten fatal crashes occurred throughout the study area during the course of the three year (January 1, 2011 – December 31, 2013) analysis period. The following intersections with KY 52 were the only locations determined to have crash issues based on an analysis of crashes and rates: the Eastern Bypass, KY 977, and Drowning Creek Road.
- A cluster of identified and potential archaeological resource sites exist north of the Kentucky River, approximately in the middle of the study area.
- Numerous Underground Storage Tanks (UST) / Hazmat sites are located along the existing corridor routes.

and were ranked as lower priorities by the LO/S. As a result, Routes #2 and #3 are not recommended. If it is determined at a later stage that the construction of Route #1 is cost prohibitive, it is recommended to consider implementing the remaining improvements along the existing corridor.

PROJECT DEVELOPMENT AND ANALYSIS

A detailed, multi-step process was used to develop and evaluate potential improvement projects. The process included the technical analysis derived from the existing conditions overview, field reviews, and input from the PDT.

Improvement projects were developed in three categories:

1. Spot Improvement – projects at individual locations along the existing route;
2. Corridor Improvement – improvements to provide a consistent typical section along the existing route; and
3. New Route – new roadway connections.

Also considered were combinations of any of the three categories.

Figures ES-3, 4 and 5 display all alternatives considered.

STUDY RECOMMENDATION AND PRIORITIZATION

Based on the project analysis, discussion with the PDT, input from the LO/S, and referring to the purpose and need established for this project it was determined that the recommendation from this study is to improve the existing corridor with the addition of Route #1.

As a reference, this includes the following improvement options (as shown on **Figures ES-6**):

- 52-A
- 52-B
- 52-C
- 52-E1
- 82-A
- 82-B
- Route #1

Overall, improvements to the existing route plus Route #1 best meet the identified purpose and need for this project. Routes #2 and #3 only met portions of the purpose and need components

Figure ES-3: KY 89 and KY 82 Improvement Projects

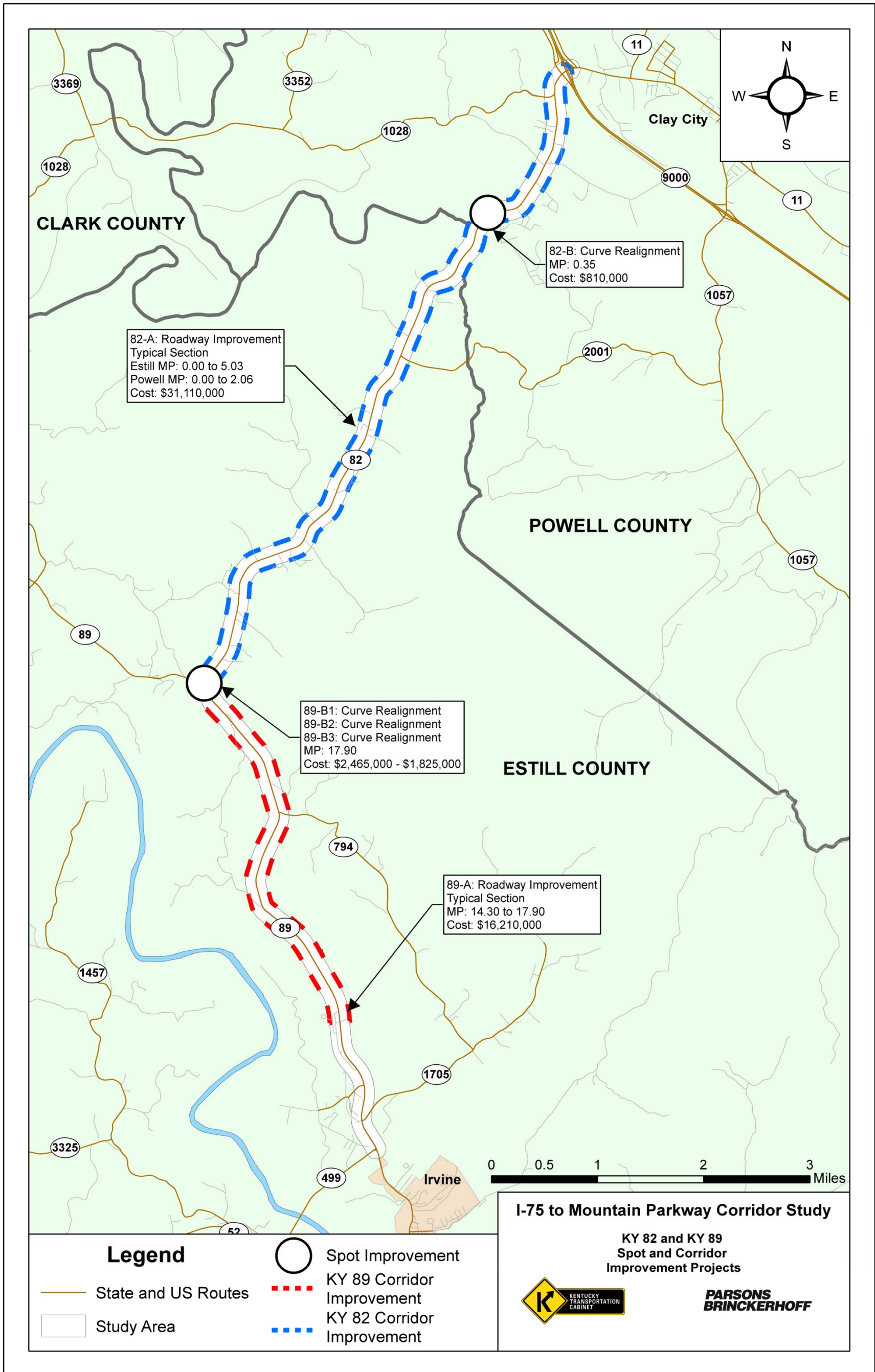
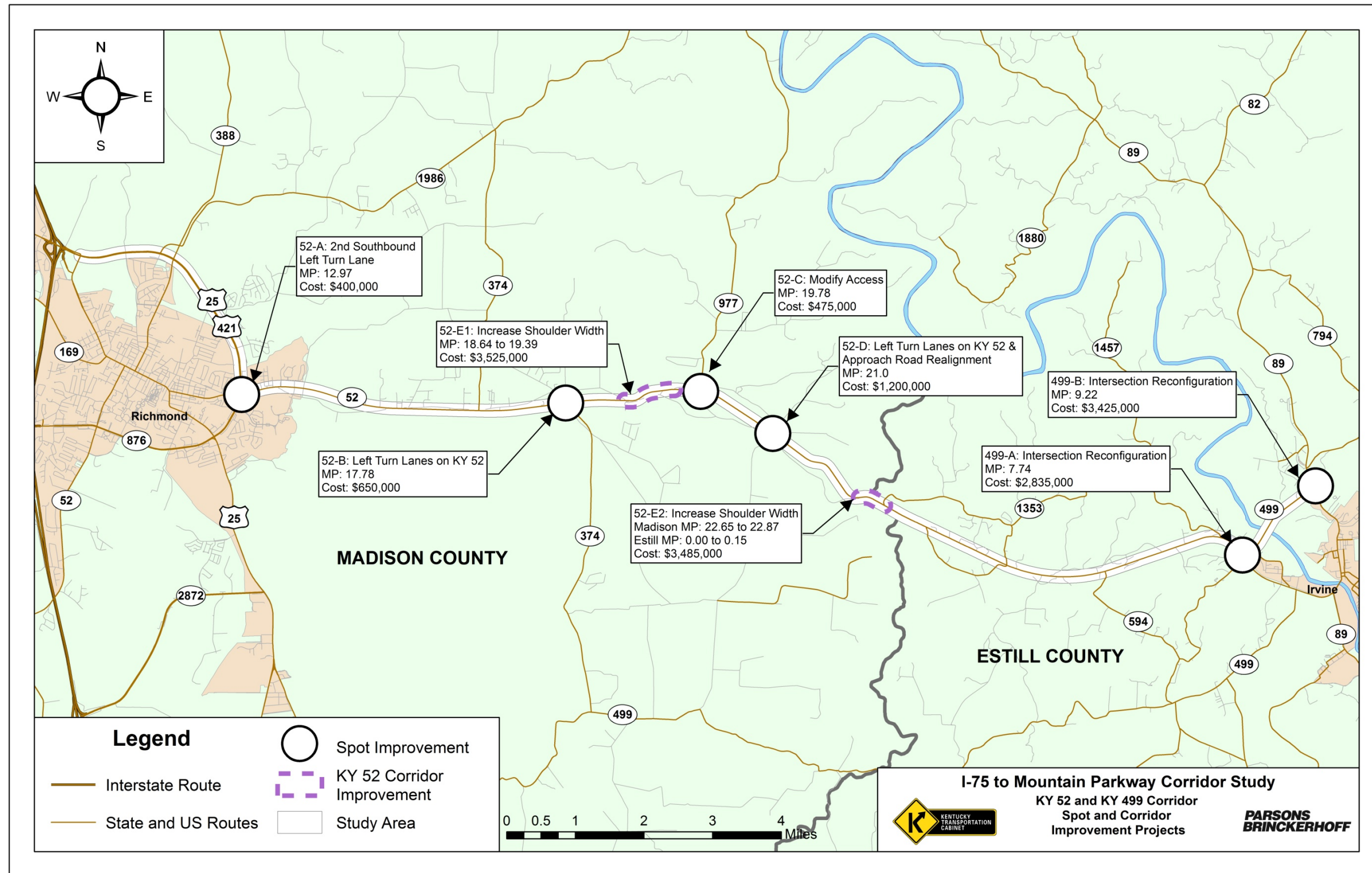




Figure ES-4: KY 52 and KY 499 Improvement Projects

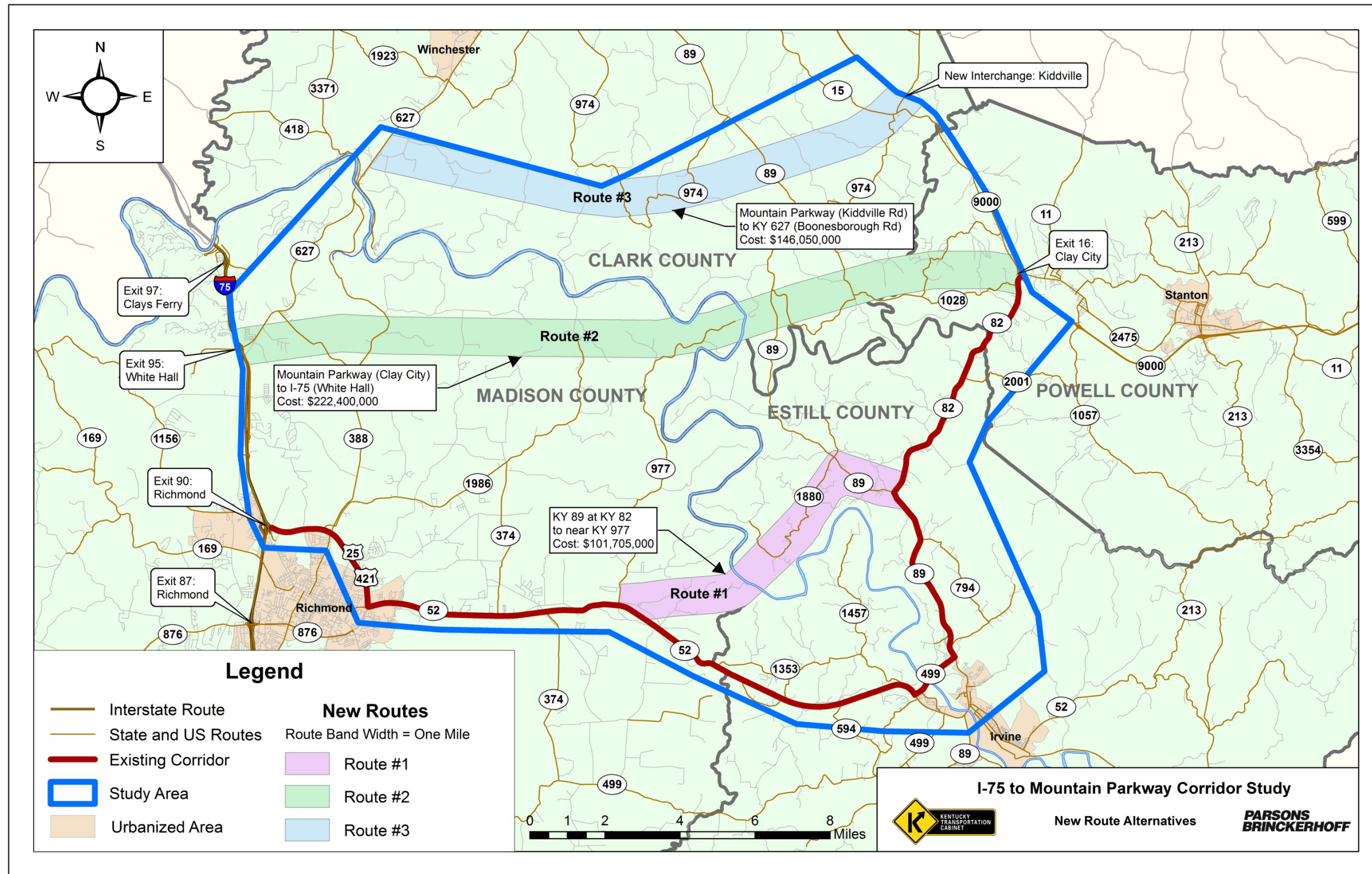


I-75 to Mountain Parkway Corridor Study
 KY 52 and KY 499 Corridor
 Spot and Corridor
 Improvement Projects

I-75 to Mountain Parkway Corridor Study - Executive Summary

Figure ES-5: New Routes



I-75 to Mountain Parkway Corridor Study – Executive Summary

Proposed phasing of the study recommendation is provided to assist with future development (see **Figure ES-6**). Three distinct phases were identified considering safety and operations, cost, and LO/S input. The total cost for all phases is \$138,675,000.

Phase 1 – Spot Improvements

- Includes 52-A, 52-B, 52-C, and 82-B
- Total cost = \$2,335,000
- Individually all improvement projects are less than \$1,000,000
- This would address the safety component by improving two intersections with CCRFs that exceed 1.0

Phase 2 – Corridor Improvements

- Includes 52-E1 and 82-A
- Total cost = \$34,635,000
- These improvements would address all geometric deficiencies on KY 82 (42 deficiencies)

Phase 3 – Route #1

- Total cost = \$101,705,000
- This connection would provide the last piece to improve travel time, provide connectivity, and allow for an additional through travel option, removing some traffic from the remaining portion of KY 52 and KY 89

Further ranking of project prioritization was completed within Phase 1 – Spot Improvements and Phase 2 – Corridor Improvements. The methodology for the prioritization of the different projects in each phase considered several factors to determine the order in which each piece is recommended to be constructed (high, medium, low priority). This includes input received from the LO/S, traffic volumes (for the corridor improvements), crash rate factors (CCRF) and the number of geometric deficiencies present.

Phase 1 – Spot Improvements Prioritization

- High Priority: 52-C
 - Total Cost = \$475,000
 - Highest ranking of the spot improvement projects by the LO/S
 - CCRF = 1.55
- Medium Priority: 52-B
 - Total Cost = \$650,000
 - High ranking response of the spot improvement projects by the LO/S
 - CCRF = 0.77
- Medium Priority: 82-B
 - Total Cost = \$810,000

- A split of high and medium ranking response of the spot improvements projects by the LO/S
- CCRF = 0.51
- 3 Geometric Deficiencies

• Low Priority: 52-A

- Total Cost = \$400,000
- Medium ranking response of the spot improvement projects by the LO/S
- CCRF = 0.93 – 1.70
- 1 Geometric Deficiency
- Recent work (less than one year) has been completed to improve southbound left turn queuing issues

Phase 2 – Corridor Improvements Prioritization

- Phase 2A: KY 82 Northern Portion (Estill County MP 4.92: near Powell County Line – Powell County MP 2.06: KY 15)
 - Total Cost = \$10,350,000
 - 22 geometric deficiencies
 - Highest frequency of crashes of KY 82 sections
 - 2040 ADT = 7,300 – 6,000
- Phase 2B: KY 52-E1 (MP 18.64: near Old KY 52 to MP 19.39: near Elliston Rd)
 - Total Cost = \$3,525,000
 - Highest ranking of the corridor improvements by the LO/S
 - 1 geometric deficiency
 - 2040 ADT = 16,100
- Phase 2C: KY 82 Southern Portion (MP 0.00: KY 89 – MP 2.36: OB Stamper Rd)
 - Total Cost = \$10,985,000
 - 15 geometric deficiencies
 - 2040 ADT = 4,500
- Phase 2D: KY 82 Central Portion (MP 2.36: OB Stamper Rd – MP 4.92: near Powell County Line)
 - Total Cost = \$9,775,000
 - 5 geometric deficiencies
 - 2040 ADT = 6,000

Funding / Next Steps

At this time there is no funding in the 2014 Highway Plan for any future phases of project development. Funding would need to be secured for future project development.



1.0 INTRODUCTION

The consulting firm of Parsons Brinckerhoff was contracted by the Kentucky Transportation Cabinet (KYTC) to perform a study to examine ways to improve the route for travelers between I-75 and the Mountain Parkway. Issues such as safety, roadway geometrics, capacity, congestion, environmental and human impacts, in addition to local officials / stakeholders (LO/S) input were all evaluated and documented through the course of the study. Several options were considered as part of the study, ranging from no build (as a baseline for comparison), to improvement alternatives along the existing routes (KY 52 / KY 499 / KY 89 / KY 82), to a new connector route, or a combination of these. All information has been compiled to provide this summary report documenting the study and the process.

Members of the Project Development Team (PDT) included KYTC District 7, KYTC District 10, KYTC Central Office Division of Planning, Bluegrass Area Development District (BGADD) and the consultant team which consisted of Parsons Brinckerhoff, Third Rock Consultants LLC, and Cultural Resource Analysts, Inc. The BGADD provided input throughout the study process and assisted by providing a high-level Environmental Justice Overview.

1.1 Study Objectives

Based on the initial direction provided by the KYTC, seven primary study objectives were developed, as summarized below.

1. Examine existing traffic, roadway, environmental, and safety conditions along the existing routes between I-75 and the Mountain Parkway;
2. Identify roadway problems or deficiencies;
3. Define the study's purpose and need;
4. Develop a list of improvements;
5. Evaluate the list of improvements, considering local official / stakeholder (LO/S) input as well as transportation, community, environmental, geotechnical, and economic benefits and impacts;
6. Provide a recommendation based on the identified project purpose and need; and
7. Prioritize projects to allow for a phased implementation approach.

While KYTC has the ultimate responsibility for constructing and maintaining safe and efficient highways, KYTC desires to incorporate LO/S input into the evaluation and decision-making process. Therefore, all seven study objectives were completed in coordination with input from the LO/S.

1.2 Project Location and Study Area

The study area is located in Madison, Clark, Estill and Powell Counties. The southern / eastern boundary is formed by KY 52 / KY 499 / KY 89 / KY 82. The boundary then follows the Mountain Parkway north. The northern boundary goes just south of Winchester, Kentucky, including the existing bridge crossing of the Kentucky River on KY 627 near Fort Boonesborough State Park.

The study area then follows I-75 south to the Richmond Bypass (US 25 / US 421) and connects with KY 52. **Figure 1** shows the study area.

There have been improvements along most of KY 52, providing a wider typical section with passing opportunities. KY 499 is a relatively new road constructed as an optional route around Irvine. A section of KY 89 has also recently been reconstructed near the Estill County School Complex to provide a wider typical section with 12-foot travel lanes and 10-foot shoulders.

At the outset of this study (per discussions at the study scoping meeting), US 25 (the Richmond Bypass) and KY 52 from US 25 to Charlie Norris Road (KY 374) would not be included in the study area. The reasoning for this decision was that these sections have been improved recently and no data / information have been noted related to these routes which would require additional improvements at this time. For continuity, the existing route has been shown to include these areas; however, detailed analysis and data were not compiled during the course of this study. However, projects may be proposed for these routes if determined necessary as part of overall improvements to the existing corridor routes.

1.3 Study Process

The study process used to evaluate potential alternatives consists of four major elements:

1. Define the purpose and need of the study;
2. Develop potential improvement options;
3. Evaluate the improvements; and
4. Provide a recommendation for improvements.

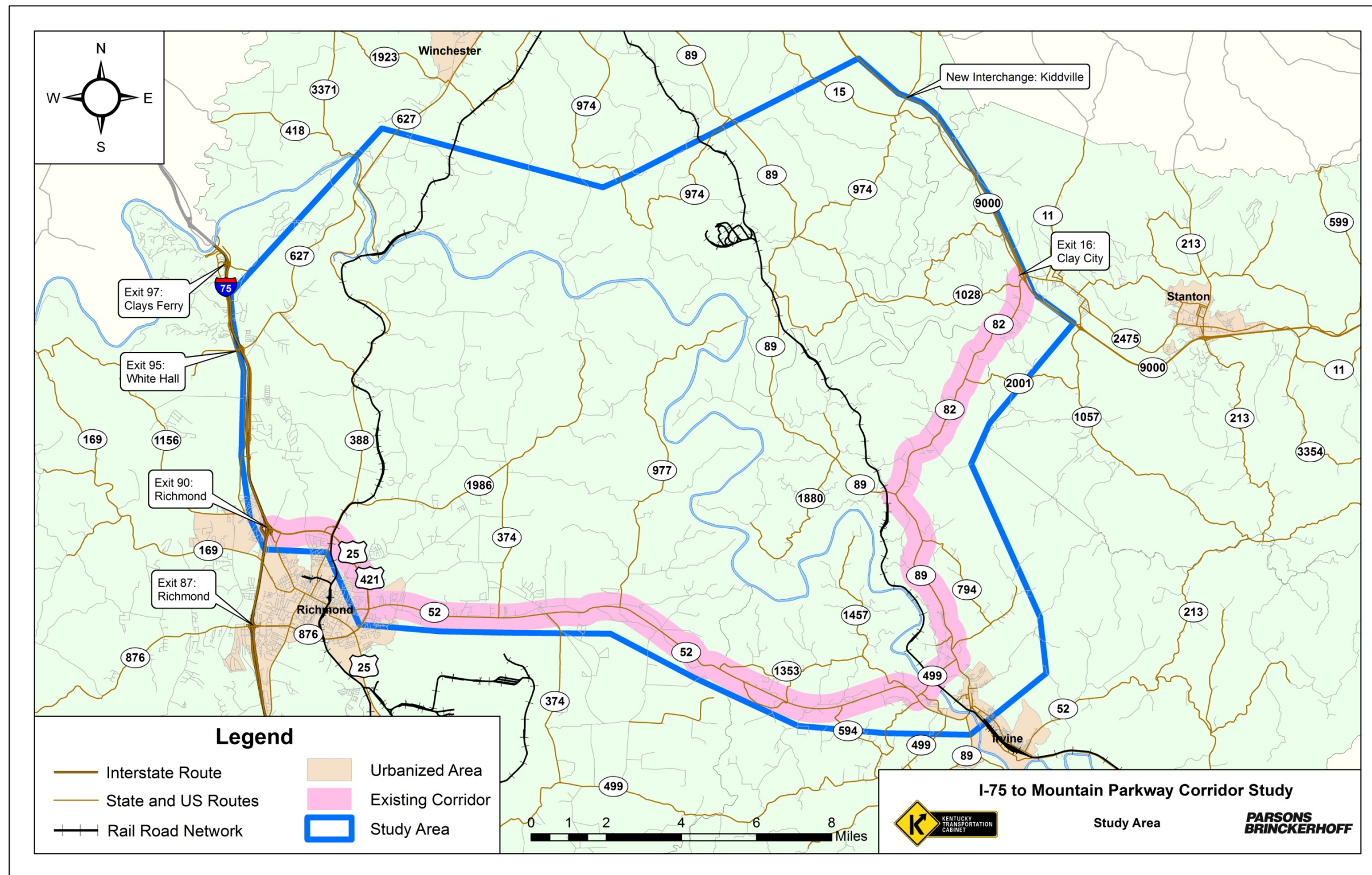
The subsequent chapters of this report explain these steps with additional detail provided in appendices. The first chapter outlines the purpose and need of the study. The following chapters provide an overview of existing conditions (traffic, operations, safety, and environmental overview). The existing conditions documentation is used to confirm the purpose and need and provide a basis for the development of possible improvements.

In addition to the technical analysis, LO/S input was gathered as part of the study process. The framework for including this as well as the PDT input in the study process is presented in the chapter following the technical analysis.

Next, discussion related to the development of the list of improvements and evaluation is presented in the form of project summary sheets. Each sheet details the individual project issue(s) along with the improvement project to address the issue(s). Recommendations for this study are presented at the end of the report as well as identified project priorities for use in future project development stages.



Figure 1: Study Area





2.0 PURPOSE AND NEED

It is important to establish the purpose and need for a project during its early stages since it defines the reason(s) for doing the study and provides the basis for the development, evaluation, and comparison of alternatives. The three parts to a complete purpose and need statement include: 1) the purpose, 2) the need, and 3) goals and objectives. The purpose identifies the problem to be solved by the study and is supported by the need. Goals and objectives are other elements of the purpose and need statement that go beyond the transportation issues of the study and should be considered and addressed as part of a successful solution to the problem.

The purpose and need statement for this study was developed from issues identified in field reviews, through LO/S input, as well as from the analysis of deficiencies identified in the existing roadway conditions.

2.1 Purpose

The purpose of the I-75 to Mountain Parkway Corridor Study is to improve mobility, connectivity and safety, as well as to address roadway deficiencies between I-75 and the Mountain Parkway.

2.2 Need

Supporting the study purpose is the study need. Discussion of project issues, goals, and objectives was part of a meeting with the PDT held at the beginning of the study on May 1, 2014 with further comments provided during the second PDT meeting on July 17, 2014. Additional input was requested about project issues and goals during the LO/S meeting on September 23, 2014. Attendees were given the opportunity to voice their thoughts at the meeting as well as on the survey forms provided. This input, along with the initial technical analysis, has shown a documented need exists for transportation improvements in the study area. The supporting need is presented below.

Safety – Three intersections throughout the study area have a critical crash rate factor (CCRF) equal to or greater than 1.0. These include:

- KY 52 / US 25 (Eastern Bypass) – CCRF = 1.70 to 0.93
- KY 52 / KY 977 – CCRF = 1.55
- KY 52 / Drowning Creek Road – CCRF = 1.00

Roadway Deficiencies – KY 89 and KY 82 have noted vertical and horizontal deficiencies (52 locations total).

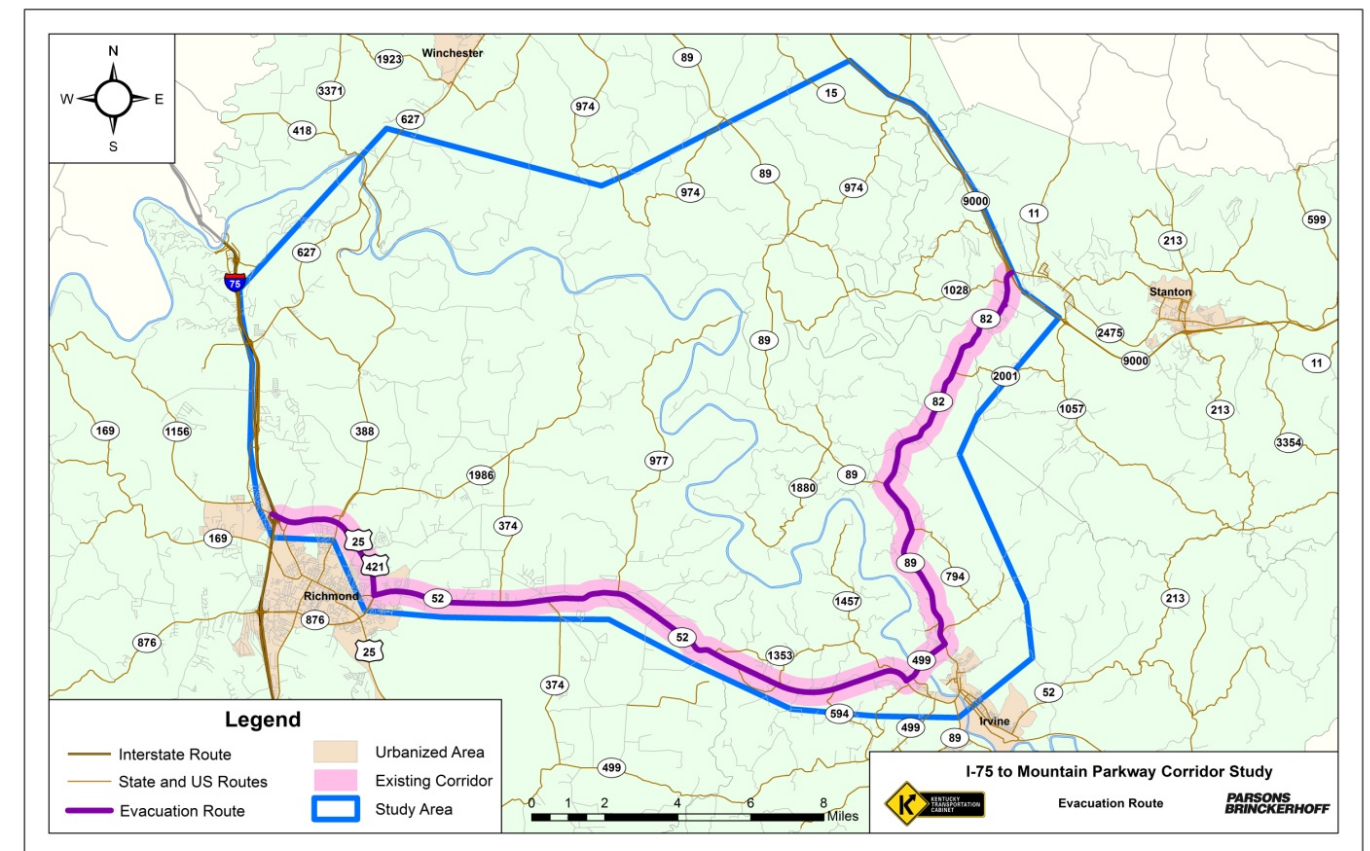
Travel Time Reliability – KY 89 and KY 82 are two lane roads with limited passing opportunities. Numerous deficient horizontal and vertical curves require drivers to slow down to negotiate.

Access – Multiple access points exist near some study area intersections creating a number of conflict points and sight distance issues for turning versus through vehicles.

Connectivity – Currently, the existing roadways in this corridor do not provide a direct southern connection between I-75 and Mountain Parkway. Therefore, there is a need to improve this connectivity by considering routes that are more direct than the existing roadways.

Emergency Management – The Chemical Stockpile Emergency Preparedness Program (CSEPP) was created when the Army was directed to dispose of its aging chemical weapons inventory. The Bluegrass Army Depot is one of five Army installations in the United States that currently stores chemical weapons. In the event of an incident, emergency evacuation plans have been prepared. One route follows the existing study area routes (KY 52 / KY 499 / KY 89 / KY 82). This is shown on **Figure 2**. Actual maps of the evacuation routes within the study area counties are included in **Appendix A**. These maps and information were provided from the following website: <http://csepp.ky.gov/counties/>.

Figure 2: CSEPP Evacuation Route





2.3 Goals and Objectives

In accordance with KYTC's policy on purpose and need statements, the following goals and objectives were developed to balance environmental and community issues with transportation issues.

- Provide solutions to meet the purpose of the project while avoiding / minimizing / mitigating impacts to human and natural environmental features.
- Provide improvement options that address identified needs.



3.0 EXISTING AND FUTURE CONDITIONS

A detailed inventory was completed that examined ongoing and identified transportation projects, existing roadway characteristics, existing and future traffic volumes, level of service (LOS), capacity, crash rates, and multimodal facilities. The following sections provide more detail about each topic.

3.1 Review of Ongoing and Identified Transportation Projects

Projects ongoing or currently identified either within or in the vicinity of the study area were identified for reference purposes. These include the KYTC Unscheduled Needs List (UNL) / Project Identification Form (PIF) projects summarized in **Table 1**.

Projects identified in the PIFs originated from previous data collection and analysis to specify problem areas. All projects that were listed on PIFs show the initial need for a study for this corridor. This study will build upon that need and look to provide improvements to address identified needs. The KYTC Six Year Highway Plan (FY 2014 – 2020) was also reviewed and there are multiple projects identified in Estill County along the study area corridor. All projects are SP funded (as defined in the Highway Plan “state construction “not” available”). They include the following:

- Item No. 10-8306.00: Spot Improvement on KY 89 / KY 82 from Irvine to Mountain Parkway (Construction cost = \$1,770,000)
- Item No. 10-8306.10: Spot Improvement on KY 89 to correct sight distance at Dry Ridge Road intersection (Construction cost = \$1,060,000)
- Item No. 10-8306.20: Spot Improvement on KY 89 to correct sight distance at entrance south of KY 794 intersection (Construction cost = \$600,000)

A programming study, **Power Plant Construction Transportation Impact Study for Clark-Estill-Powell Counties** was prepared by the KYTC Division of Planning in March 2006. The study evaluated system connectivity between the Mountain Parkway and the proposed power generating facilities at Trapp and Irvine and considered safety improvement by examining horizontal and vertical curvature deficiencies and bridge weight restrictions. Recommendations from that study that are relevant to this current study include several phases:

- KY 82 Phase I – Reconstruct KY 82 from MP 4.6 in Estill County to MP 2.1 in Powell County (Estimated cost = \$7.1 million)
- KY 82 Phase II – Reconstruct KY 82 from MP 0.0 in Estill County to MP 4.5 in Estill County (Estimated cost = \$13.3 million)
- KY 89 Phase IV – Reconstruct KY 89 from MP 17.9 in Estill County to MP 14.6 in Estill County (Estimated cost = \$21.6 million)

Table 1: Project Identification Forms

County	District	PIF#	Date	Route	Description	Begin Mile Point	End Mile Point	Section Length (miles)	Costs
Madison	7	07 076 D0052 98.00	8/14/2008	KY 52	Reconstruct KY 52 from Charlie Norris Rd to Estill Co Line	16.496	22.869	6.373	\$34,000,000
Estill	10	10 033 D0052 23.00	8/18/2008	KY 52	Improve LOS and Safety from MP 22.269 in Madison Co to KY 449 in Estill Co.	0.000	6.399	6.399	\$45,822,000
Estill	10	10 033 D0052 23.01	1/7/2011	KY 52	Stabilize slide and Repair Roadway	4.000	4.100	0.100	\$905,000
Estill (Powell)	10	10 033 D0082 20.00	8/26/2004	KY 82	Upgrade existing system	0.000	5.029 (1.084)	6.113	\$32,632,000
Estill	10	10 033 D0089 19.10	8/1/2008	KY 89	Improve LOS and Safety from Landfill Rd to Railroad Bridge	14.198	18.379	4.181	\$21,127,000
Powell	10	10 099 D0082 102.00	1/21/2005	KY 82	Poor geometrics, little shoulders, and 1.28 CCRF (Improve Safety)	1.536	1.856	0.320	N/A



3.2 Existing Roadway Characteristics

The KYTC's Highway Information System (HIS) database was used to compile the roadway characteristics of the existing routes within the corridor study area (KY 52 / KY 499 / KY 89 / KY 82). The highway characteristics summary is included in **Table 2**.

Table 2: Existing Routes Highway Characteristics Summary

Section	Route	Begin Mile Point	End Mile Point	Section Length (miles)	Functional Class	Facility Type	Lane Width (feet)	Shoulder Width (feet)	Median Type	Median Width (feet)	Posted Speed Limit (MPH)
1	US 25	16.20	16.28	0.08	Urban - Other Principal Arterial	4 Lane	12	3-11	Depressed	32	55
		KY 52	KY 52 SB Approach								
2	US 25	16.28	18.70	2.42	Urban - Other Principal Arterial						
		KY 52 SB Approach	KY 1986								
3	US 25	18.70	19.87	1.18	Urban - Other Principal Arterial						
		KY 1986	US 25X - KY2875								
4	KY 52	12.97	13.01	0.04	Rural - Minor Arterial						
		US 25	US 25 WB Approach								
5	KY 52	13.01	15.40	2.39	Rural - Minor Arterial						
		US 25 WB Approach	Moberly Road NO 2								
6	KY 52	15.40	17.76	2.36	Rural - Minor Arterial						
		Moberly Road NO 2	KY 374/Moberly Road EB Approach								
7	KY 52	17.76	17.82	0.06	Rural - Minor Arterial						
		KY 374/Moberly Road EB Approach	KY 374/Moberly Road WB Approach								
8	KY 52	17.82	19.77	1.95	Rural - Minor Arterial						
		KY 374/Moberly Road WB Approach	Baumstark Road/KY 977 EB Approach								
9	KY 52	19.77	19.81	0.04	Rural - Minor Arterial						
		Baumstark Road/KY 977 EB Approach	Baumstark Road/KY 977 WB Approach								
10	KY 52	19.81	20.98	1.17	Rural - Minor Arterial						
		Baumstark Road/KY 977 WB Approach	CR 1028 (Drowning Creek Rd) EB Approach								
11	KY 52	20.98	21.02	0.04	Rural - Minor Arterial						
		CR 1028 (Drowning Creek Rd) EB Approach	CR 1028 (Drowning Creek Rd) WB Approach								
12	KY 52	21.02	22.80	1.78	Rural - Minor Arterial						
		CR 1028 (Drowning Creek Rd) WB Approach	EB Approach County Line (MP 22.87)								
13	KY 52	22.80	0.01	0.08	Rural - Minor Arterial						
		EB Approach County Line (MP 22.87)	WB Approach County Line								
14	KY 52	0.01	3.69	3.68	Rural - Minor Arterial						
		WB Approach County Line	KY 594								



Table 2: Existing Routes Highway Characteristics Summary (cont.)

Section	Route	Begin Mile Point	End Mile Point	Section Length (miles)	Functional Class	Facility Type	Lane Width (feet)	Shoulder Width (feet)	Median Type	Median Width (feet)	Posted Speed Limit (MPH)
15	KY 52	3.69	5.76	2.07	Rural - Minor Arterial	2 Lane	12	0-10	none	0	55
		KY 594	KY 499 SB Approach								
16	KY 52	5.76	5.80	0.04	Rural - Minor Arterial						
		KY 499 SB Approach	KY 499								
17	KY 499	7.74	7.79	0.05	Rural - Major Collector						
		KY 52 Departure	KY 52 WB Approach								
18	KY 499	7.79	9.22	1.43	Rural - Major Collector						
		KY 52 WB Approach	KY 89/KY 499								
19	KY 89	12.81	13.07	0.26	Rural - Major Collector						
		KY 89/KY 499	KY 1705								
20	KY 89	13.07	14.10	1.03	Rural - Major Collector						
		KY 1705	Ent To Estill Co High School								
21	KY 89	14.10	17.90	3.80	Rural - Major Collector						
		Ent To Estill Co High School	KY 82								
22	KY 82	0.00	1.98	1.98	Rural - Major Collector						
		KY 89	Lilly Ferry Road								
23	KY 82	1.98	5.03	3.05	Rural - Major Collector						
		Lilly Ferry Road	Powell County Line								
24	KY 82	0.00	1.18	1.18	Rural - Major Collector						
		Estill County Line	Forge Mill Road								
25	KY 82	1.18	2.06	0.88	Rural - Major Collector	4 Lane	12				45
		Forge Mill Road	KY 15/Mountain Parkway Ramp								



To document existing geometric horizontal and vertical deficiencies along the existing routes, archived project plans were downloaded from the KYTC website, with any missing sections or newer plans requested directly from KYTC. This enabled a complete set of existing plan and profile sheets to be assembled for the entire route (KY 52, KY 499, KY 89, and KY 82). The **American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets (2011)** and the **KYTC Highway Design Manual** were consulted to identify locations along the existing route where either vertical curvature did not meet current sight distance criteria or horizontal curvature did not meet minimum radius criteria from the guidelines. This full set of plan and profile sheets with identified deficiencies is included in **Appendix B**. Also included on the sheets is an overlay of key environmental features such as streams, as well as crash data. This formed a very useful reference comparing locations with crashes and geometric deficiencies to determine if there was any overlap between the data.

Refer to the following table (**Table 3**) and figures (**Figures 3 and 4**) for a summary of vertical and horizontal curve deficiencies. Station and mile point information is not provided for the horizontal curve deficiencies as one point does not cover the curve. For exact locations of each deficiency refer to the figures and the plan and profile sheets in **Appendix B**. There are a total of 56 locations along the existing routes with locations that have geometric curves that do not meet current design standards. While the majority of the existing routes have a speed limit posted at 55 mph, a review of design criteria was also performed at a posted speed of 45 mph to provide a range of the deficiency. As shown in the following table, 24 (approximately 43%) of the locations would meet design criteria at 45 mph. The color coding on the table shows in green the locations that would meet at 45 mph with the rest shown in red that do not meet design criteria at either speed.

Table 3: Summary of Existing Vertical and Horizontal Geometric Deficiencies

Location #	Route	Station	Mile Point	Vertical Curve Stopping Sight Distance			Horizontal Curve Minimum Radius		
				Actual	45 MPH Criteria	55 MPH Criteria	Actual	Required (45mph)	Required (55mph)
A	KY 52	108+10	0.02	473	Meets	Does not meet	-	-	-
B	KY 52	428+85	19.11	301	Does not meet	Does not meet	-	-	-
C	KY 499	101+00	7.73	317	Does not meet	Does not meet	-	-	-
D	KY 499	177+00	9.19	212	Does not meet	Does not meet	-	-	-
1	KY 89	212+66	14.73	421	Meets	Does not meet	-	-	-
2	KY 89	215+16	14.78	292	Does not meet	Does not meet	-	-	-
3	KY 89	246+16	14.77	229	Does not meet	Does not meet	-	-	-
4	KY 89	252+66	15.49	279	Does not meet	Does not meet	-	-	-
5	KY 89	259+69	15.63	311	Does not meet	Does not meet	-	-	-
6	KY 89	267+76	15.78	324	Does not meet	Does not meet	-	-	-
7	KY 89	271+91	15.86	279	Does not meet	Does not meet	-	-	-
8	KY 89	277+66	15.98	236	Does not meet	Does not meet	-	-	-
9	KY 89	295+41	16.31	346	Does not meet	Does not meet	-	-	-
10	KY 89	-	-	-	-	-	888	Meets	Does not meet
11	KY 89	298+91	16.38	321	Does not meet	Does not meet	-	-	-
12	KY 89	305+06	16.50	330	Does not meet	Does not meet	-	-	-
13	KY 89	314+16	16.67	358	Does not meet	Does not meet	-	-	-
14	KY 89	331+66	17.00	300	Does not meet	Does not meet	-	-	-
15	KY 89	335+66	17.08	388	Meets	Does not meet	-	-	-
16	KY 89	340+16	17.16	278	Does not meet	Does not meet	-	-	-
17	KY 89	346+66	17.28	301	Does not meet	Does not meet	-	-	-
18	KY 89	356+66	17.47	445	Does not meet	Does not meet	-	-	-
19	KY 89	-	-	-	-	-	749	Meets	Does not meet
20	KY 89	365+43	17.64	486	Meets	Does not meet	-	-	-
21	KY 89	369+41	17.72	245	Does not meet	Does not meet	-	-	-
22	KY 82	-	-	-	-	-	528	Does not meet	Does not meet
23	KY 82	102+47	0.05	247	Does not meet	Does not meet	-	-	-
24	KY 82	118+46	0.35	443	Meets	Does not meet	-	-	-
25	KY 82	138+66	0.73	489	Meets	Does not meet	-	-	-
26	KY 82	147+86	0.90	492	Meets	Does not meet	-	-	-
27	KY 82	155+08	1.04	289	Does not meet	Does not meet	-	-	-
28	KY 82	-	-	-	-	-	837	Meets	Does not meet
29	KY 82	161+55	1.16	425	Meets	Does not meet	-	-	-
30	KY 82	165+55	1.24	401	Meets	Does not meet	-	-	-
31	KY 82	170+29	1.33	435	Meets	Does not meet	-	-	-
32	KY 82	178+68	1.48	325	Does not meet	Does not meet	-	-	-
33	KY 82	183+48	1.57	435	Meets	Does not meet	-	-	-
34	KY 82	-	-	-	-	-	844	Meets	Does not meet
35	KY 82	-	-	-	-	-	889	Meets	Does not meet
36	KY 82	211+19	2.09	423	Meets	Does not meet	-	-	-
37	KY 82	227+93	2.40	473	Meets	Does not meet	-	-	-
38	KY 82	259+11	2.97	458	Meets	Does not meet	-	-	-
39	KY 82	264+11	3.07	435	Meets	Does not meet	-	-	-
40	KY 82	274+10	3.26	445	Meets	Does not meet	-	-	-
41	KY 82	-	-	-	-	-	919	Meets	Does not meet
42	KY 82	369+16	0.06	256	Does not meet	Does not meet	-	-	-
43	KY 82	-	-	-	-	-	871	Meets	Does not meet
44	KY 82	380+05	0.27	291	Does not meet	Does not meet	-	-	-
45	KY 82	384+30	0.35	199	Does not meet	Does not meet	-	-	-
46	KY 82	-	-	-	-	-	360	Does not meet	Does not meet
47	KY 82	388+00	0.42	318	Does not meet	Does not meet	-	-	-
48	KY 82	401+00	0.66	351	Does not meet	Does not meet	-	-	-
49	KY 82	-	-	-	-	-	817	Meets	Does not meet
50	KY 82	454+00	1.66	256	Does not meet	Does not meet	-	-	-
51	KY 82	459+00	1.76	149	Does not meet	Does not meet	-	-	-
52	KY 82	464+00	1.85	233	Does not meet	Does not meet	-	-	-



Figure 3: KY 52 and KY 499 Existing Geometric Deficiencies

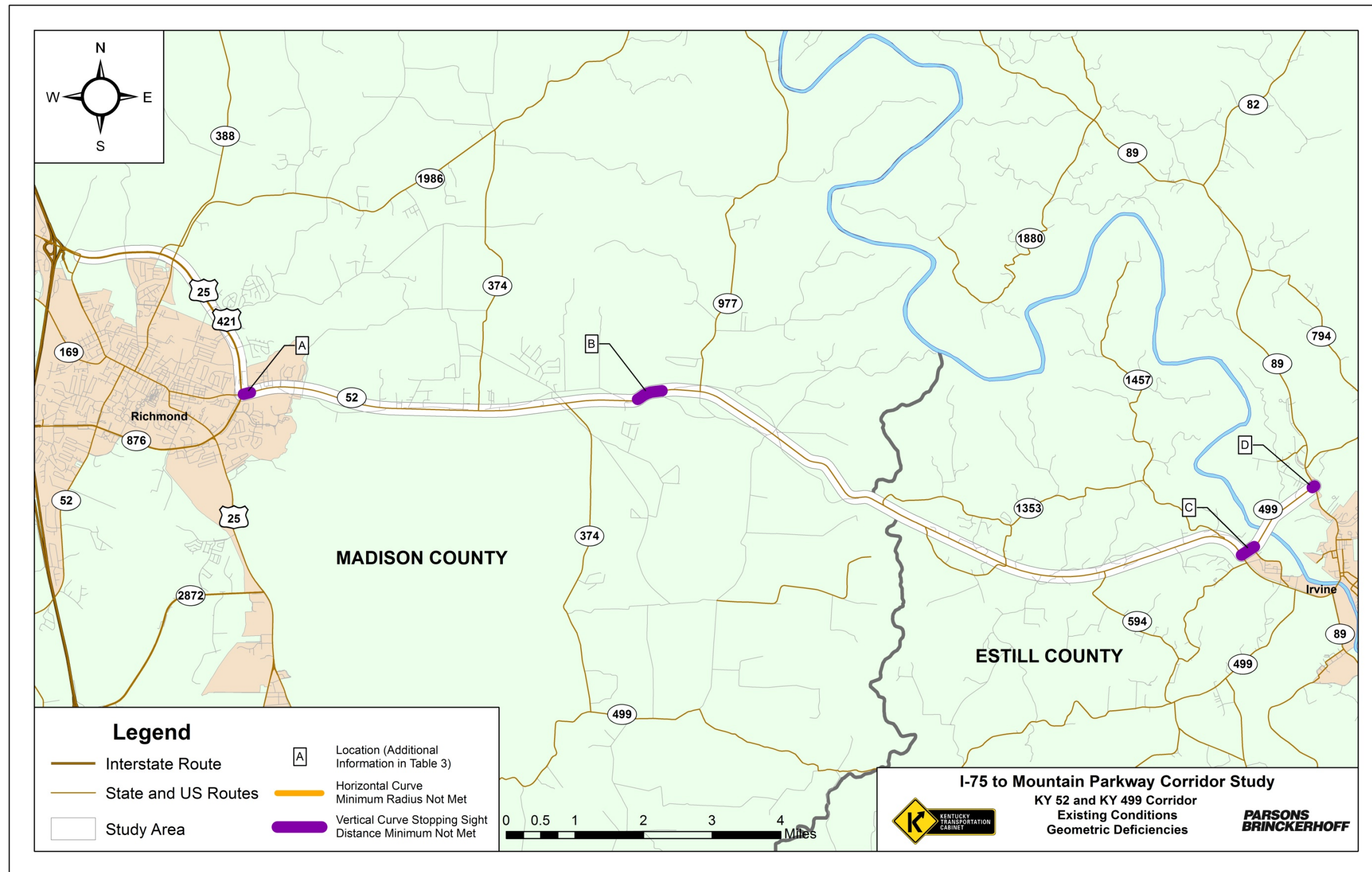
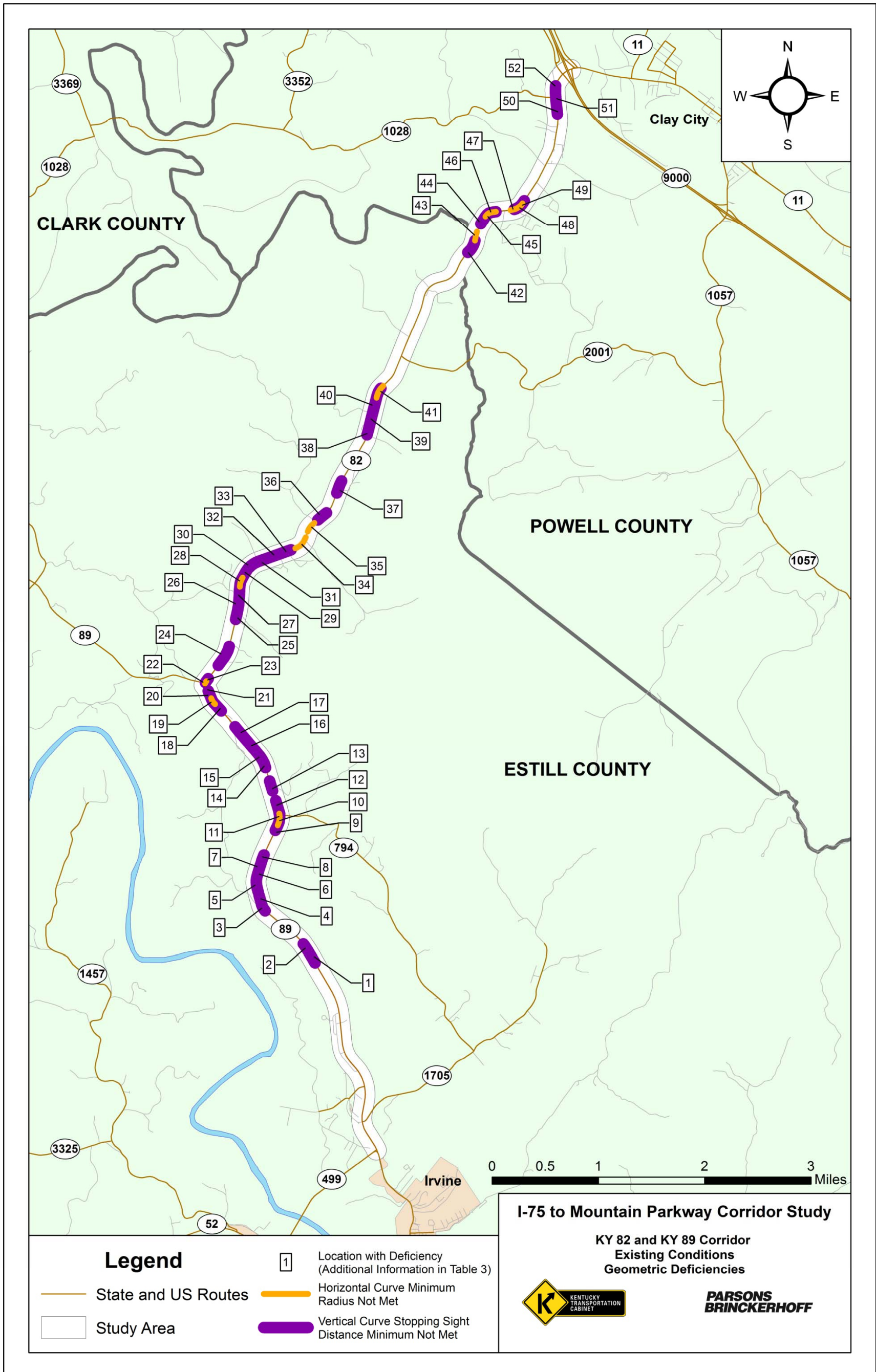


Figure 4: KY 89 and KY 82 Existing Geometric Deficiencies





3.3 2014 Traffic Volumes, Level of Service and Capacity

Traffic volumes along the I-75 to Mountain Parkway corridor were obtained using KYTC's traffic count system database (CTS). The corridor has a mixed cross-section with short four-lane sections in Madison County, which transitions to a two-lane section outside of the city limits, continuing for the rest of the existing study area routes. Traffic counts, along with roadway characteristics, were used to evaluate the capacity and level of service (LOS) along the corridor.

Two-Lane Highway Analysis

A corridor LOS analysis was prepared for the two-lane highways (refer to **Table 2** for a list of two-lane highways) using the HCS 2010 two-lane road analysis module. The analysis module is based on the *Highway Capacity Manual 2010* (HCM)¹. There are three classes of roadways used for this method: Class I highways, which include higher speed arterials and daily commuter routes, Class II highways, which include lower speed collector roadways and roads primarily designed to provide access, and Class III highways which serve moderately developed areas. Class III highways may be portions of Class I or II highways that pass through small towns or developed recreational areas. Driver expectations regarding speed and flow are important in determining a highway's class, and thus its desired LOS. **Table 4** displays the evaluation criteria for each class of highway. All routes for this study (KY 52 / KY 499 / KY 89 / KY 82) are considered to be Class I facilities.

Table 4: LOS Criteria for Two-Lane Highway

LOS	Class I Highways		Class II Highways	Class III Highways
	Percent Time Spent Following (%)	Average Travel Speed (mi/h)	Percent Time Spent Following (%)	Percent of Free Flow Speed (%)
A	≤ 35	>55	≤ 40	>91.7
B	>35 – 50	>50 – 55	>40 – 55	>83.3 – 91.7
C	>50 – 65	>45 – 50	>55 – 70	>75.0 – 83.3
D	>65 – 80	>40 – 45	>70 – 85	>66.7 – 75.0
E	>80	≤40	>85	≤66.7
F	LOS F applies whenever the flow rate exceeds the capacity			

Source: Highway Capacity Manual (2010)

Multilane Highway Analysis

Levels of service for multilane highway sections are based on density expressed in terms of passenger cars per mile per lane (pc/mi/ln) as shown in **Table 5**. Density is used to define level of service because it is an indicator of freedom to maneuver within the traffic stream and the proximity to other vehicles. Speed in terms of mean passenger-car speed and volume-to-capacity (v/c) ratios are interrelated with density and can be used to characterize a multilane highway segment. LOS D is the threshold for desirable traffic operations used in this study. For multilane highways, a LOS D corresponds to a density between 26 and 35 passenger cars per mile per lane.

Table 5: LOS Criteria for Multilane Highways

LOS	Density Range (pc/mi/ln)
A	0 - 11
B	> 11 - 18
C	> 18 - 26
D	> 26 - 35
E (55mph)	> 35 - 41
E (45mph)	> 35 - 45
F (55mph)	> 41
F (45mph)	> 45

Source: Highway Capacity Manual (2010)

Figures 5 and **6** on the following pages show the 2014 LOS and v/c ratios along the existing I-75 to Mountain Parkway corridor. **Table 6** provides this information by segment.

As shown in the table and on the maps, all segments are under capacity (a v/c ratio of 1.0 is considered capacity). The issue with traffic operations that results in a poor LOS for some sections (primarily segments of KY 52 near KY 499 and KY 82) is the lack of passing opportunities.

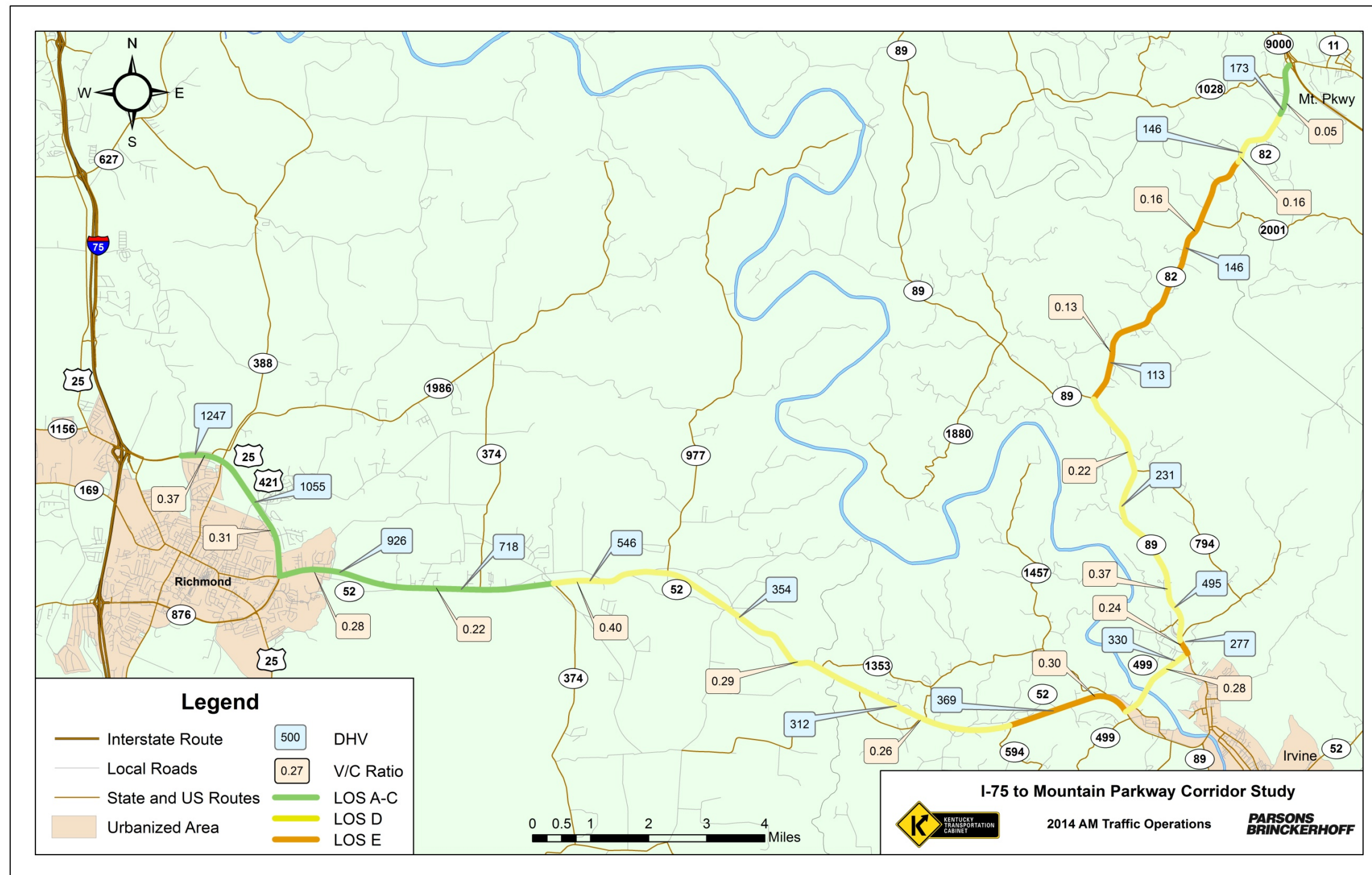
3.4 Future Traffic Volumes, Level of Service and Capacity

Historic traffic counts from the CTS database were used to determine growth rates along the existing corridor. Traffic growth along the existing routes ranged from 0.5% to 1.5% per year. The 0.5% rate was only utilized on the Richmond Bypass as most of the adjacent parcels are moderately developed. KY 89 and KY 82 were assigned growth rates of 1.0% and 1.5% respectively as more potential development opportunities exist along these routes. These growth rates were then applied to 2014 traffic volumes with a straight line growth to develop future year 2040 traffic volumes. The HCM and methodologies discussed in the previous section were used to calculate LOS and v/c ratios for the Future Year 2040. **Figures 7** and **8** show the AM and PM peak period LOS and v/c ratios expected with additional traffic along the corridor. **Table 6** also provides the segment breakdown for the traffic operations analysis for 2040.

¹ *Highway Capacity Manual 2010*, Transportation Research Board



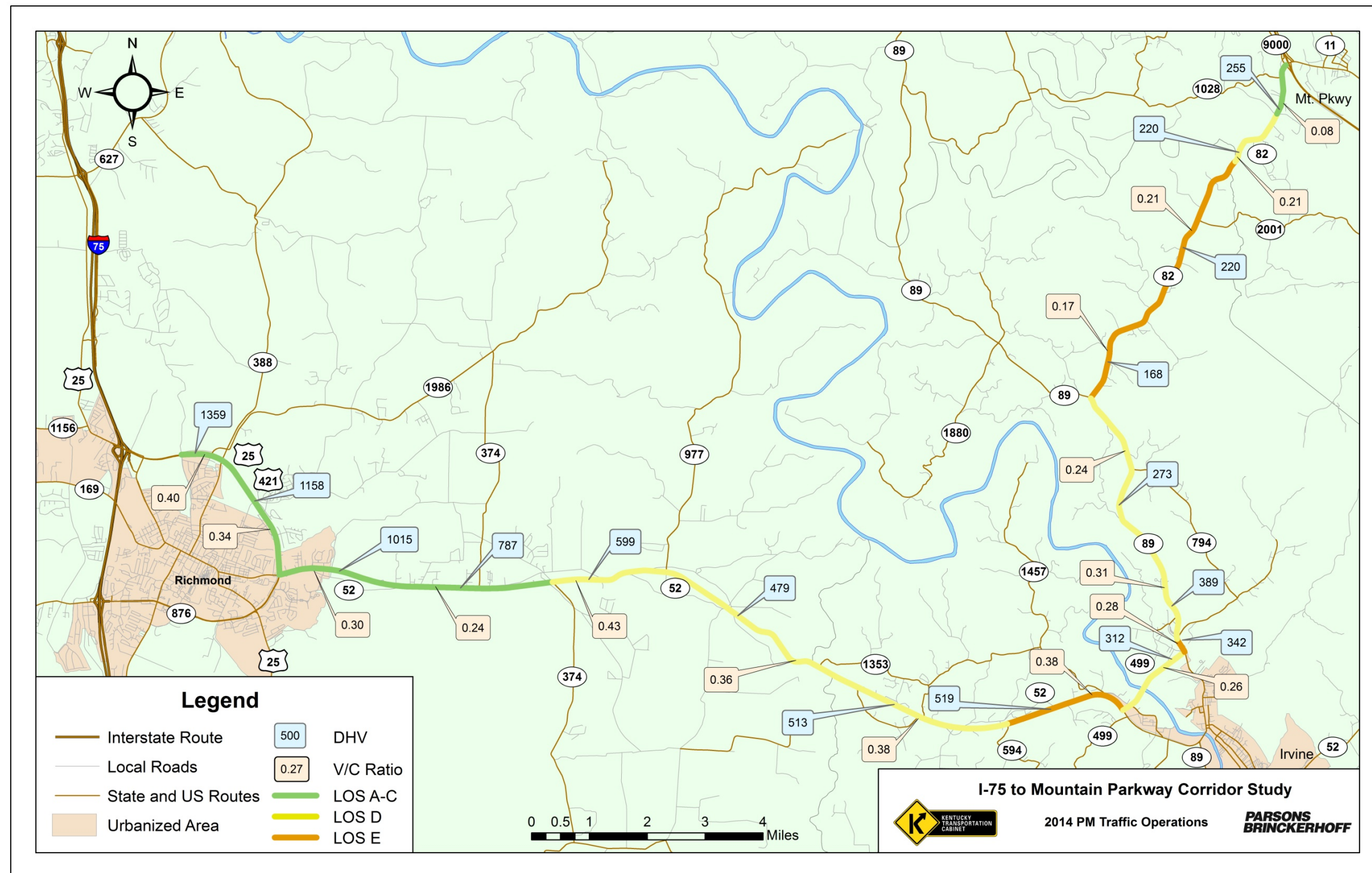
Figure 5: 2014 LOS and V/C Ratios in the AM Peak Period²



² Segment lengths are listed in Table 6



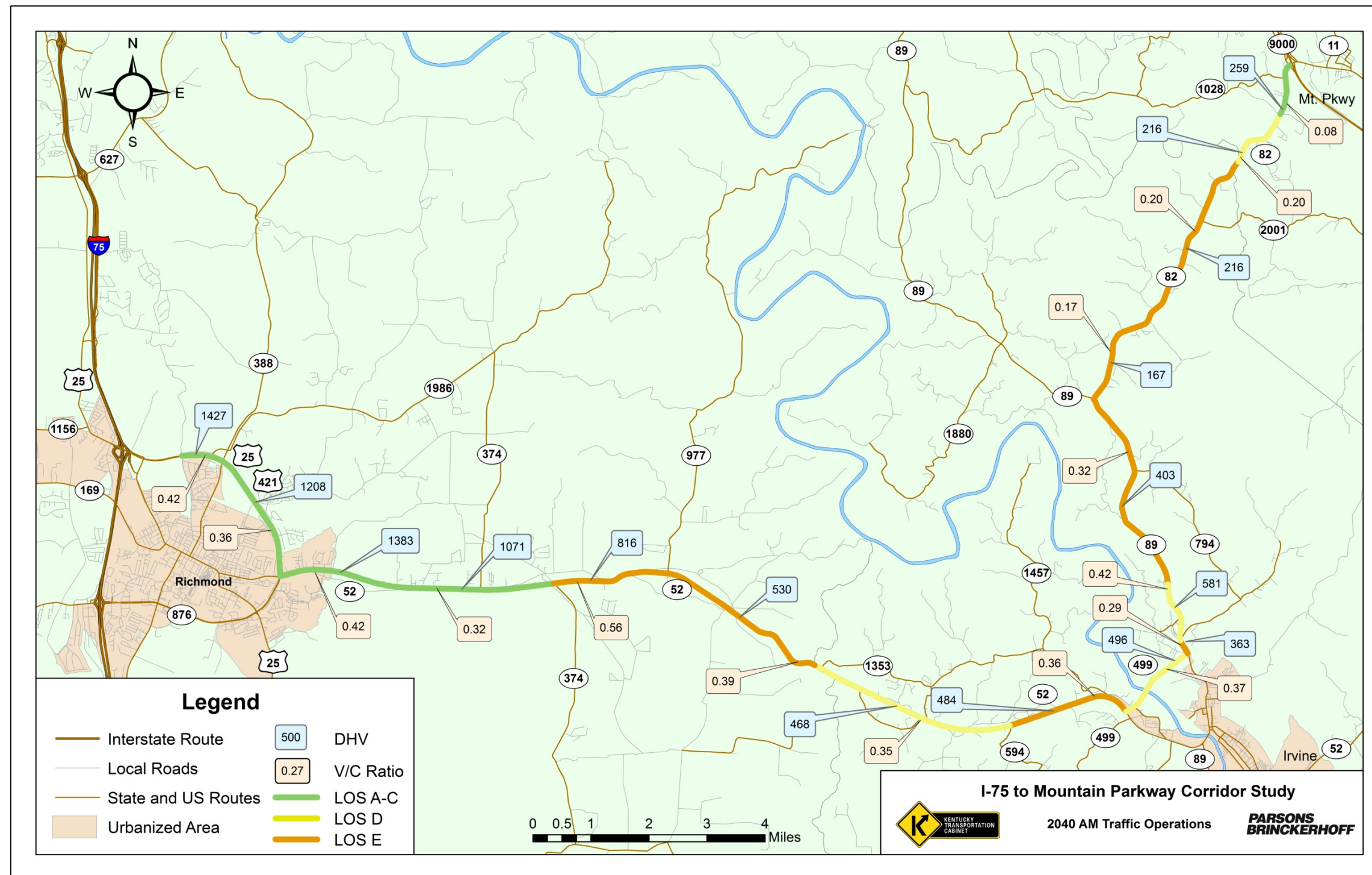
Figure 6: 2014 LOS and V/C Ratios in the PM Peak Period³



³ Segment lengths are listed in Table 6



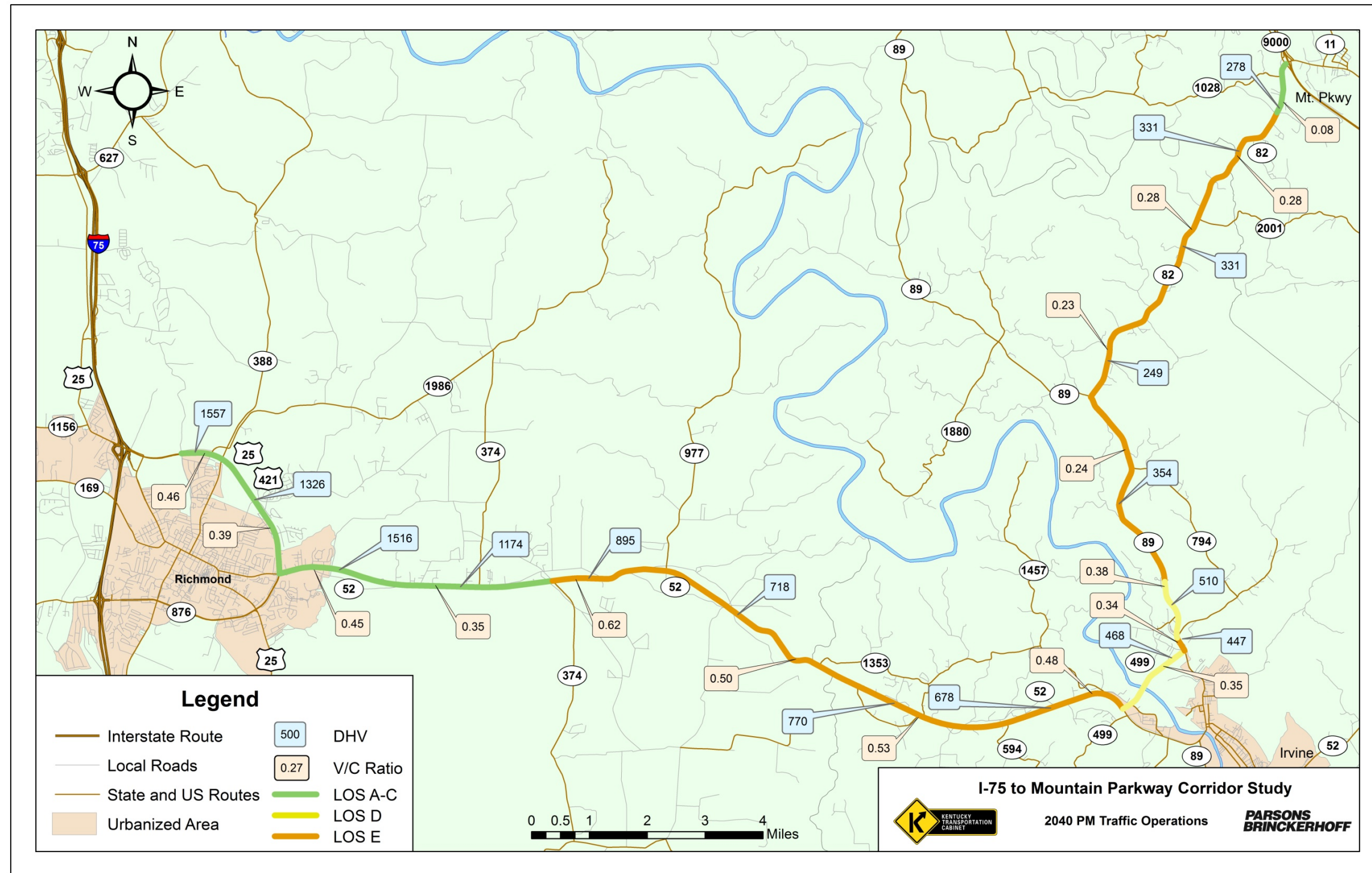
Figure 7: 2040 LOS and V/C Ratios in the AM Peak Period⁴



⁴ Segment lengths are listed in Table 6



Figure 8: 2040 LOS and V/C Ratios in the PM Peak Period⁵



⁵ Segment lengths are listed in Table 6



Table 6: 2014 and 2040 LOS and V/C Ratios by Segment

Route	Section	Begin Mile Point	End Mile Point	Truck %	2014 ADT	2014 AM V/C Ratio	2014 AM LOS	2014 PM V/C Ratio	2014 PM LOS	2040 ADT	2040 AM V/C Ratio	2040 AM LOS	2040 PM V/C Ratio	2040 PM LOS
US 25	1	16.20	18.70	8.1%*	20,300	0.31	A	0.34	B	23,200	0.36	B	0.39	B
		KY 52	KY 1986											
	2	18.70	19.87	8.1%*	21,900	0.37	B	0.40	B	25,100	0.42	B	0.46	B
		KY 1986	US 25X - KY2875											
KY 52	3	12.97	15.40	9.9%*	18,300	0.28	A	0.30	B	27,400	0.42	B	0.45	B
		US 25	Moberly Road NO 2											
	4	15.40	17.78	5.8%	14,200	0.22	A	0.24	A	21,200	0.32	B	0.35	B
		Moberly Road NO 2	KY 374/Moberly Road											
	5	17.78	19.78	9.9%*	10,800	0.40	D	0.43	D	16,100	0.56	E	0.62	E
		KY 374/Moberly Road	Baumstark Road/KY 977											
	6	19.78	22.87	9.9%*	8,700	0.29	D	0.36	D	13,000	0.39	E	0.5	E
Baumstark Road/KY 977		Estill County Line												
7	0.00	3.69	9.9%*	9,300	0.26	D	0.38	D	13,900	0.35	D	0.53	E	
	Madison County Line	KY 594												
8	3.69	5.80	4.3%	9,800	0.30	E	0.38	E	12,800	0.36	E	0.48	E	
	KY 594	KY 499												
KY 499	9	7.741	9.215	5.0%	5,700	0.28	D	0.26	D	8,500	0.37	D	0.35	D
		KY 52 Departure	KY 89											
KY 89	10	12.81	13.07	9.7%*	6,500	0.24	E	0.28	E	8,500	0.29	E	0.34	E
		KY 499	KY 1705											
	11	13.07	14.10	7.9%	5,700	0.37	D	0.31	D	7,500	0.42	D	0.38	D
12	14.10	17.90	9.7%*	4,600	0.22	D	0.24	D	6,000	0.32	E	0.24	E	
	Ent To Estill Co High School	KY 82												
KY 82	13	0.00	1.98	3.9%	3,000	0.13	E	0.17	E	4,500	0.17	E	0.23	E
		KY 89	Lilly Ferry Road											
	14	1.98	5.03	9.7%*	4,000	0.16	E	0.21	E	6,000	0.20	E	0.28	E
		Lilly Ferry Road	Powell County Line											
15	0.00	1.18	9.7%*	4,000	0.16	D	0.21	D	6,000	0.20	D	0.28	E	
	Estill County Line	Forge Mill Road												
16	1.18	2.06	9.7%*	4,900	0.05	A	0.08	A	7,300	0.08	A	0.08	A	
		Forge Mill Road	KY 15/Mountain Parkway Ramp											

Note: * denotes that Truck % was determined from the KYTC 2008 Traffic Forecasting Report as there was no recent count available at this location.



3.5 Crash Analysis

Crash data was obtained for this study from the Kentucky State Police Collision Analysis database for a three-year period from January 1, 2011 through December 31, 2013. All reported crashes were mapped along the corridor on the plan and profile sheets found in **Appendix B**. The crash record data set is included in **Appendix C** for reference. Along all study area routes (KY 52 / KY 499 / KY 89 / KY 82), 576 crashes occurred during the three year period.

The crash rate along the existing corridor routes was computed using the methodology provided in the crash analysis report periodically published by the Kentucky Transportation Center (KTC).⁶ The crash rate is based on the number of reported crashes along the segment of roadway, the average daily traffic on that segment, the time frame of the analysis, and the length of the section. It is expressed in terms of crashes per 100 million vehicle-miles and is compared to a statewide critical crash rate⁷ derived from critical crash rate tables for highway sections in the KTC crash report (Appendix D of KTC crash report). The comparison is expressed as a ratio of the segment crash rate to the critical crash rate and is referred to as the critical crash rate factor (CCRF). If the factor is greater than one, it may indicate crashes are occurring due to circumstances that cannot be attributed to random.

The section crash rate is also compared directly to the statewide average crash rate presented in the KTC crash report. The statewide averages consider all crashes for a specified period that are listed in the Kentucky State Police Collision Analysis database and stratified by functional classification (Table B-2 in KTC crash report). Section rates that exceed the statewide average crash rate but not the critical crash rate may be problem areas, but they are not statistically proven to be higher crash areas. Therefore, this second comparison is used to identify a second tier of highway sections that may have crash problems and could be considered for safety improvements if warranted based on further analysis.

The calculation of crash rates for the existing corridor roadways is shown in **Table 7**. In the initial analysis, evaluation sections were determined by roadway characteristics and traffic volumes (broken out when there was a logical split).

After mapping all of the crashes and reviewing the visual locations along the corridor, it was determined that additional spot segments should be added at locations where clusters of crashes appeared along the corridor. A spot is referred to as a location less than 0.3 miles in length. In total, nine additional spot locations were identified as candidates for a spot segment calculation (Denoted by * next to the section # in **Table 7**). After reprocessing the data, three of the nine spot locations were found to have a CCRF of greater than 1.0 (shown in **Table 7** and depicted in **Figure 10**).

⁶ Analysis of Traffic Crash Data in Kentucky (2008 – 2012), Kentucky Transportation Center Research Report KTC-13-13/KSP2-11-1F.

⁷ The critical crash rate is the threshold above which an analyst can be statistically certain (at a 99.5% confidence level) that the section crash rate exceeds the average crash rate for a similar roadway and is not mistakenly shown as higher than the average due to randomly occurring crashes.

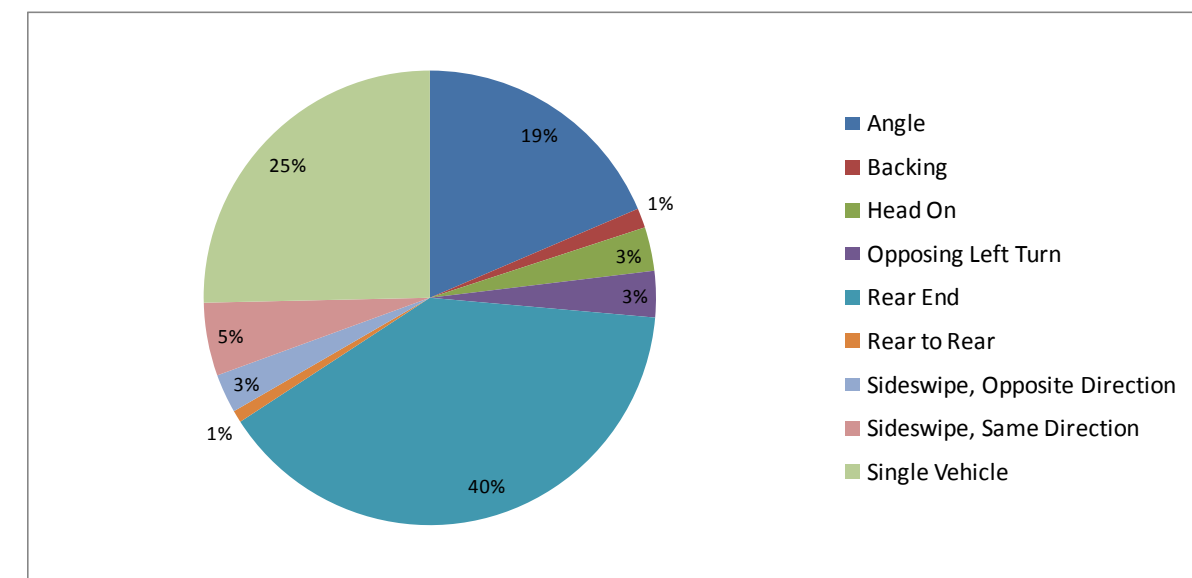
They include the following intersections:

- KY 52 / US 25 (Eastern Bypass) – CCRF = 1.70
- KY 52 / KY 977 – CCRF = 1.55
- KY 52 / Drowning Creek Road – CCRF = 1.00

As part of the data review, the manner of collision was reviewed for all reported crashes to determine if there is a similar pattern in crash type. **Figure 9** shows the various manners of collision for all crashes. The crash analysis shows that:

- Rear end crashes accounted for 40% of all crashes
- Single vehicle crashes accounted for 25% of all crashes

Figure 9: Manner of Collision



Further review of the crash data showed that 58% of all of the crashes occurred in clear weather. In addition, 71% occurred during the daylight hours.

A review of the severity of the collisions showed that out of the 576 crashes, 22% (125 crashes) resulted in an injury and 1% (10 crashes) resulted in a fatality. The rest of the collisions resulted in property damage only. As shown in **Figure 10**, ten fatal crashes occurred throughout the study area. At the LO/S meeting, it was noted by an attendee that several fatal crashes had occurred at the Drowning Creek Bridge (near the Madison / Estill County line). The three years of data compiled for this study noted two fatal collisions at this location – one a head-on collision and one an angle collision.



Table 7: Crash Rate Analysis

Route	Section	Begin Milepoint	End Milepoint	Total Crashes	Average Daily Traffic	Section / Spot Length (miles)	Exposure "M" (100 or 1 MVM)	Statewide Average Crash Rate	Section / Spot Crash Rate	Statewide Critical Crash Rate	Critical Crash Rate Factor
US 25	1*	16.20 KY 52	16.28 KY 52 SB Approach	27	20,300	0.08	1.215	410	22	1.3	0.93
	2	16.28 KY 52 SB Approach	18.70 KY 1986	135	20,300	2.42	0.537	410	251	344.1	0.73
		18.70 KY 1986	19.87 US 25X - KY2875								
KY 52	4*	12.97 US 25	13.01 US 25 EB Approach	32	18,300	0.04	1.597	182	20	0.9	1.70
	5	13.01 US 25 EB Approach	15.40 Moberly Road NO 2	31	18,300	2.39	0.479	182	65	238.8	0.27
		15.40 Moberly Road NO 2	17.76 KY 374/Moberly Road EB Approach								
	6	17.76 KY 374/Moberly Road EB Approach	17.82 KY 374/Moberly Road WB Approach	10	10,800	0.06	0.846	182	12	1.1	0.77
		17.82 KY 374/Moberly Road WB Approach	19.77 Brumstark Road/KY 977 EB Approach								
	8	19.77 Brumstark Road/KY 977 EB Approach	19.81 Brumstark Road/KY 977 WB Approach	17	8,700	0.04	1.784	182	10	1.2	1.55
		19.81 Brumstark Road/KY 977 WB Approach	20.98 CR 1028 (Drowning Creek Rd) EB Approach								
	10	20.98 CR 1028 (Drowning Creek Rd) EB Approach	21.02 CR 1028 (Drowning Creek Rd) WB Approach	11	8,700	0.03	1.155	182	10	1.2	1.00
		21.02 CR 1028 (Drowning Creek Rd) WB Approach	22.80 EB Approach County Line (MP 22.869)								
	12	22.80 EB Approach County Line (MP 22.869)	0.01 WB Approach County Line	7	9,300	0.07	0.687	182	10	1.1	0.61
		0.01 WB Approach County Line	3.69 KY 594								
	14	3.69 KY 594	5.76 KY 499 SB Approach	41	9,300	3.69	0.375	182	109	266.9	0.41
		5.76 KY 499 SB Approach	5.80 KY 499								
	15	5.80 KY 499		30	9,800	2.07	0.222	182	135	278.2	0.49
		5.76 KY 499 SB Approach	5.80 KY 499								
	16*	5.76 KY 499 SB Approach	5.80 KY 499	7	9,800	0.04	0.652	182	11	1.1	0.58
5.80 KY 499											

- Critical Crash Rate Factor >1, Section/Spot Crash Rate Exceeds Statewide Critical Rate (High Crash Rate Section/Spot)
- Critical Crash Rate Factor <1, Section/Spot Crash Rate Exceeds Statewide Average Rate
- Critical Crash Rate Factor <1, Section/Spot Crash Rate Lower Than Statewide Average Rate

Notes:
 Section * denotes that a spot rate analysis was used instead of a section analysis as the length is less than 0.30 mile
 Analysis Period: 3 Years (1/1/2011 to 12/31/2013)
 Crash rates are expressed in crashes per 100 MVM (100 million vehicle miles traveled) for sections; 1 MVM for spots

Section Exposure (M) = [(ADT) x (365) x (Time Frame of Analysis (Years)) x (Section Length)] / 100,000,000
 Section /Spot Crash Rate = Total Crashes / Exposure
 Spot Crash Rate = [(1,000,000) x (Total Crashes)] / [(365) x (Analysis Period in Years) x (ADT)]
 Critical Crash Rate Factor = Section or Spot Crash Rate / Statewide Critical Crash Rate



Table 7: Crash Rate Analysis (continued)

Route	Section	Begin Milepoint	End Milepoint	Total Crashes	Average Daily Traffic	Section / Spot Length (miles)	Exposure "M" (100 or 1 MVM)	Statewide Average Crash Rate	Section / Spot Crash Rate	Statewide Critical Crash Rate	Critical Crash Rate Factor
KY 499	17*	7.741 KY 52 Departure	7.789 KY 52 WB Approach	7	5,700	0.05	1.122	225	6	1.3	0.87
	18	7.79 KY 52 WB Approach	9.215 KY 89/KY 499	10	5,700	1.43	0.089	225	112	321.5	0.35
KY 89	19*	12.81 KY 89/KY 499	13.07 KY 1705	3	6,500	0.26	0.421	225	7	1.2	0.34
	20	13.07 KY 1705	14.10 Ent To Estill Co High School	6	5,700	1.03	0.064	225	93	336.5	0.28
	21	14.10 Ent To Estill Co High School	17.90 KY 82 (Hargett-Clay City Rd)	14	4,600	3.80	0.192	225	73	288.2	0.25
KY 82	22	0.00 KY 89	1.98 Lilly Ferry Road	9	3,000	1.98	0.065	225	138	334.0	0.41
	23	1.98 Lilly Ferry Road	5.03 Powell County Line	10	4,000	3.05	0.134	225	75	303.4	0.25
	24	0.00 Estill County Line	1.18 Forge Mill Road	9	4,000	1.18	0.052	225	174	353.1	0.49
	25	1.18 Forge Mill Road	2.06 KY 15/Mountain Parkway Ramp	13	4,900	0.88	0.047	225	277	335.4	0.83

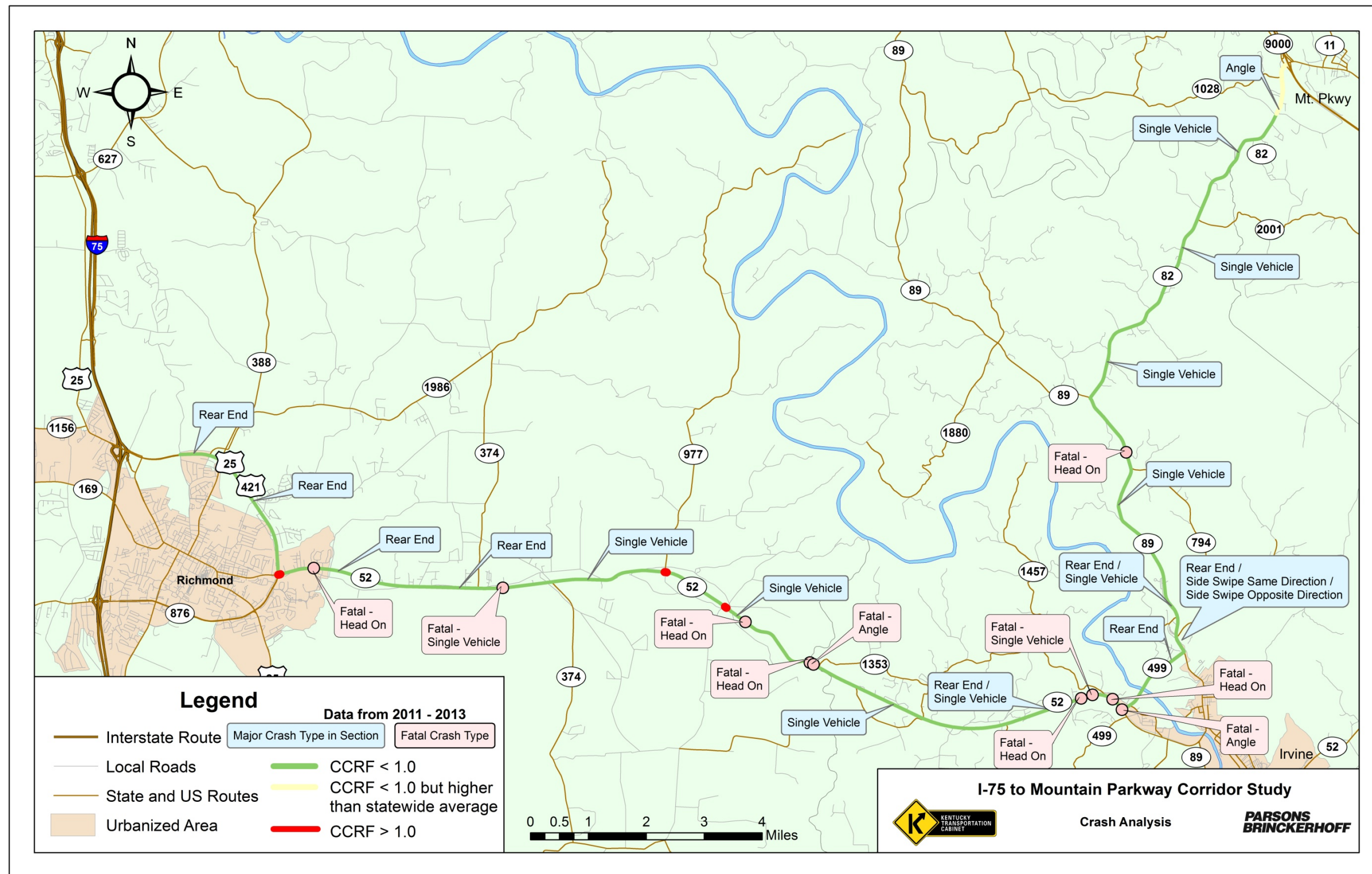
- Critical Crash Rate Factor >1, Section/Spot Crash Rate Exceeds Statewide Critical Rate (High Crash Rate Section/Spot)
- Critical Crash Rate Factor <1, Section/Spot Crash Rate Exceeds Statewide Average Rate
- Critical Crash Rate Factor <1, Section/Spot Crash Rate Lower Than Statewide Average Rate

Notes:
 Section * denotes that a spot rate analysis was used instead of a section analysis as the length is less than 0.30 mile
 Analysis Period: 3 Years (1/1/2011 to 12/31/2013)
 Crash rates are expressed in crashes per 100 MVM (100 million vehicle miles traveled) for sections; 1 MVM for spots

Section Exposure (M) = [(ADT) x (365) x (Time Frame of Analysis (Years)) x (Section Length)] / 100,000,000
 Section / Spot Crash Rate = Total Crashes / Exposure
 Spot Crash Rate = [(1,000,000) x (Total Crashes)] / [(365) x (Analysis Period in Years) x (ADT)]
 Critical Crash Rate Factor = Section or Spot Crash Rate / Statewide Critical Crash Rate



Figure 10: Existing Corridor Crash Analysis





3.6 Multimodal Facilities

Pedestrian Facilities

The existing corridor is classified throughout as a rural roadway and does not have pedestrian facilities. There are some pedestrian accommodations at intersections such as crosswalks and pedestrian activated signals. One location to note is at the KY 52 / KY 977 intersection. During a field review, pedestrian signals were identified at the intersection; however, no crosswalks or Americans with Disabilities Act (ADA) accessible provisions were made for utilizing these signals to cross KY 52.

Bicycle Facilities

An investigation was undertaken to identify any existing bike routes or trails in the overall study area or along the existing corridor. This was completed by researching cycling clubs and speaking with local cyclists within the area. The closest cycling shop to the existing corridor is located in downtown Richmond and is two miles from the intersection of US 25 and KY 52. In addition to the Richmond bike shop (Mike's Hike and Bike) information was also provided by the BGADD and Clark Ambition organizations.

The research found that there are no official routes which traverse the existing corridor, but the Bluegrass Bike Tour, documented on KYTC's Bikewalk website, crosses the existing corridor at the KY 374 intersection in Madison County. The Bluegrass Bike Tour is a north / south route that continues through Winchester and ultimately ends in Maysville, KY. Further, cycling is also documented (via the internet through a popular route mapping website – *mapmyride.com*) by individually logged routes along KY 89 and KY 82 in Estill and Powell Counties. Additionally, KY 974 and KY 1028 were identified in multiple maps. All rides observed that utilized the previously mentioned routes had lengths greater than 25 miles, which suggests that there are a limited number of participants who actually utilize this route.

Throughout the rest of the study area, there are additional routes identified in Clark County including those utilized in the 2014 Preservation Pedal in Winchester in June. This event featured a 100, 50 and two 25 mile routes as options for participants. The 100 and one of the 25 mile routes utilized KY 974 and KY 1923 for this event. These may overlap with the development of any new routes in the northern portion of the study area.

Transit Facilities

There are no designated fixed-route transit facilities (bus or rail) located along the existing corridor or within the study area. The cities of Winchester and Richmond do provide bus transit services; however these are located outside of the study area and do not affect operations within the study area.

Railroad Facilities

CSX Transportation maintains a rail line running generally north / south through the eastern portion of the study area through Irvine. There is a second line that runs north / south as well in the western portion of the study area, intersecting with the Eastern Bypass (US 25) and paralleling KY 388. Both are active lines, and potential crossings will need to be considered as part of the

alternative development process for any new routes through the study area. Refer to the study area map (**Figure 1**) at the beginning of this report for a graphical view of the locations.



4.0 ENVIRONMENTAL OVERVIEW

An environmental overview was performed with respect to the following:

- Cultural Historic Overview
- Archaeological Resources
- Environmental Characteristics
- Environmental Justice Overview

The following sections provide more detail about each subject.

4.1 Cultural Historical Overview

The Cultural Historic Overview, located in **Appendix D**, includes a records review for the overall study area as well as a more detailed windshield field survey for the existing corridor. The boundaries of the existing corridor were assumed to be one mile total (1/2 mile on each side of the existing routes centerline). Any properties either listed on the National Register of Historic Places (NRHP) or determined to be potentially eligible within this band were included in the list. Within the entire study corridor the following is a breakdown of the number of NRHP listed resources by county:

- Clark County (6)
- Madison County (15)
- Estill County (2)
- Powell County (0)

Other locations to note include the Boonesborough Townsite Historic District (5 contributing elements). The Boonesborough Fort Site is a National Historic Landmark, and while the fort is no longer extant, the site remains and is part of the Fort Boonesborough State Park. In addition to these, remnants of Boone Trace are evident in Madison County, generally running north-south in the western portion of the study area. Boone Trace is a historic road forged by Daniel Boone in 1775. While not listed in the NRHP, the Friends of Boone Trace have plans to nominate the entire Kentucky portion of the road and preserve it as a heritage walking trail.

Throughout the entire study area, 20 additional locations are determined eligible or recommended for listing in the NRHP.

Along the existing corridor, the following is a list of NRHP listed resources:

- Griggs House (KY 977, north of Waco)
- Moberly House (0.3 miles north of Old KY 52, north of Moberly)
- Chenault House / Burnam House (north of Lexington Road, east of I-75)
- Cornelison Pottery / Bybee Pottery (KY 52 east)

There are also 13 potentially significant and / or eligible properties within the existing corridor including the Bluegrass Army Depot as well as multiple properties that comprise a potential historic district for downtown Waco.

There are also 41 additional properties or resources along the corridor that were previously surveyed, but determined to not be eligible.

Tables and a corresponding reference map that illustrates relative locations of all of these resources (individual properties, districts, and Boone Trace) are included in **Appendix D**.

4.2 Archaeological Resources

Similar to the Cultural Historic Overview, a records review was performed for the overall study area with additional focus on the existing corridor which included a windshield field survey. The records review found that 16 archaeological sites listed on the NRHP are within the overall study area. All 16 are located within either Madison or Clark Counties. One of the sites is the Boonesborough Fort, and the remaining sites are all associated with the Fort Boonesborough Townsite Historic District.

Information compiled from the Office of State Archaeology (OSA) provided an additional 47 significant or potentially significant archaeological sites within the overall study area, and 8 sites located within the existing corridor. These include a broad range of site types and dates including prehistoric stone mounds, earth mounds, mound complexes, non-mound earthworks, and open habitations without mounds. Historic site types represented include cemeteries, farm / residences, and military sites. Most of the sites within the existing corridor are historic cemeteries (6), one is a historic farm and / or residence, and the remaining one is a prehistoric open habitation site.



4.3 Environmental Characteristics

An environmental constraints map was developed for this study to document major environmental features such as potential Underground Storage Tanks (UST) / Hazmat sites, streams, wetlands, and floodplains. This map is included as **Figure 11**. As shown on the map, the Kentucky River is a major feature that generally cuts through the middle of the study area. Other features to note are a high concentration of UST / Hazmat sites found along the existing corridor. Other features are scattered throughout the overall study area.

A list of threatened and endangered species was compiled for the four counties that comprise the study area and is included as **Appendix E**. There are nine federally listed endangered or proposed endangered species which include:

- Virginia Big-eared Bat
- Gray Myotis
- Indiana Bat
- Northern Long-eared Bat
- Snuffbox
- Fanshell
- Running Buffalo Clover
- Short's Bladderpod
- White-haired Goldenrod

In addition, there are 58 species that are listed as either endangered, threatened or of some special concern by the state.

4.4 Environmental Justice

An Environmental Justice (EJ) Review was prepared by the Bluegrass Area Development District (BGADD) for the study area, and examined the potential disproportionate adverse community impacts on selected groups (minority, low-income, elderly and disabled). Year 2012 census data from the area was examined at the census tract and census block group levels. There are fourteen census tracts that make up and surround the study area. The analysis found that nine of the fourteen census tracks have elevated percentages of target populations. **Table 8** summarizes the findings of the EJ Review. The entire report can be found in **Appendix F**. During further project development stages, more in-depth EJ analysis will need to be undertaken in conjunction with right-of-way acquisition.

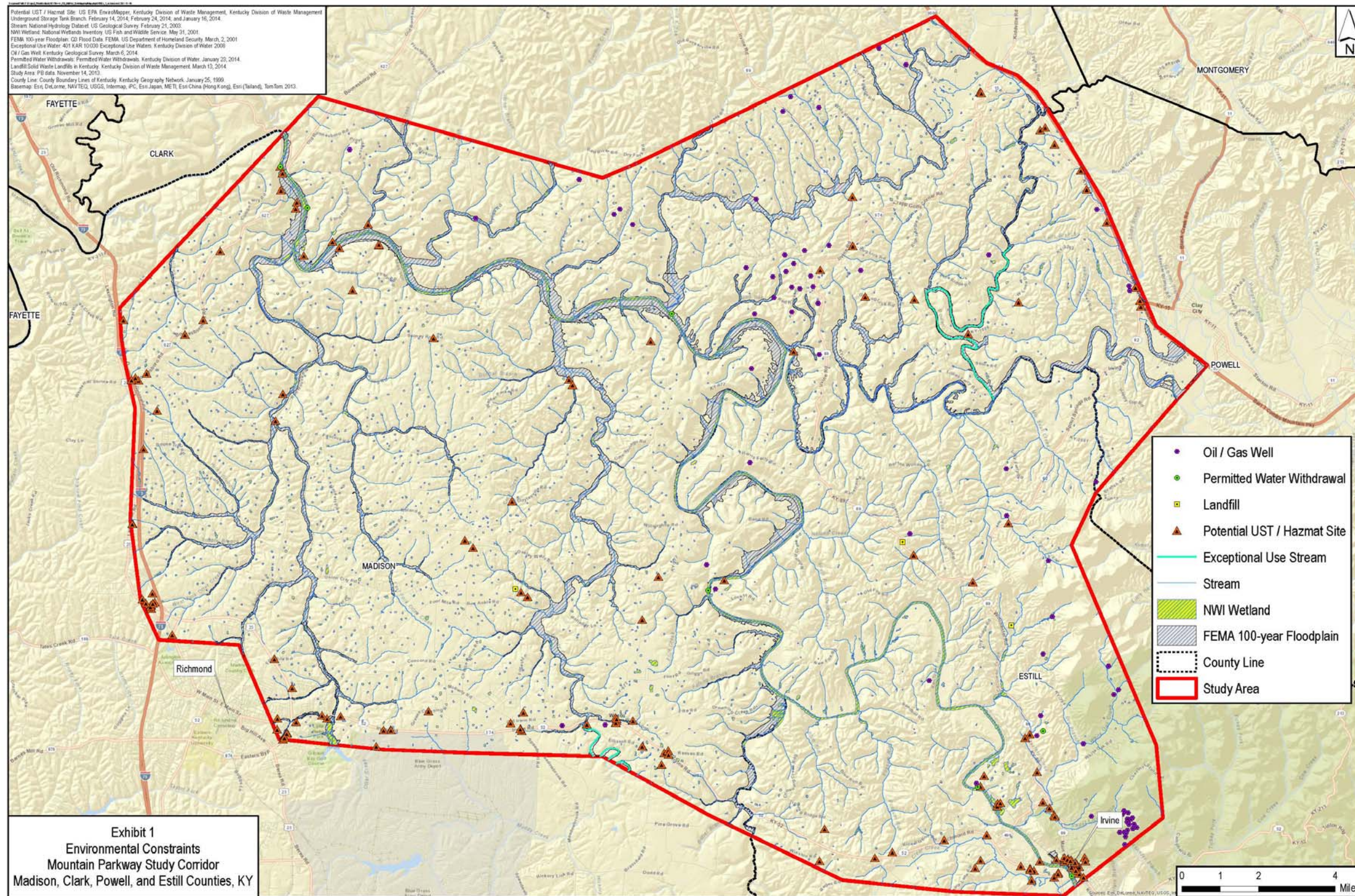
Table 8: Environmental Justice Summary

	Minority %	Persons Below Poverty Level %	Persons 60 and Over %	Disability
United States	36.6%	14.9%	18.6%	10.1%
Kentucky	13.7%	18.6%	19.2%	15.4%
BGADD	13.0%	17.9%	17.7%	13.0%
CT 102	13.1-16.1%	>22.3%	< 17.6%	13.1-16.1%
CT 103	> 16.2%	>22.3%	< 17.6%	>16.2%
CT 107.01	> 16.2%	>22.3%	< 17.6%	< 12.9%
CT 204	< 12.9%	< 17.8%	>22.1%	>16.2%
CT 205	< 12.9%	< 17.8%	>22.1%	< 12.9%
CT 9202	< 12.9%	>22.3%	>22.1%	>16.2%
CT 9203	< 12.9%	>22.3%	< 17.6%	>16.2%
CT 9204	< 12.9%	>22.3%	17.8-22%	>16.2%
CT 9702	< 12.9%	>22.3%	< 17.6%	>16.2%

	Below Reference Threshold
	Just Above Threshold
	Significantly Above Threshold



Figure 11: Environmental Constraints Map





5.0 LOCAL OFFICIALS / STAKEHOLDERS AND PROJECT DEVELOPMENT TEAM MEETINGS

5.1 Local Officials and Stakeholders Meeting

A meeting was held with local elected officials and other stakeholders (LO/S) from Madison, Clark, Estill, and Powell Counties on September 23, 2014. Invited attendees included local elected officials (county Judge-Executives), road supervisors, fire chiefs, sheriffs, members of the local chamber of commerce, and multiple local development entities. A total of 32 people attended this meeting. This meeting was held to obtain feedback on improvement options and to prioritize projects to move forward in the planning process. A summary of the meeting is given below, and the meeting minutes are provided in **Appendix G**.

The presentation to the attendees included an overview of the study, the purpose and need, existing conditions information, and study alternatives. The alternatives were broken into three different categories – spot, corridor, and new routes. All attendees were asked to fill out a survey form to collect comments about the study and provide rankings of each type of improvement. The information from these surveys (and other feedback during the meeting) is incorporated in the evaluation of alternatives and prioritization.

The issues which most concerned the respondents from the survey included:

1. Safety
2. Congestion / Heavy Traffic (tied with #3)
3. Travel Time / Long Waits (tied with #2)
4. Business Impacts
5. Impacts to the Environment

Other responses related to improvement alternatives preferences and rankings are presented later in this report in conjunction with the analysis of the improvement options.

5.2 Project Development Team (PDT) Meetings

Three meetings were also held with the KYTC, the BGADD and Parsons Brinckerhoff to discuss study issues, including the LO/S meeting (preparation and results), issues and goals, development and evaluation of improvements, and recommendations. The meeting minutes for all PDT meetings are included in **Appendix H**.

PDT Meeting #1 – May 1, 2014: The purpose of the meeting was to provide an overview of the existing conditions and facilitate a discussion of initial alternatives (improve the existing route, a short connection between KY 82 and KY 52, and a new route alternative). The discussion also included appropriate typical sections for the existing corridor and new routes. It was determined that two 12-foot lanes with 10-foot shoulders is the desired typical section for both alternatives.

PDT Meeting #2 – July 17, 2014: The purpose of this meeting was to review the list of proposed alternatives which were separated into three different types of projects. The first group included spot improvements. A total of eight spot improvements were identified along the corridor and each addressed deficiencies along the existing route. Next, were three corridor improvements which would create a consistent typical section throughout the existing routes. The final type was the new route alternatives, two of which were completely new green field projects and one was a shorter connector between KY 82 and KY 52. Following the discussion about the alternatives, the PDT discussed the best way to present this information to the local officials and stakeholders at the September 23, 2014 meeting.

PDT Meeting #3 – September 23, 2014: The purpose of this meeting was to review and discuss the comments received and results from the prioritization process during the LO/S meeting. In this meeting, the summary of the surveys was discussed and KYTC expressed the expectation for the study to consider all of the technical and LO/S input, providing an overall study recommendation.



6.0 PROJECT DEVELOPMENT

6.1 Project Development Methodology

A detailed, multi-step process was used to develop and evaluate potential improvement projects. The process included the technical analysis derived from the existing conditions overview, field reviews, and input from the PDT.

Improvement projects were developed in three categories:

1. Spot Improvement – projects at specific locations along the existing route;
2. Corridor Improvement – improvements to provide a consistent typical section along the existing route; and
3. New Route – new roadway connections.

Information about each of the project development components is provided in more detail in the following sections.

6.1.1 Technical Analysis

All data compiled as part of the existing conditions and environmental overviews was used to identify locations for improvement that had one or more issues. The plan and profile sheets developed for the existing corridor routes provided a quick overview and location of geometric deficiencies and crashes. It was determined that the main areas of concern on KY 52 were spot (intersection) locations that had numerous crashes clustered around the intersections. There were few geometric deficiencies along KY 52. The opposite was true for KY 89 and KY 82. There were few crash clusters along these routes but numerous vertical and horizontal curve deficiencies. Based on this, projects developed were focused on spot improvement projects along KY 52 and corridor improvement projects along KY 89 and KY 82. With the number of vertical and horizontal deficiencies along KY 89 and KY 82, each one could be considered an improvement project. However, for practical constructability, it makes more sense to complete improvements to the whole corridor with potential phasing of grouped deficiencies. There were only two locations along KY 89 and KY 82 that stood out as individual spot projects – the KY 89 / KY 82 intersection and one deficient horizontal curve on KY 82. This particular curve was not close to meeting current design guidelines whereas all others on KY 82 could be improved to meet the design criteria through the corridor improvement project.

6.1.2 Field Reviews

To further develop improvements for the existing corridor (KY 52 / KY 499 / KY 89 / KY 82) as identified through the technical analysis, a field review was performed. Locations with numerous crashes and locations with geometric deficiencies were reviewed to document any issues that might contribute to the identified problems at these locations. Measurements of the typical section

(lane widths / shoulder widths) were taken at several spots throughout the corridor to confirm data obtained from the HIS database. All pertinent notes and pictures were included in the development of each potential project as displayed later in this report. Subsequent field reviews were conducted for additional locations throughout the existing corridor to review / confirm existing features such as verification of structures along the corridor and other typical section elements.

6.1.3 PDT Involvement

At the beginning of the study at the scoping meeting, it was discussed that this study should consider improvement options along the existing routes that connect I-75 to the Mountain Parkway (with the exception of US 25), as well as possible new routes. Several broad options for new routes were discussed including a new route that would connect I-75 directly to the Mountain Parkway, as well as a smaller route that would connect KY 52 near KY 977 and terminate at the KY 89 / KY 82 intersection (effectively bypassing KY 499 and KY 89). Further discussion led to the inclusion of Clark County into the study area and the potential consideration of a northern route that would utilize the existing bridge over the Kentucky River near Fort Boonesborough.

6.2 Project Overviews

Project sheets were developed to consolidate and present concise information about each project developed within the three project categories. Each sheet contains all pertinent information about the project including background information, any identified deficiencies, notes from the field review, improvement options, along with a preliminary cost estimate.

Each project along the existing corridor is labeled according to route and assigned a letter beginning with A (generally assigned going west to east or south to north).

New routes were assigned a number only (1, 2, and 3). As this study is for planning purposes and project feasibility, a specific alignment was not determined for any of the new routes. Rather, a corridor is provided that is one mile in width to illustrate relative alternative location(s) while allowing for flexibility in future project development. There are only three new routes developed for consideration. These were determined based on the following:

- Logical Termini / Connectivity – Connecting to an existing interchange along I-75 or the Mountain Parkway serves more users as well as reduces costs as opposed to proposing a new interchange. The existing tie-in locations along I-75 became the White Hall exit (Exit 95) along I-75 and either the new Kiddville interchange or the interchange at Clay City (Exit 16) along the Mountain Parkway. If portions of the existing corridor are used (KY 52 and KY 82), another logical termini for a new route would be to construct a connection from KY 52 (near KY 977) to KY 82 (at KY 89) which would reduce the length of the existing corridor.



- **Cost Consideration** – To reduce the overall cost of a new corridor, consideration was given to utilizing the existing bridge over the Kentucky River at Fort Boonesborough. This led to a northern option that would utilize the new interchange at Kiddville on the Mountain Parkway and tie into KY 627 (utilizing a portion of KY 627 to connect to I-75).
- **Environmental Features** – The Environmental Overview conducted for this study identified major features throughout the study area. One area of particular note is a high concentration of archaeological sites located near the middle of the study area north of the Kentucky River in Clark County. To avoid this area, a new route would either need to go north or south of this area. A northern route already was developed to utilize the existing bridge crossing at Fort Boonesborough; therefore a middle route was developed that connects from White Hall (Exit 95) on I-75 to Clay City (Exit 16).

Figures 12 and 13 provide an overview of improvement project locations along the existing corridor. **Figure 14** provides a graphical view of the new route options. Individual project sheets follow these figures that provide details on each project. The following chapter includes more detailed information on the analysis of the improvement options and evaluation components.

6.3 Typical Sections

The proposed new typical section is shown on the project sheets for the corridor improvement projects along KY 52, KY 89, and KY 82. During the first PDT meeting, typical sections for the existing routes were discussed. The overall desire of the PDT would be to provide a consistent typical section along the existing corridor routes that is complementary of the improved existing sections of KY 52 and KY 89 (near the Estill County High School). This includes 12-foot travel lanes and 10-foot shoulders (8-foot paved; 2-foot gravel). Additional discussion was given to the consideration of reducing the shoulder width for cost savings to 8-foot (6-foot paved; 2-foot gravel). This reduction of cost is included in the project sheets for reference. However, for consistency purposes with the existing improved sections of KY 52 and KY 89, as well as the desire to provide a wide shoulder for emergency management (providing adequate width to move a car to the shoulder out of the travel way), the wider typical section was selected.

A similar typical section for the new routes as was proposed for the existing corridor was determined to be appropriate. Based on preliminary projected traffic volume information for each route, a four-lane typical section would not be warranted now or in the future year of 2040. For cost development purposes, the new routes did not include the construction of interchanges along the route. If any of these alternatives are advanced to the next phase of project development, further consideration may be given to modifications to the typical section and access management. Other considerations may include any shoulder improvements for bicyclists or a separate multimodal shared use path.



Figure 12: KY 52 and KY 499 Corridor Improvement Projects

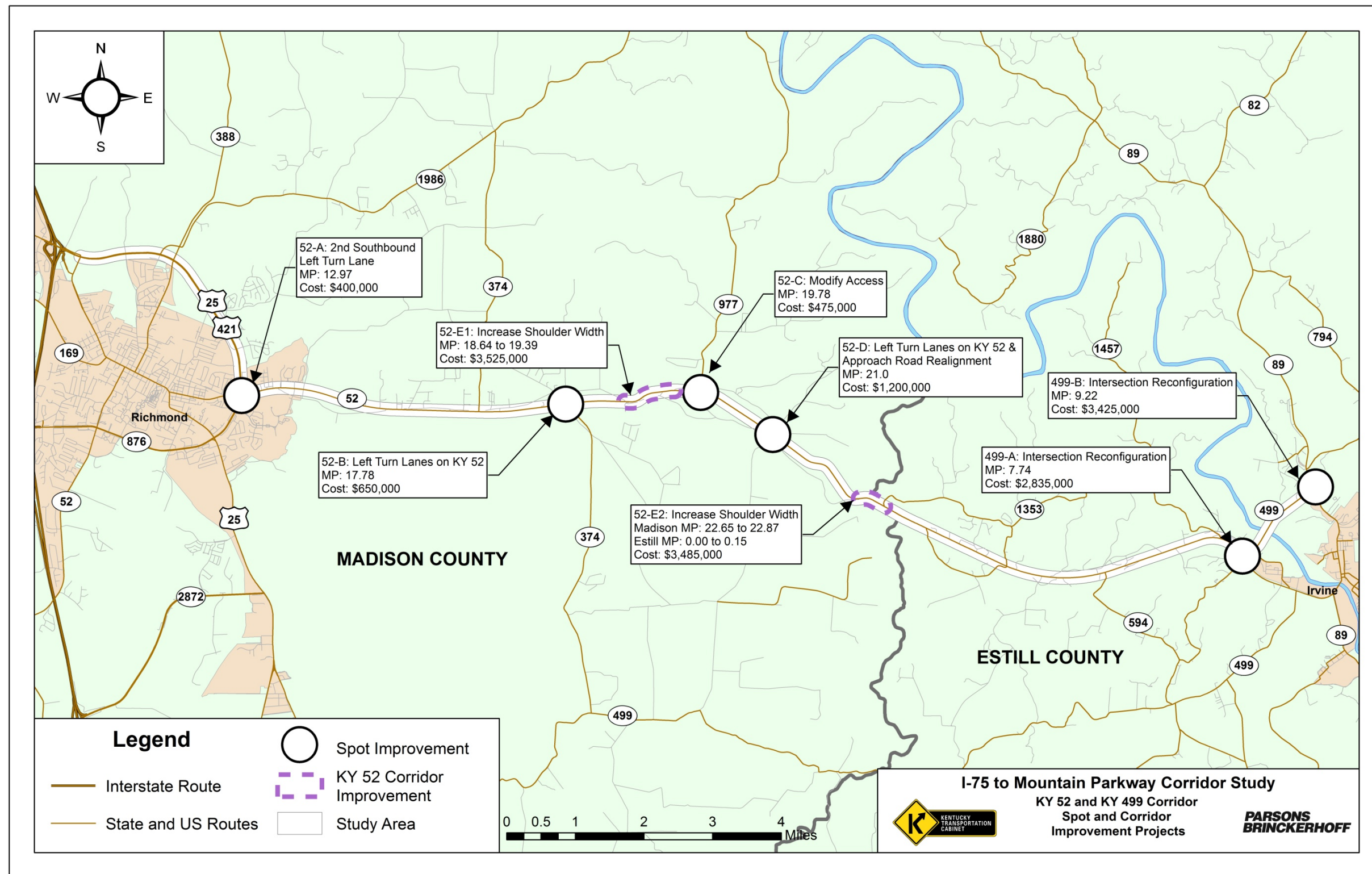




Figure 13: KY 89 and KY 82 Corridor Improvement Projects

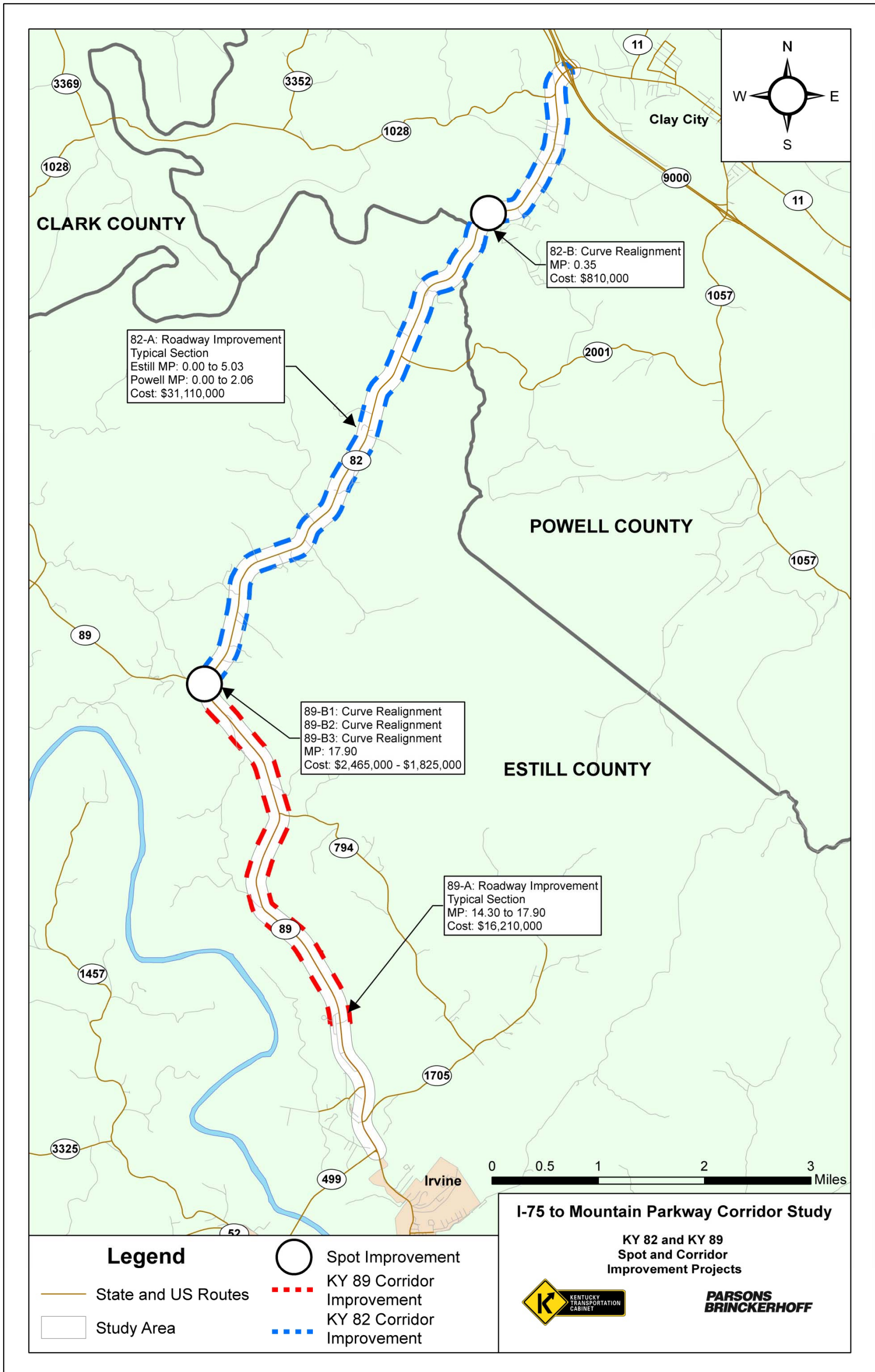
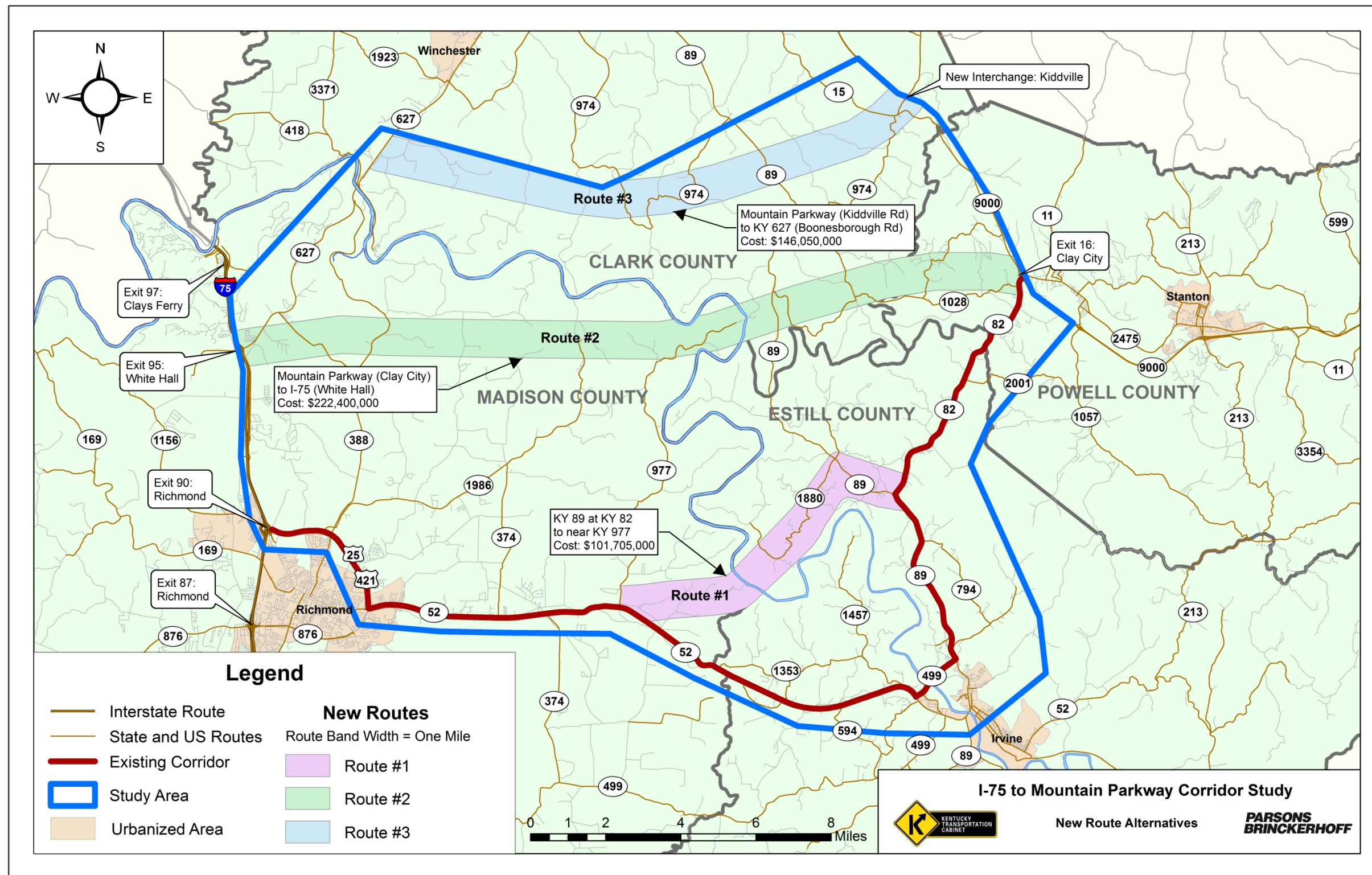




Figure 14: New Routes





Madison County

KY 52 / Eastern Bypass Intersection Improvement

KY 52 MP:12.97

Project #52-A

INFORMATION

- High speed approach on KY 52 (55 MPH)
- High left turn volume (southbound on Eastern Bypass to eastbound on KY 52)
- Recent extension of southbound left turn lane from Eastern Bypass to KY 52
- US 421 / US 25 southbound approach 2040 AADT: 23,200, V/C = 0.36
- KY 52 westbound approach 2040 AADT: 27,400, V/C = 0.42

ISSUES

- **SAFETY**
- **MOBILITY**
- **CONGESTION**

- Cars stopping in southbound travel lanes to turn left (PM Peak)
- 50 of 59 crashes were rear end collisions (Data from 2011 – 2013)
- Southbound approach CCRF – 0.93
- Westbound approach CCRF – 1.70



KY 52 WB approach



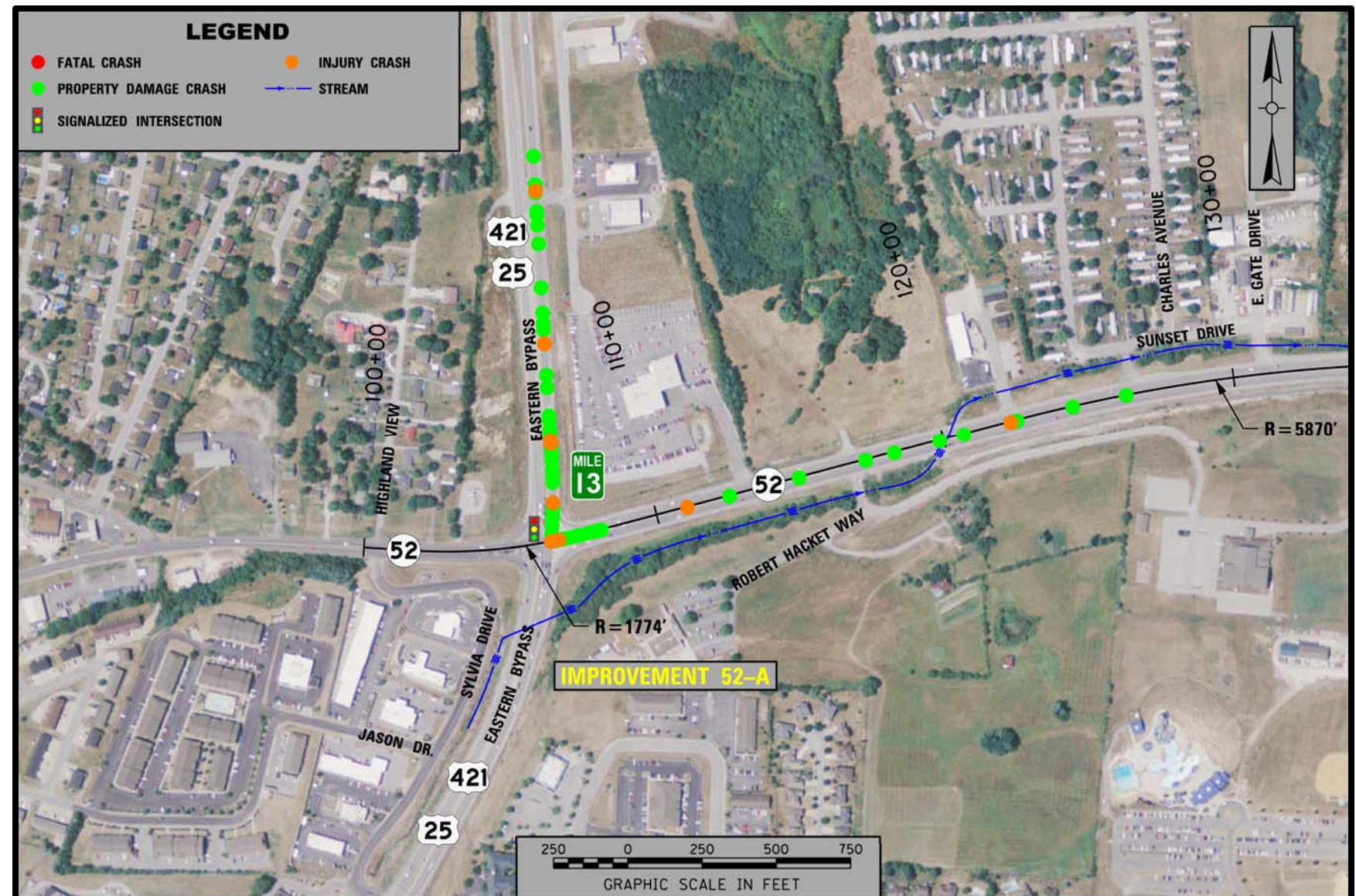
US 25 SB approach

IMPROVEMENT

- Review turn lane volumes to determine if any additional capacity improvements / signal timing modifications would improve intersection operations.

Project Cost Estimate (in 2014 Dollars):

Design:	\$50,000
ROW:	\$50,000
Utilities:	\$100,000
Construction:	\$200,000
Total:	\$400,000





Madison County

KY 52 / KY 374 Intersection Improvement

KY 52 MP: 17.78

Project #52-B

INFORMATION

- High speed approach on KY 52 (55 MPH)
- 2040 AADT: 21,200, V/C = 0.32
- Public comment - High speed differential causing incidents (crashes)
- KY 374 is part of the Bluegrass Bike Tour Route

ISSUES

- **SAFETY**
- 5 of 10 crashes were rear end collisions (Data from 2011 – 2013)
- Intersection CCRF – 0.77

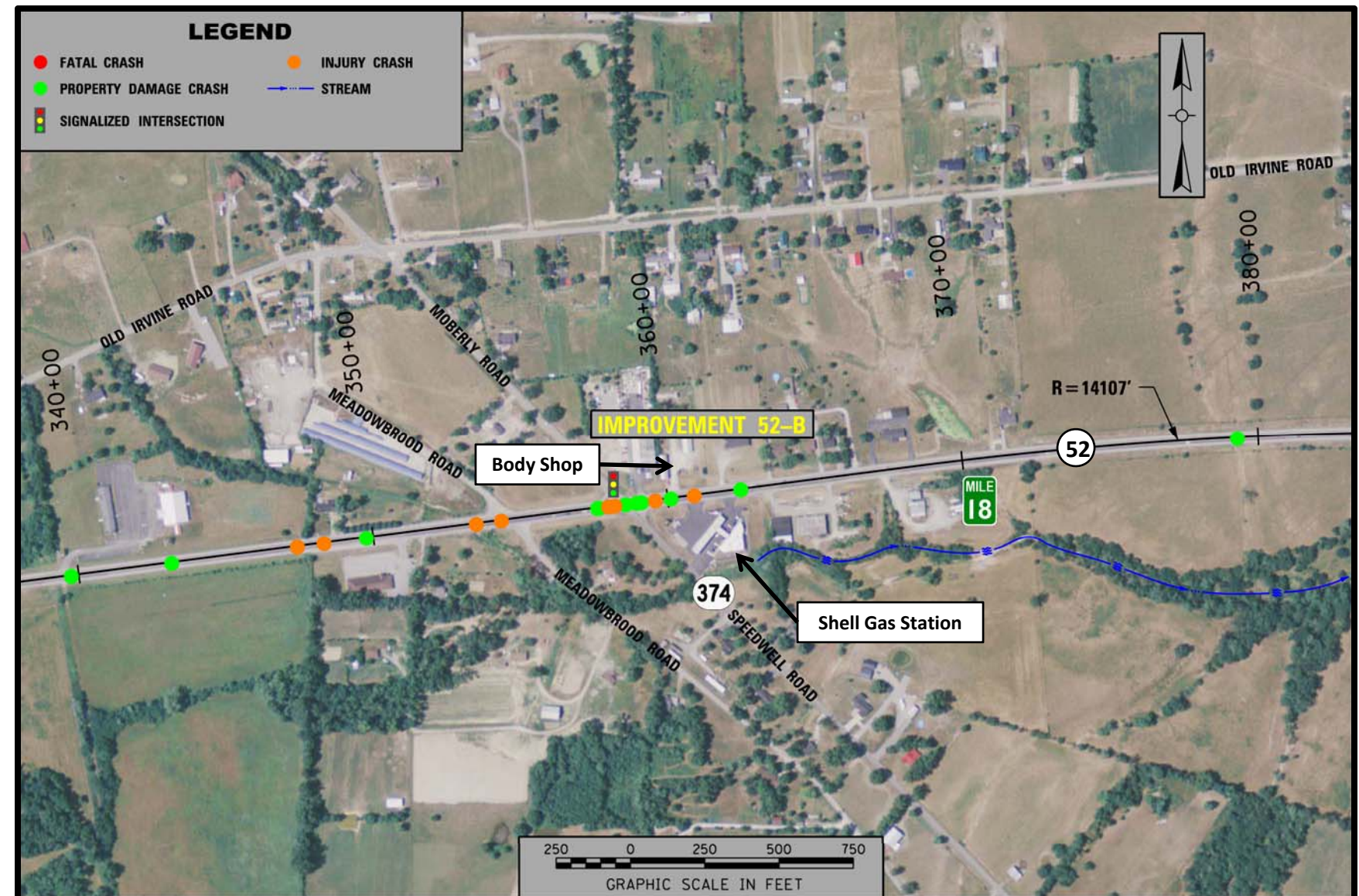


IMPROVEMENT

- Provide left turn lanes both eastbound and westbound on KY 52 per the KYTC Auxiliary Turn Lane Policy.
- Consolidate access points near intersection to reduce conflict points.
 - 2nd Shell Gas Station entrance
 - Auto / body shop entrance on KY 52 adjacent to the intersection (use Moberly Road entrance)
- Consider intersection lighting (3 of 10 crashes occurred at night or dusk). Not included in cost estimate at this time.

Project Cost Estimate (in 2014 Dollars):

Design:	\$100,000
ROW:	\$50,000
Utilities:	\$100,000
Construction:	\$400,000
Total:	\$650,000





Madison County

KY 52 / KY 977 Intersection Improvement

KY 52 MP: 19.78

Project #52-C

INFORMATION

- High speed approach on KY 52 (55 MPH)
- 2040 AADT: 16,100, V/C = 0.56

ISSUES

- **SAFETY**
- Sight distance issues on KY 52 when vehicles queued in turn lanes or waiting at the traffic signal
- 7 of 17 crashes were angle (Data from 2011 – 2013)
- 4 of 17 crashes were rear end collisions (Data from 2011 – 2013)
- 4 of 17 crashes were single vehicle collisions (Data from 2011 – 2013)
- Intersection CCRF – 1.55



KY 52 Bank Entrance



KY 52 Used Car Lot



KY 52 @ KY 977 Intersection



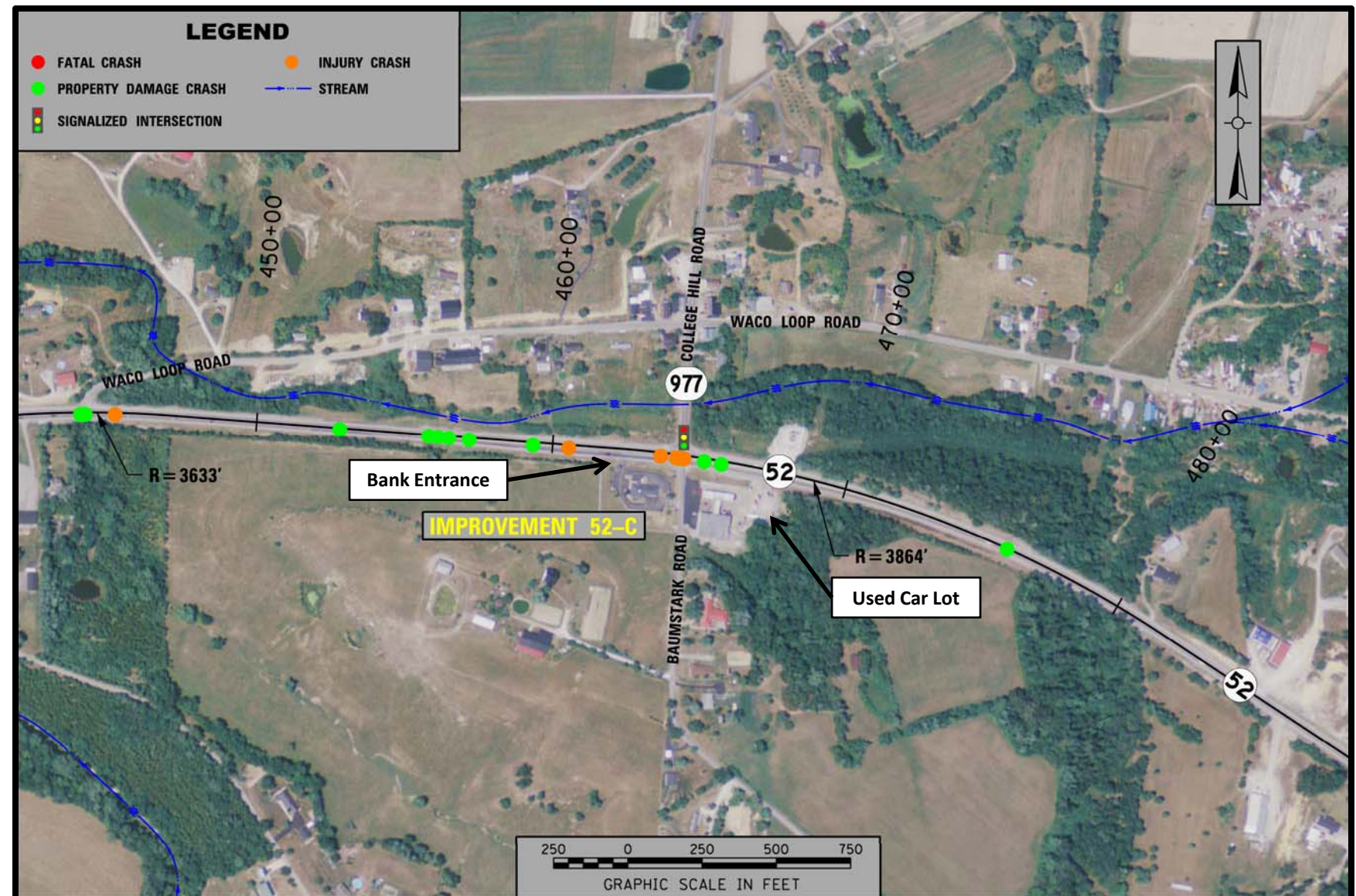
KY 52 @ KY 977 East Leg Ped Crossing

IMPROVEMENT

- Consolidate access points near intersection to reduce conflict points.
 - Used car lot adjacent to gas station
 - Bank entrance off of KY 52 – use access via Baumstark Road
- Upgrade pedestrian facilities to meet ADA requirements for existing pedestrian signal at this location.
- Consider intersection lighting (1 of 17 crashes occurred at night). Not included in cost estimate at this time.

Project Cost Estimate (in 2014 Dollars):

Design:	\$75,000
ROW:	\$50,000
Utilities:	\$50,000
Construction:	\$300,000
Total:	\$475,000





Madison County

KY 52 / Brassfield-Bybee Intersection Improvement

KY 52 MP: 21.00

Project #52-D

INFORMATION

- High speed approach on KY 52 (55 MPH)
- 2040 AADT: 13,000, V/C = 0.39

ISSUES

- **SAFETY**
- Offset intersection approaches
- Wide ditch line adjacent to roadway
- 4 of 11 crashes were rear end collisions (Data from 2011 – 2013)
- 3 of 11 crashes were angle collisions (Data from 2011 – 2013)
- Intersection CCRF – 1.00



Ditch along KY 52 EB near Bybee Rd



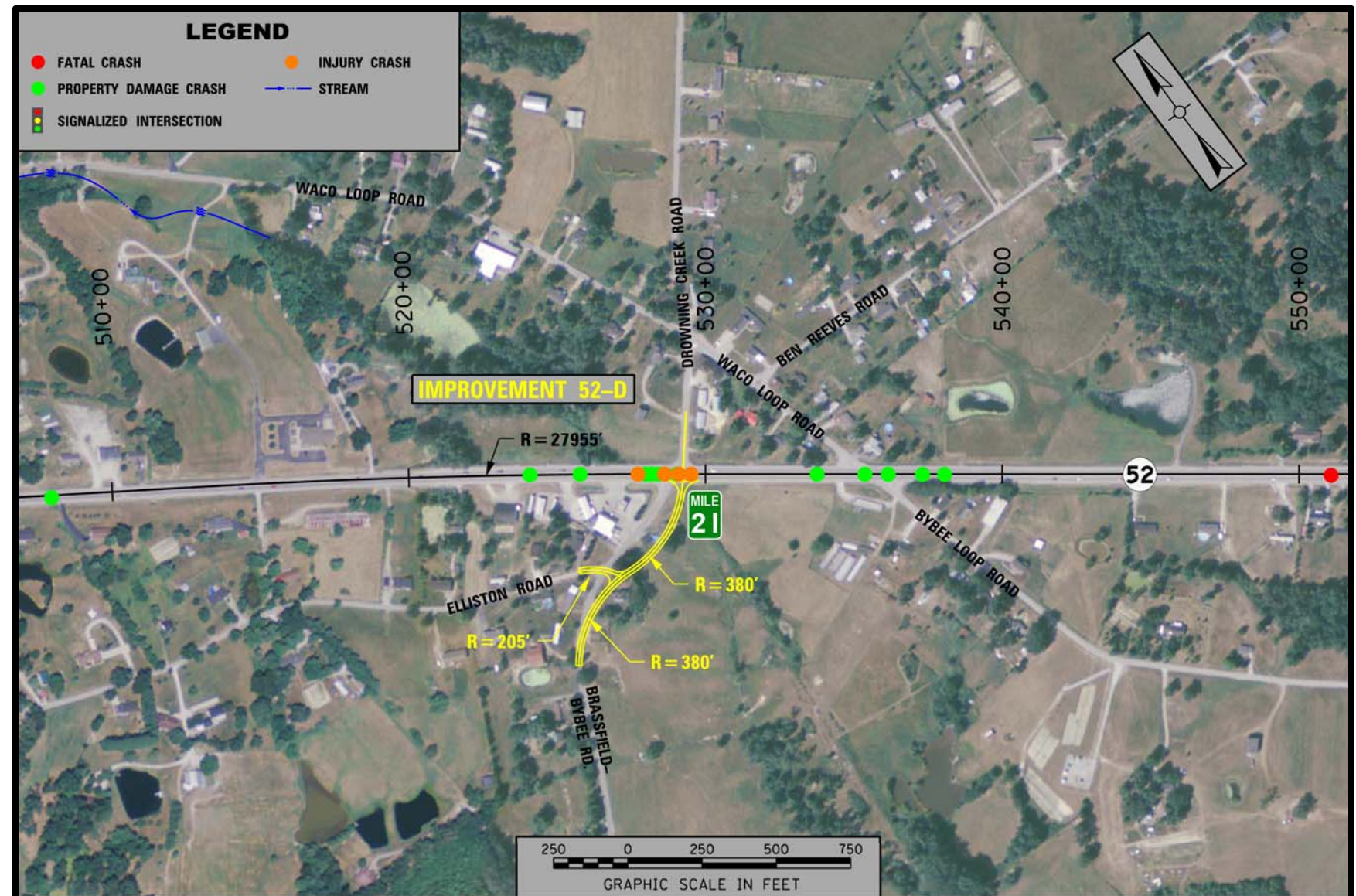
KY 52 EB at Brassfield-Bybee Rd

IMPROVEMENT

- Re-stripe two-way left-turn lane to provide designated left turn lanes.
- Re-align Brassfield-Bybee Road approach to improve intersection geometry.
- Install advance “Be Prepared to Stop When Flashing” warning signs with beacons activated when the traffic signal is turning red.
- Consider intersection lighting (2 of 11 crashes occurred at night). Not included in cost estimate at this time.

Project Cost Estimate (in 2014 Dollars):

Design:	\$200,000
ROW:	\$375,000
Utilities:	\$75,000
Construction:	\$550,000
Total:	\$1,200,000





Madison County KY 52 Roadway Improvement

Madison KY 52 MP: (18.64 to 19.39) and (22.65 to 22.87) / Estill KY 52 MP: 0.00 to 0.15

Project #52-E1 and E2

INFORMATION

- High speed rural minor arterial (55 MPH)
- Existing typical section is 2 - 12' lanes with 8' paved and 2' unpaved shoulder.
- Sections of KY 52 between MP 18.64 and MP 19.39 and MP 22.65 to MP 22.87 (and MP 0.00 to MP 0.15 in Estill County) currently do not have a full 10' shoulder.
- Public Comment – Better shoulders are needed to improve safety

ISSUES

• ROADWAY DEFICIENCY

- Inconsistent shoulder width compared to the rest of the corridor.



KY 52 WB crossing County Line



KY 52 WB at County Line



KY 52 EB at County Line



KY 52 WB crossing Elliston Rd

IMPROVEMENT

- Upgrade typical section throughout KY 52 (approx. 1.12 miles) to match existing section throughout the corridor (12' lane, 10' shoulder).
- Install centerline rumble strip.
- Cost estimate based on 10' shoulder (8' paved and 2' gravel).

E-1 Project Cost Estimate (MP 18.64 to MP 19.39) (in 2014 Dollars):

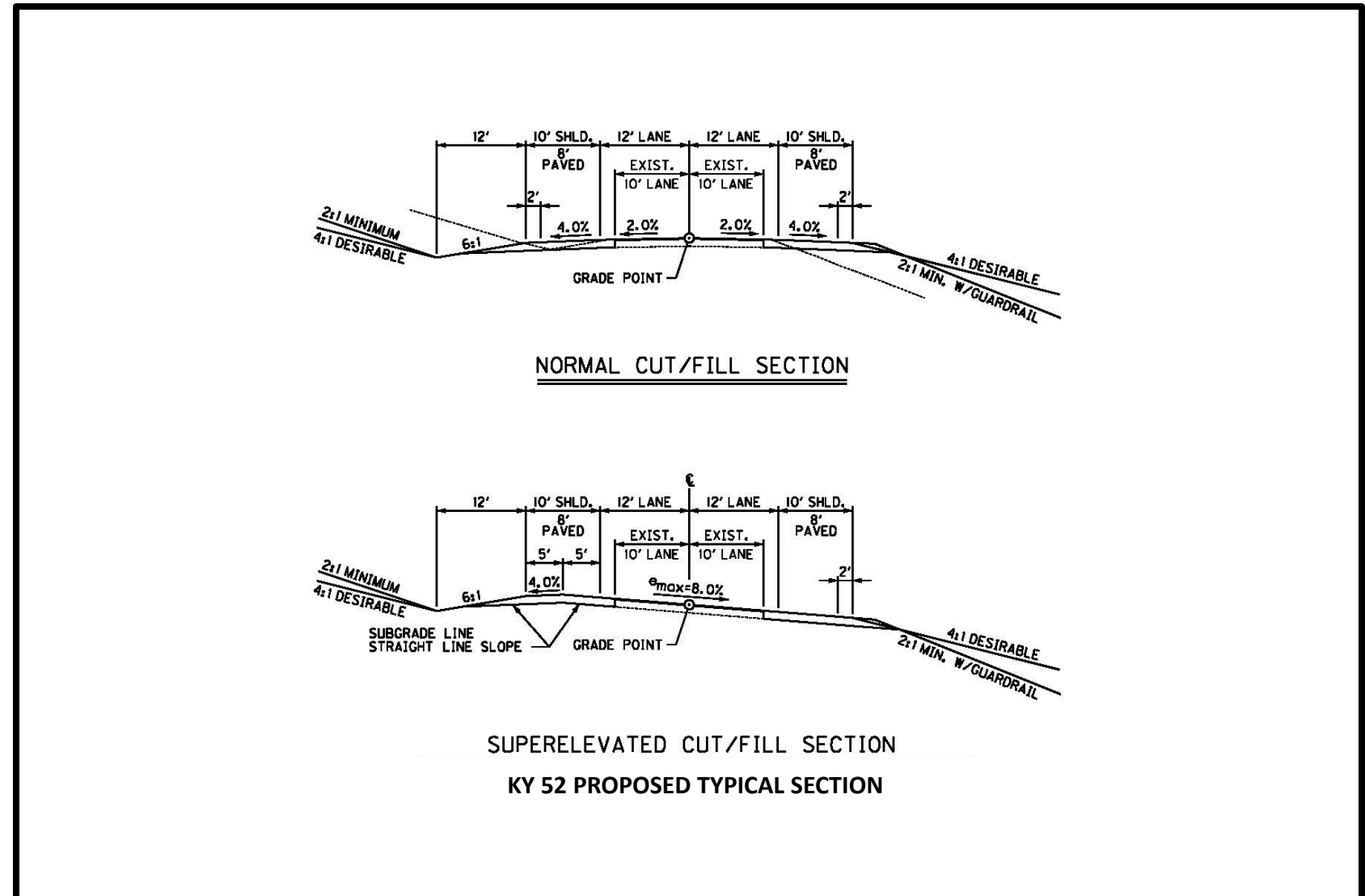
Design:	\$300,000
ROW:	\$100,000
Utilities:	\$65,000
<u>Construction:</u>	<u>\$3,060,000</u>

Total: \$3,525,000

E-2 Project Cost Estimate (MP 22.65 to MP 22.87 & MP 0.00 to MP 0.15) (in 2014 Dollars):

Design:	\$300,000
ROW:	\$300,000
Utilities:	\$75,000
<u>Construction:</u>	<u>\$2,810,000</u>

Total: \$3,485,000





Estill County

KY 499 / KY 52 Intersection Reconfiguration

KY 52 MP: 7.74

Project #499-A

INFORMATION

- High speed approach on KY 52 and KY 499 (55 MPH)
- KY 499 westbound approach 2040 AADT: 8,500, V/C = 0.37
- KY 52 southbound approach 2040 AADT: 12,800, V/C = 0.36
- KY 52 northbound approach 2040 AADT: 16,400
- Public Comment – Fatal collision was not design related

ISSUES

- **MOBILITY**
- **SAFETY**

- Disruption of flow to the corridor movement
- Location of a fatal crash
- 6 of 14 crashes were rear end collisions (Data from 2011 – 2013)
- KY 52 southbound approach CCRF – 0.58
- KY 499 westbound approach CCRF – 0.87



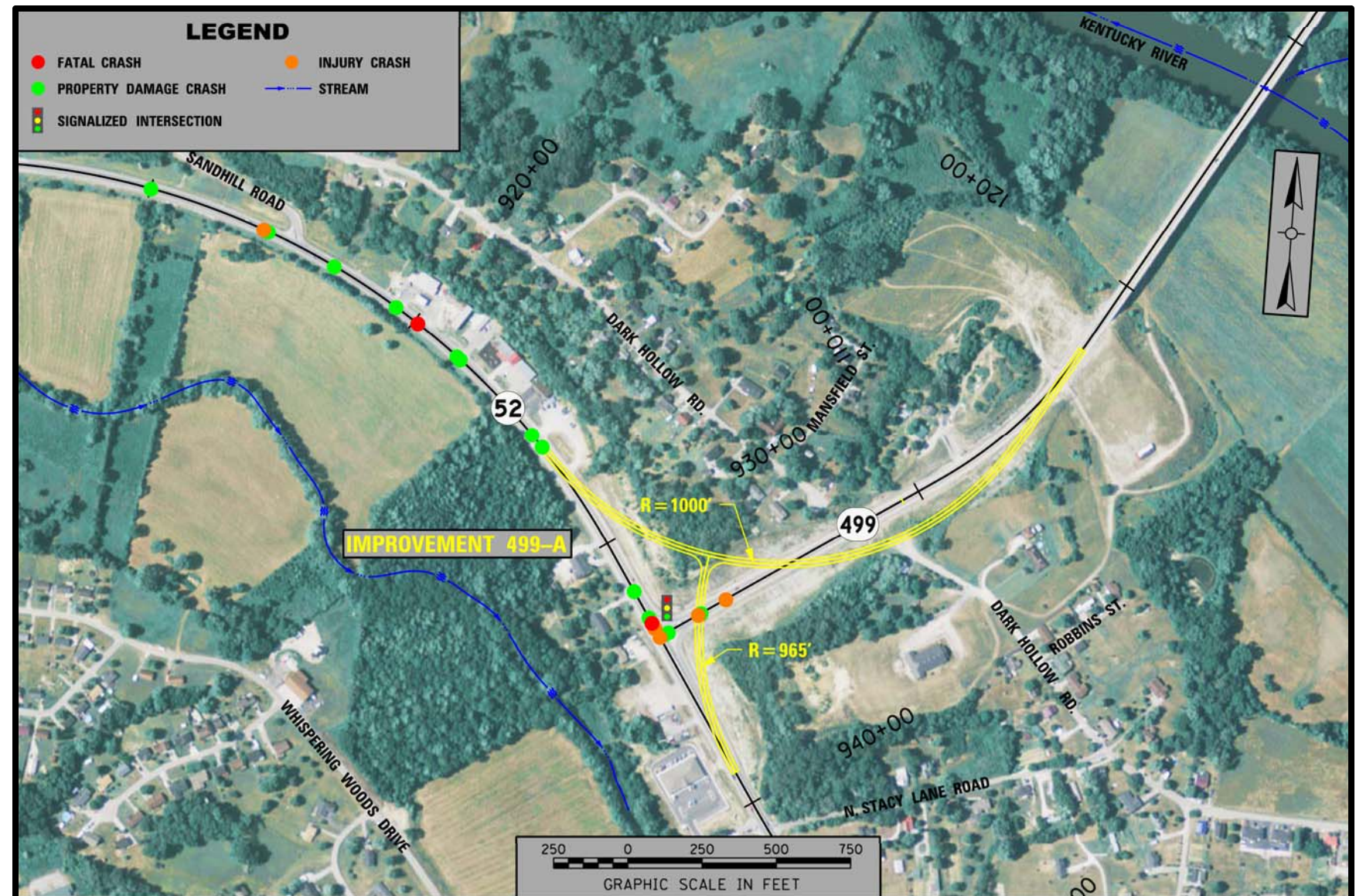
KY 499 SB Approach to KY 52

IMPROVEMENT

- Reconfigure KY 499 to KY 52 (north / west) as the major movement to create a continuous vehicle movement between I-75 and the Mountain Parkway.

Project Cost Estimate (in 2014 Dollars):

Design:	\$300,000
ROW:	\$185,000
Utilities:	\$50,000
Construction:	\$2,300,000
Total:	\$2,835,000





Estill County

KY 499 / KY 89 Intersection Reconfiguration

KY 89 MP: 9.22

Project #499-B

INFORMATION

- High speed approach on KY 89 and KY 499 (55 MPH)
- KY 499 eastbound approach 2040 AADT: 8,500, V/C = 0.37
- KY 89 southbound approach 2040 AADT: 8,500, V/C = 0.29
- KY 89 northbound approach 2040 AADT: 8,500

ISSUES

• MOBILITY

- Disruption of flow to the corridor movement
- 2 of 3 crashes were rear end collisions (Data from 2011 – 2013)
- Steep grade from the KY 499 eastbound approach

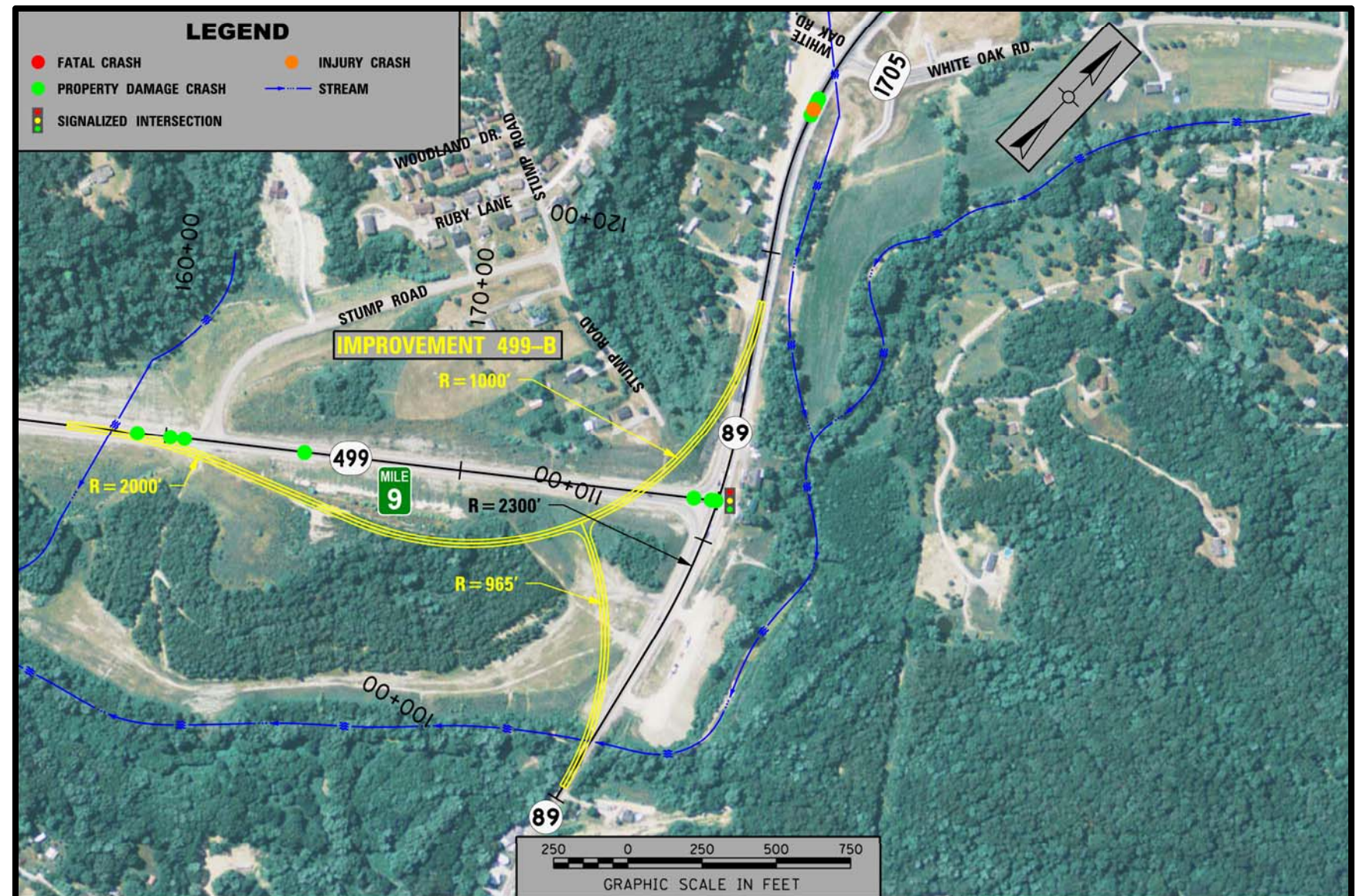


IMPROVEMENT

- Reconfigure KY 499 to KY 89 (north) as the major movement to create a continuous vehicle movement between I-75 and the Mountain Parkway.

Project Cost Estimate (in 2014 Dollars):

Design:	\$350,000
ROW:	\$125,000
Utilities:	\$50,000
Construction:	\$2,900,000
Total:	\$3,425,000





Estill County

KY 89 Roadway Improvement

KY 89 MP: 14.30 to 17.90

Project #89-A

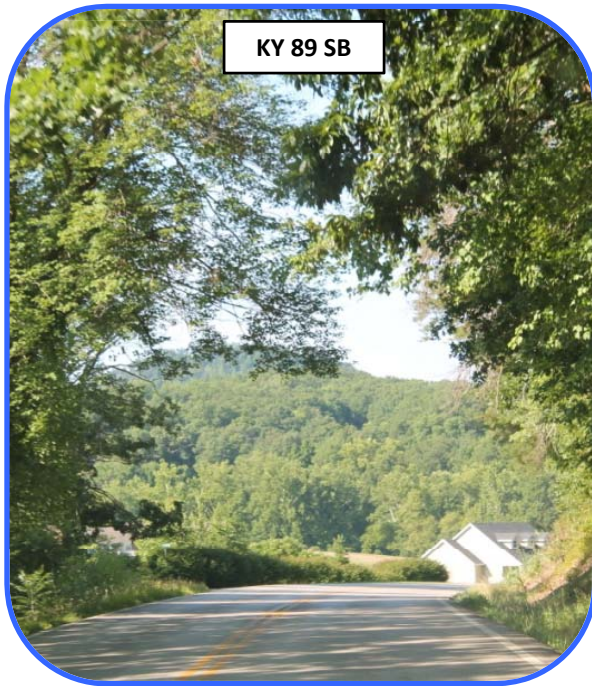
INFORMATION

- High speed rural major collector (45 – 55 MPH)
- Existing typical section is 2 - 10' lanes with 2' paved shoulder
- Section of KY 89 between MP 15 and MP 16 currently under reconstruction with 11' lane and 2' paved shoulder
- Public Comment – Address flooding issues

ISSUES

- **MOBILITY**
- **ROADWAY DEFICIENCIES**

- Deficient horizontal curves
- Deficient vertical curves



KY 89 SB near High School



KY 89 SB near Dry Ridge Rd



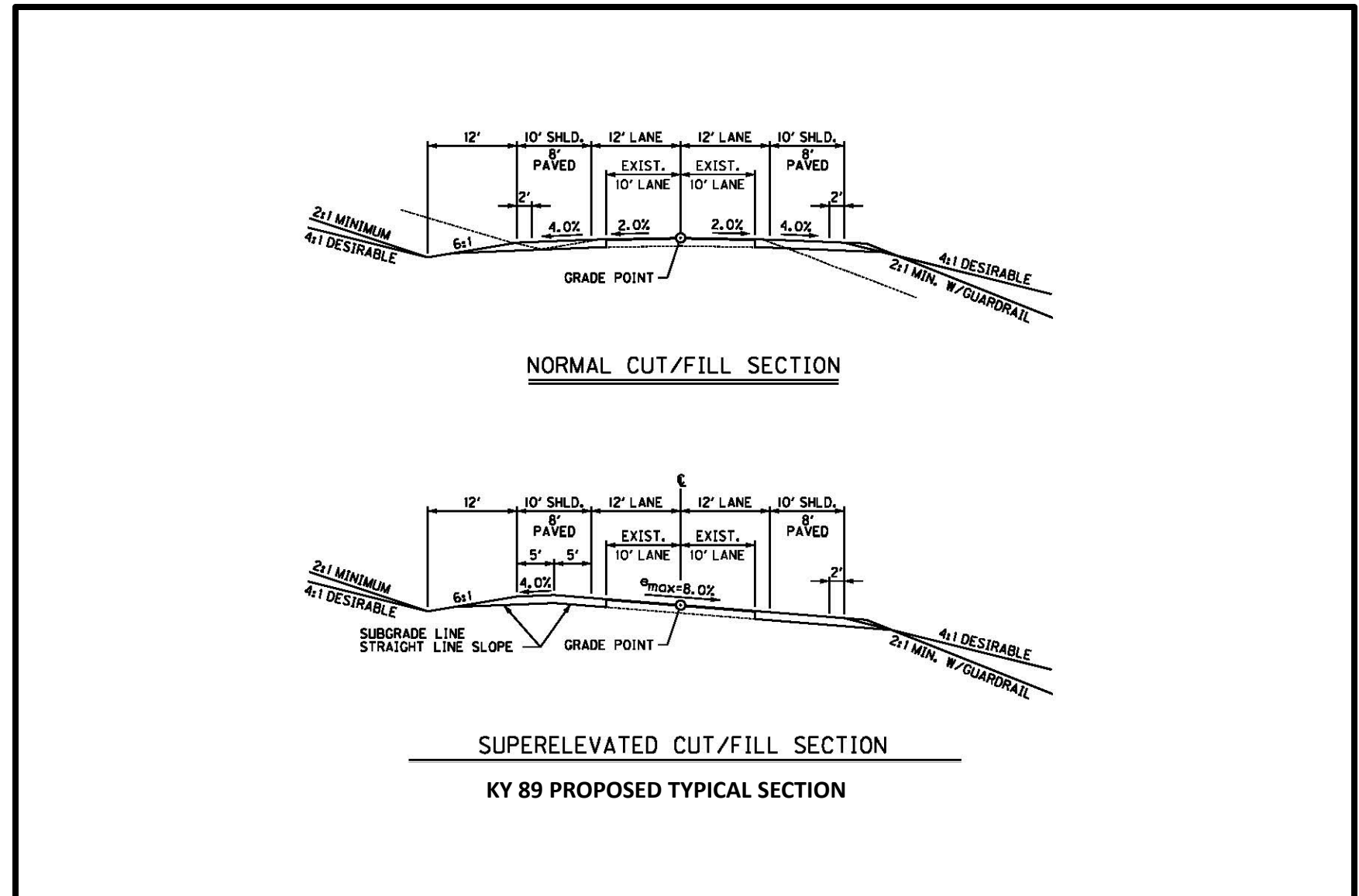
KY 89 SB near KY 82

IMPROVEMENT

- Upgrade typical section of KY 89 (approx. 3.5 miles) to match existing section near Estill County High School (12' lane, 10' shoulder).
- Install centerline rumble strip.
- Cost estimate based on 10' shoulder (8' paved and 2' gravel). Cost savings for providing an 8' shoulder (6' paved and 2' gravel) is \$500,000.

Project Cost Estimate (in 2014 Dollars):

Design:	\$1,290,000
ROW:	\$1,410,000
Utilities:	\$640,000
Construction:	\$12,870,000
Total:	\$16,210,000





Estill County

KY 89 / KY 82 Curve Realignment

KY 89 MP: 17.90

Project #89-B1,B2 and B3

INFORMATION

- High speed approach (45 – 55 MPH)
- KY 89 (south) approach 2040 AADT: 6,000, V/C = 0.32
- KY 82 (north) approach 2040 AADT: 4,500, V/C = 0.17
- KY 89 (west) approach 2040 AADT: 2,200

ISSUES

• MOBILITY

• ROADWAY DEFICIENCY

- Deficient horizontal curve
- Disruption of flow to major movement
- Houses / residences close to roadside
- Utility poles close to roadside



IMPROVEMENT

- Option B1: Realign curve to the north; will impact house and outbuildings.
- Option B2: Realign curve near existing alignment; will impact one property (appears abandoned).
- Option B3: Reconfigure intersection to provide a continuous movement from KY 89 to KY 82.

B-1 Project Cost Estimate (in 2014 Dollars):

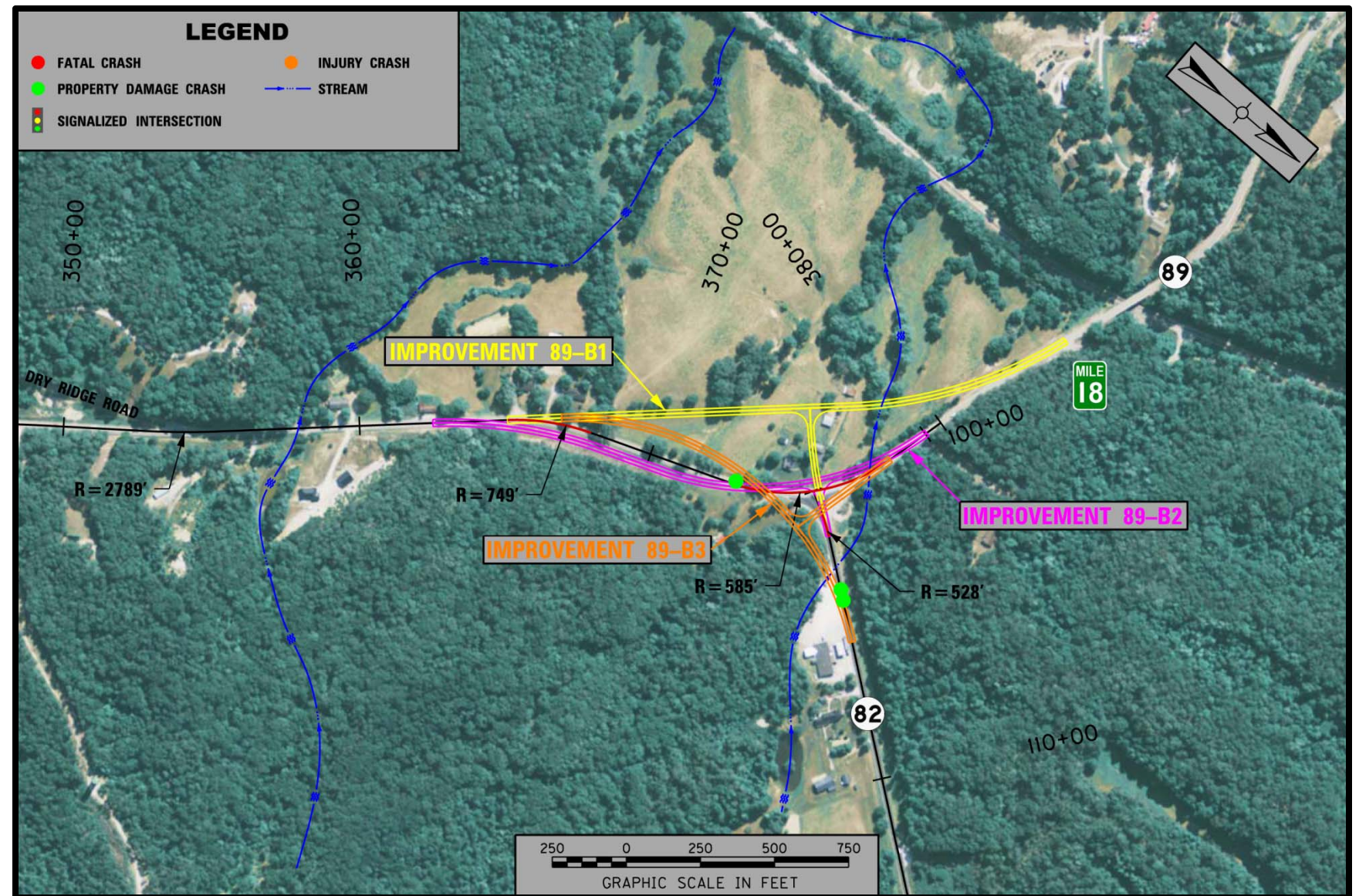
Design:	\$200,000
ROW:	\$390,000
Utilities:	\$75,000
Construction:	\$1,800,000
Total:	\$2,465,000

B-2 Project Cost Estimate (in 2014 Dollars):

Design:	\$200,000
ROW:	\$170,000
Utilities:	\$75,000
Construction:	\$1,500,000
Total:	\$1,945,000

B-3 Project Cost Estimate (in 2014 Dollars):

Design:	\$150,000
ROW:	\$300,000
Utilities:	\$75,000
Construction:	\$1,300,000
Total:	\$1,825,000





Estill / Powell County

KY 82 Roadway Improvement

Estill KY 82 MP: 0.00 to 5.03 / Powell KY 82 MP: 0.00 to 2.06

Project #82-A

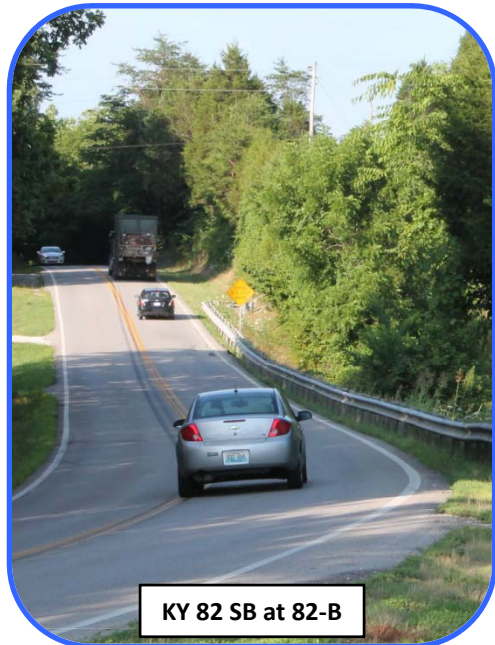
INFORMATION

- High speed rural major collector (45 – 55 MPH)
- Existing typical section is 2 - 10' lanes with 2' paved shoulder

ISSUES

- **MOBILITY**
- **ROADWAY DEFICIENCIES**

- Deficient horizontal curves
- Deficient vertical curves
- Utility poles close to roadside on approach to KY 89

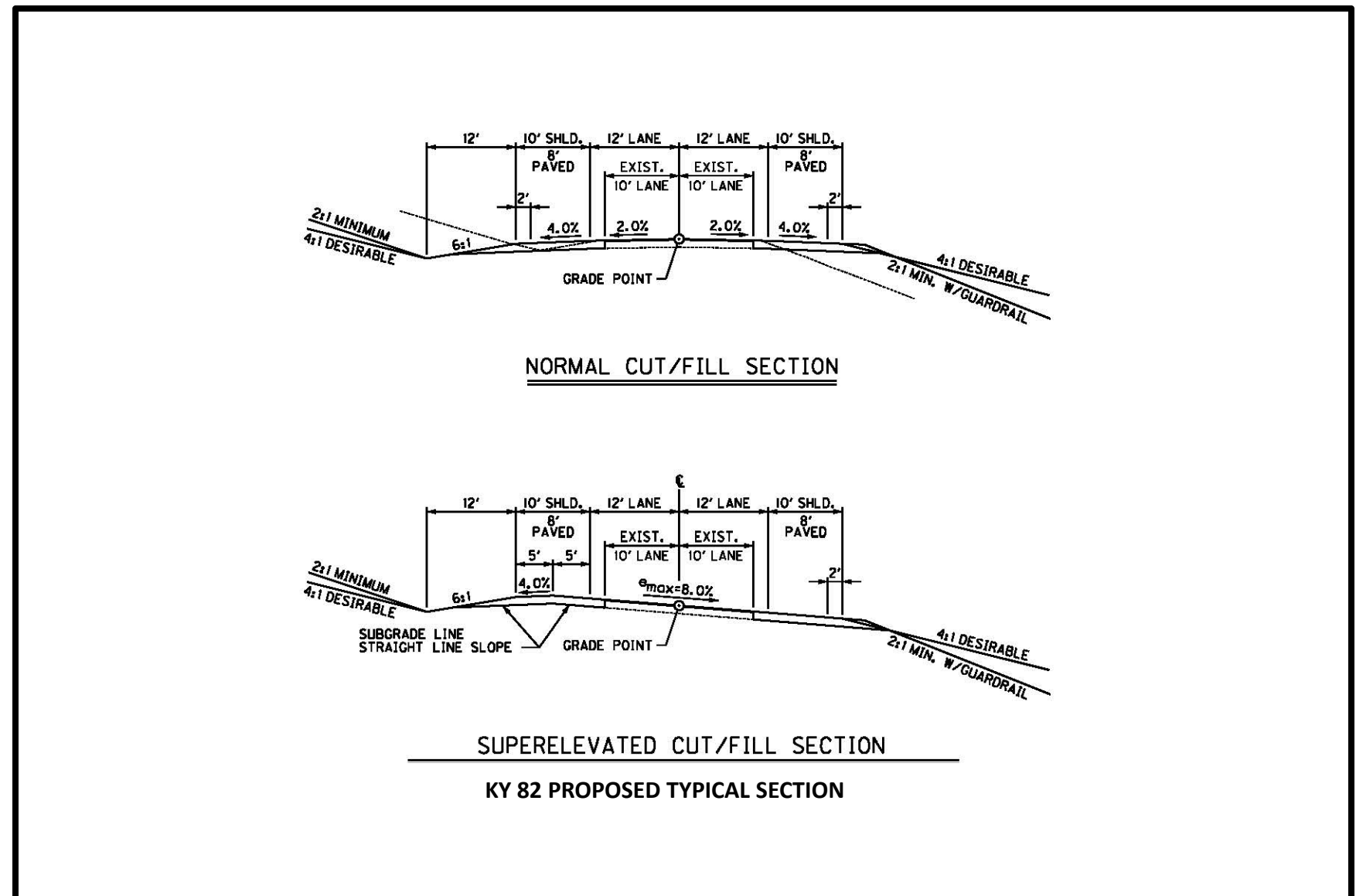


IMPROVEMENT

- Upgrade typical section of KY 82 to proposed 12' lane, 10' shoulder (approx. 6 miles).
- Install centerline rumble strip.
- Cost estimate based on 10' shoulder (8' paved and 2' gravel). Cost savings for providing an 8' shoulder (6' paved and 2' gravel) is \$800,000.

Project Cost Estimate (in 2014 Dollars):

Design:	\$2,640,000
ROW:	\$950,000
Utilities:	\$1,395,000
Construction:	\$26,125,000
Total:	\$31,110,000





Powell County

KY 82 Curve Realignment

KY 82 MP: 0.35

Project #82-B

INFORMATION

- High speed roadway (45 – 55 MPH)
- High percentage observed truck traffic

ISSUES

• ROADWAY DEFICIENCY

- Deficient horizontal curve
- All crashes (three total) reported were single vehicle collisions in wet or icy conditions (Data from 2011 – 2013)



KY 82 SB at 82-B



KY 82 SB leaving 82-B



KY 82 NB leaving 82-B

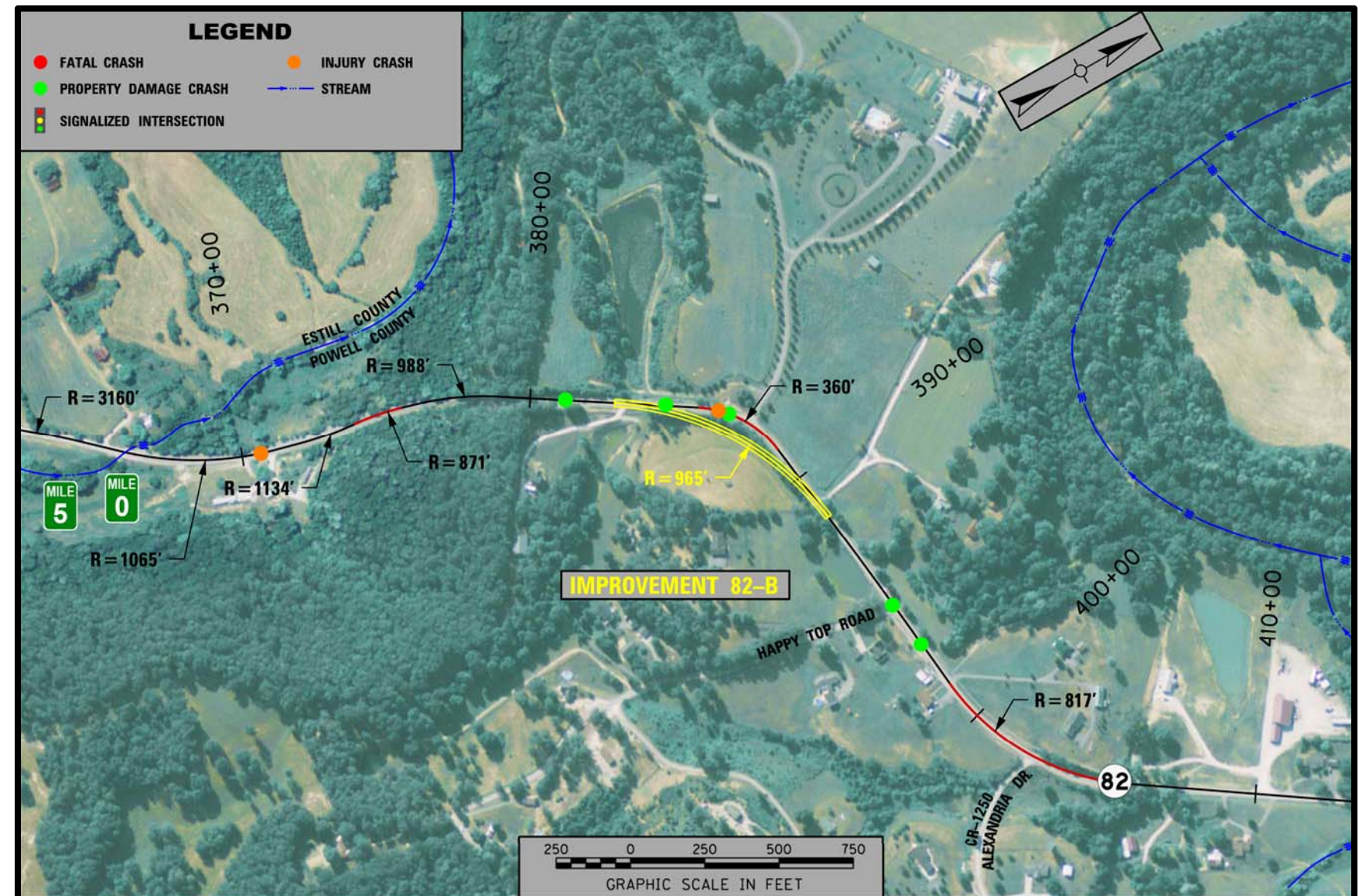
IMPROVEMENT

- Realign KY 82 to remove deficient horizontal curve.

Project Cost Estimate (in 2014 Dollars):

Design:	\$60,000
ROW:	\$25,000
Utilities:	\$75,000
Construction:	\$650,000

Total: \$810,000





Clark / Estill / Madison / Powell Counties

New Route Alternative

Project: Route #1

INFORMATION

- Currently there are only 3 bridges that cross the Kentucky River in the study area
- Existing corridor (KY 52/KY 499/KY 89/KY 82) is 33 miles long
- Existing corridor 2040 Level of Service ranges from A-E
- Existing corridor Speed Limit Travel Time is 38 minutes
- New Route Estimated ADT in 2040 is 3,600
- Public Comment – Best option for citizens of Irvine

ISSUES

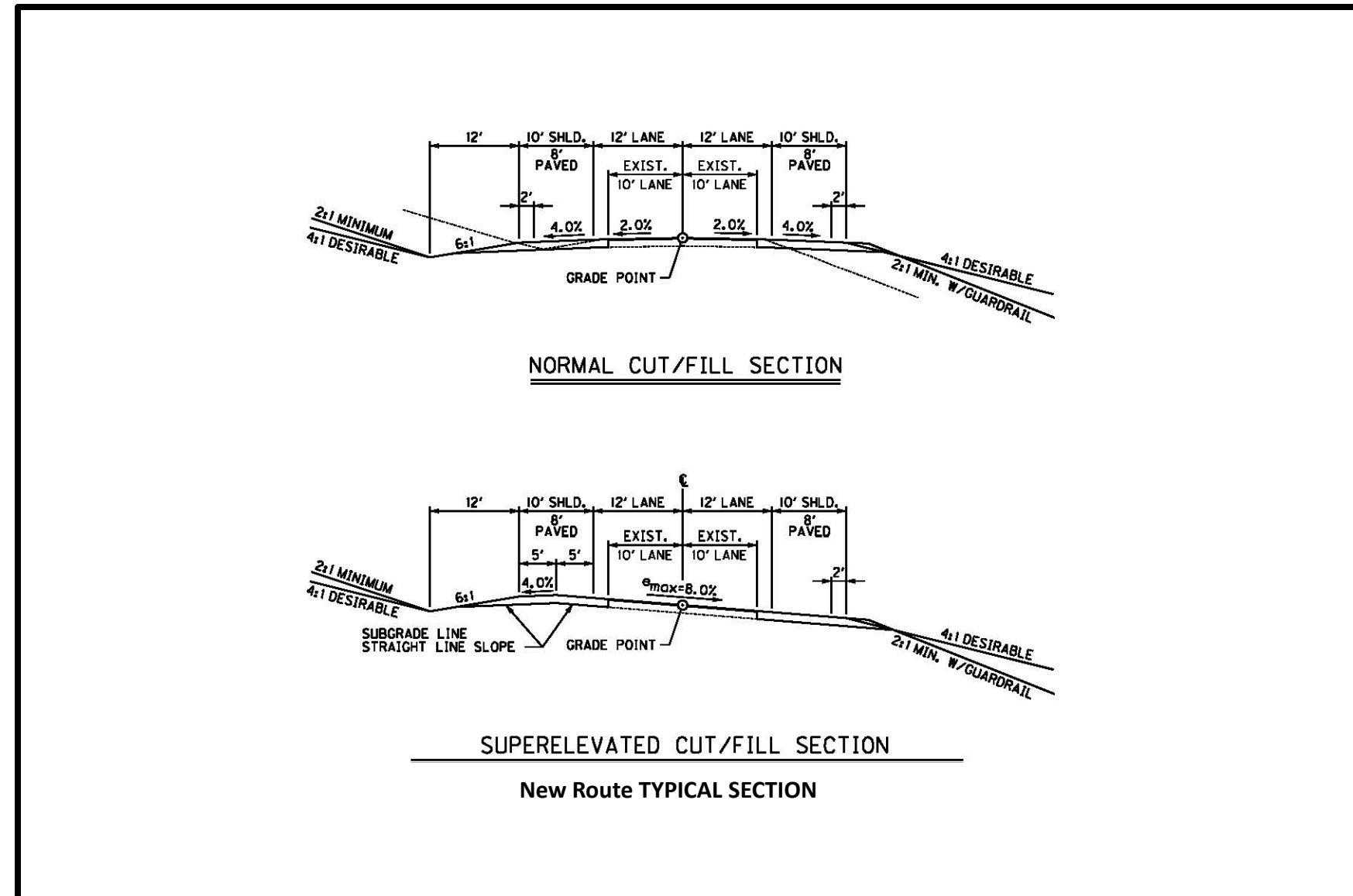
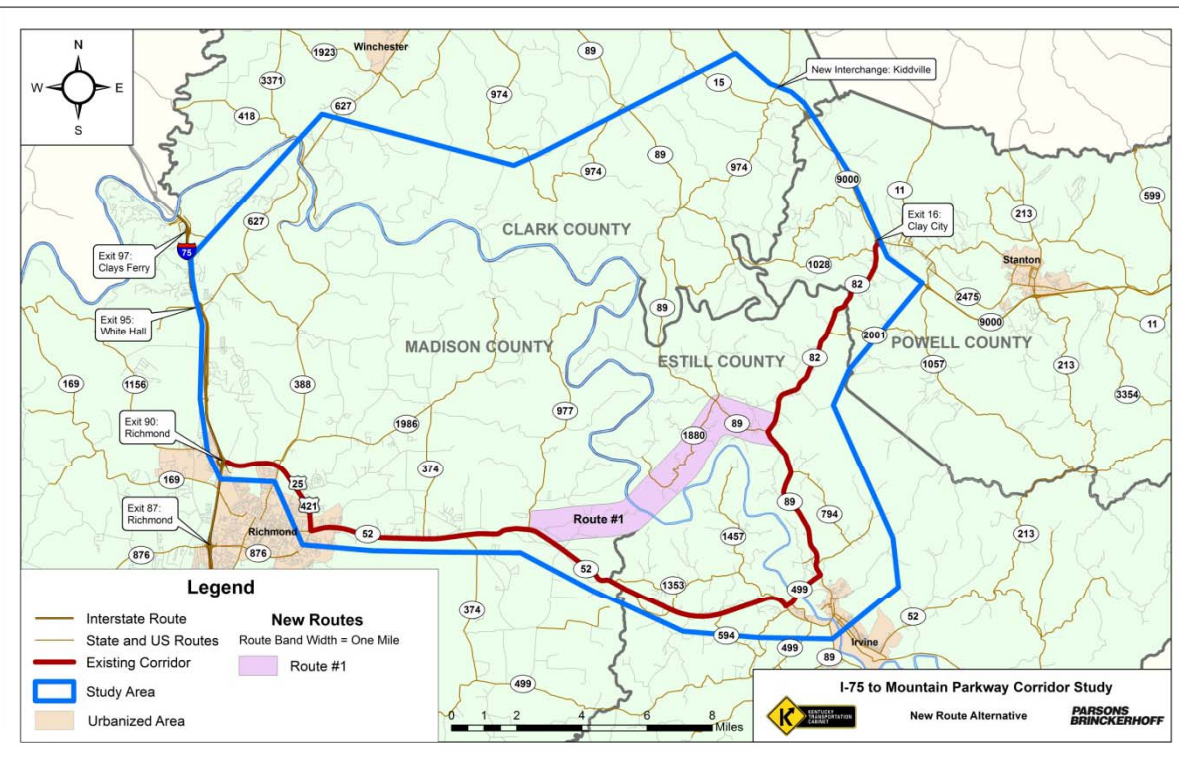
- **MOBILITY**
- **TRAVEL TIME RELIABILITY**

IMPROVEMENT

- Construct an alternate southern connection from I-75 to the Mountain Parkway utilizing the existing corridor with a new route from the KY 52 / KY 977 intersection to the KY 89 / KY 82 intersection.
- May utilize portions of existing KY 1880 and KY 89. Further evaluation to determine the feasibility of this would be required during future design phases of project development.
- Route #1 plus existing corridor would be 23 miles, a reduction of 10 miles.
- Speed limit travel time is estimated to be 25 minutes, a reduction of 13 minutes.
- Estimated 2040 LOS for new route is LOS C.

Project Cost Estimate (in 2014 Dollars):

Design:	\$9,240,000
ROW:	\$4,300,000
Utilities:	\$5,005,000
Construction:	\$83,160,000
Total:	\$101,705,000





Clark / Estill / Madison / Powell Counties

New Route Alternative

Project: Route #2

INFORMATION

- Currently there are only 3 bridges that cross the Kentucky River in the study area
- Existing corridor (KY 52/KY 499/KY 89/KY 82) is 33 miles long
- Existing corridor 2040 Level of Service ranges from A-E
- Existing corridor Speed Limit Travel Time is 38 minutes
- New Route Estimated ADT in 2040 is 2,200 – 2,600
- Public Comment – Best option for communities in Eastern Kentucky
- Public Comment – No benefit to access for citizens of Irvine

ISSUES

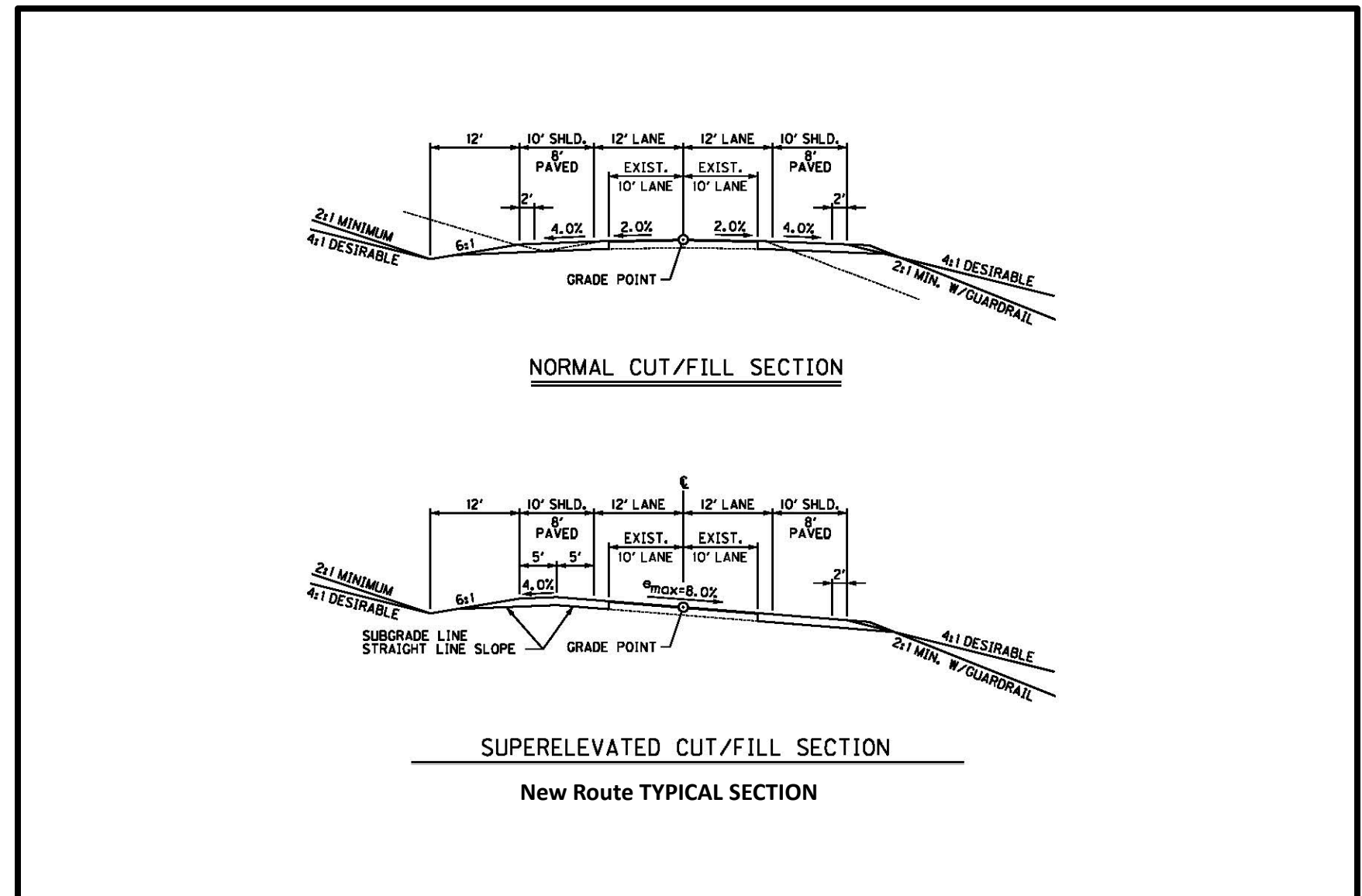
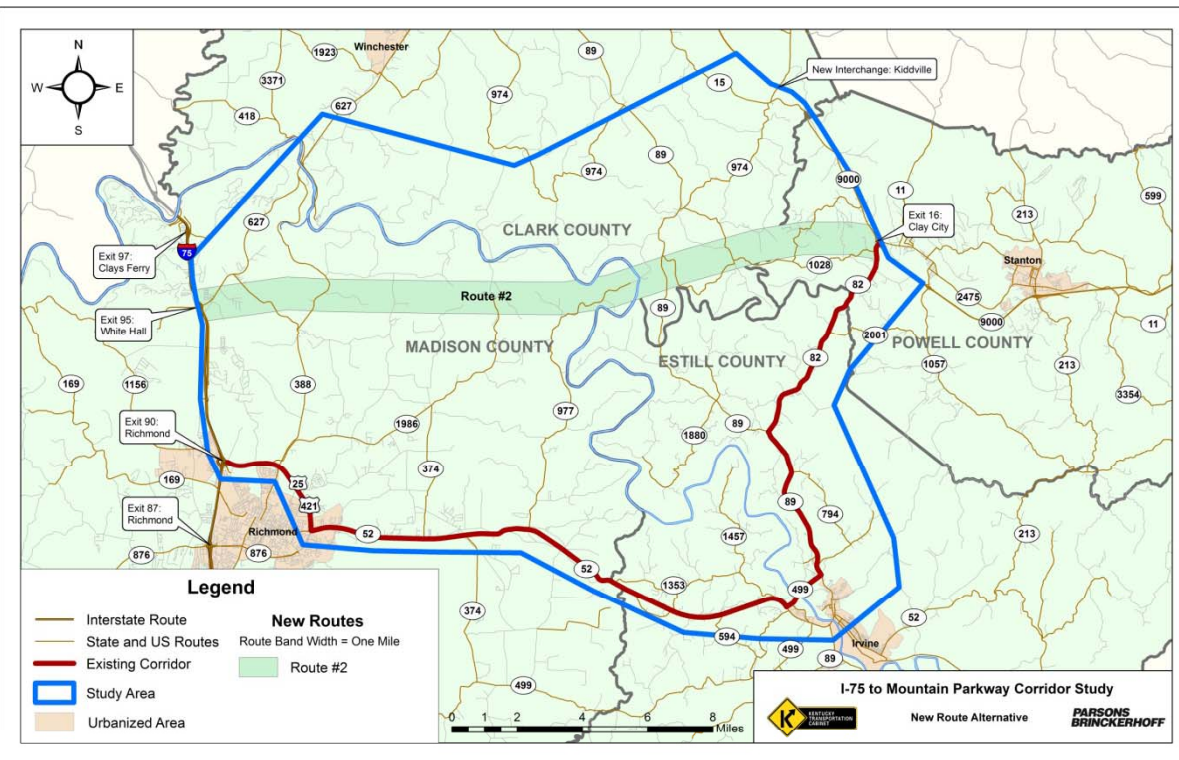
- **MOBILITY**
- **TRAVEL TIME RELIABILITY**

IMPROVEMENT

- Construct an alternate southern connection from I-75 to the Mountain Parkway from Exit 95 (White Hall) on I-75 to Exit 16 (Clay City) on the Mountain Parkway.
- Route #2 would be 22 miles, a reduction of 11 miles.
- Speed limit travel time is estimated to be 24 minutes, a reduction of 14 minutes.
- Estimated 2040 LOS for new route is LOS C.

Project Cost Estimate (in 2014 Dollars):

Design:	\$19,400,000
ROW:	\$12,650,000
Utilities:	\$15,750,000
Construction:	\$174,600,000
Total:	\$222,400,000





Clark / Estill / Madison / Powell Counties

New Route Alternative

Project: Route #3

INFORMATION

- Currently there are only 3 bridges that cross the Kentucky River in the study area
- Existing corridor (KY 52/KY 499/KY 89/KY 82) is 33 miles long
- Existing corridor 2040 Level of Service ranges from A-E
- Existing corridor Speed Limit Travel Time is 38 minutes
- New Route utilizes existing bridge crossing over the Kentucky River along KY 627
- Includes portion of KY 627 from I-75 (MP 0.20 in Madison County) to just past the Kentucky River (approximately MP 1.00 in Clark County)
- KY 627 is a 2-lane (12-foot lanes) rural principal arterial roadway with 9-11 foot shoulders and a posted speed limit of 55 mph.
- Estimated ADT in 2040 is 2,600 – 3,000
- Public Comment – No benefit to access for citizens of Irvine

ISSUES

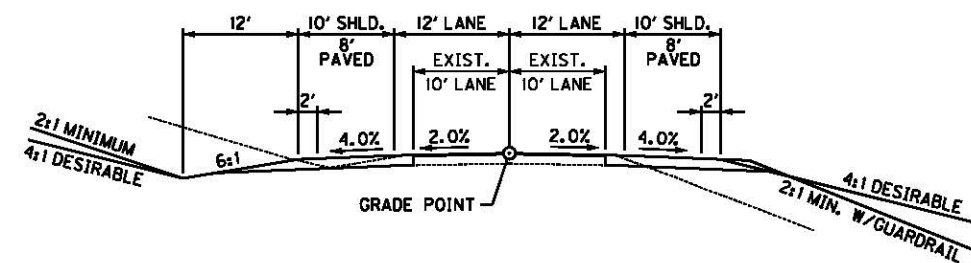
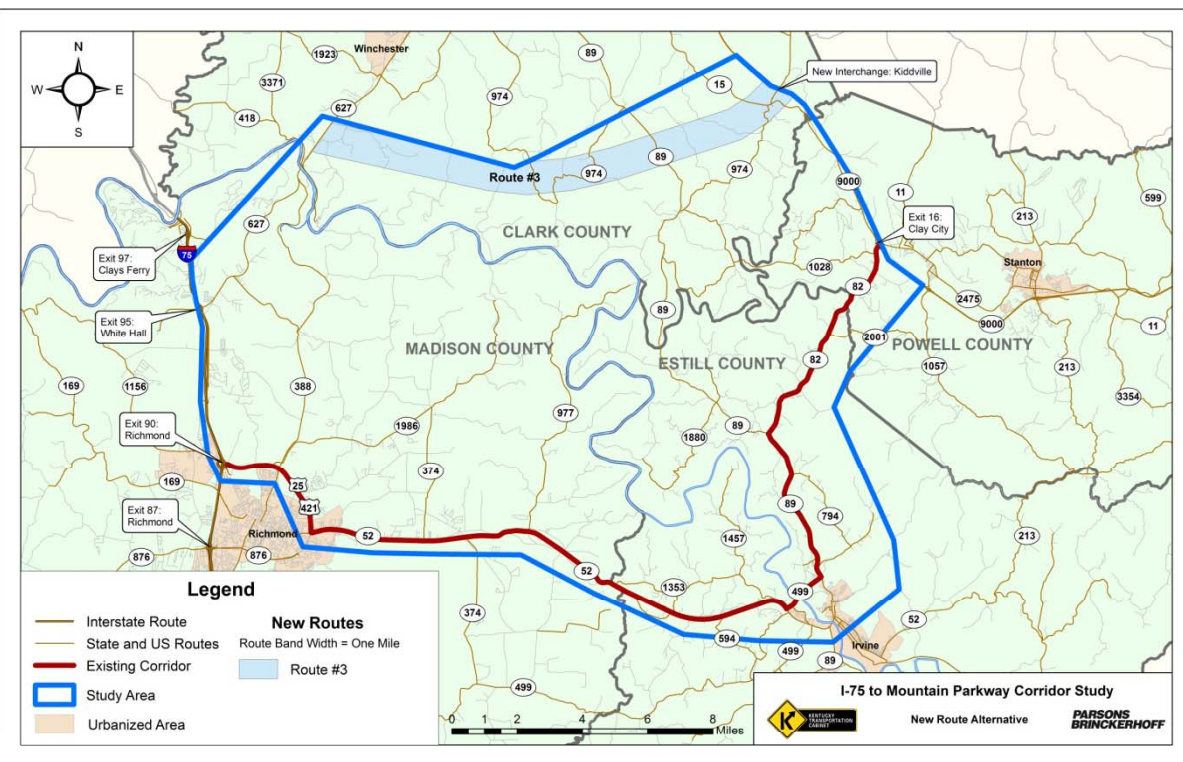
- MOBILITY
- TRAVEL TIME RELIABILITY

IMPROVEMENT

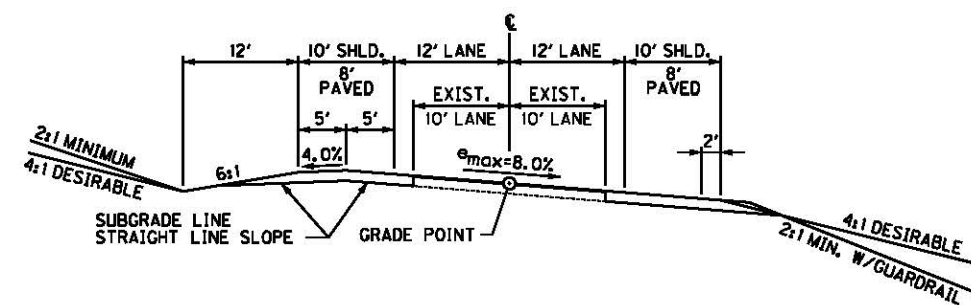
- Construct an alternate connection from I-75 to the Mountain Parkway from Exit 95 (White Hall) on I-75 via KY 627 to the new interchange at Kiddville along the Mountain Parkway.
- No improvements are proposed at this time for KY 627 in conjunction with this new route to form a continuous corridor from I-75 to the Mountain Parkway. Further review of crash data and geometric data would be required to determine if additional improvements were required.
- Route #3 would be 23 miles, a reduction of 10 miles.
- Speed limit travel time is estimated to be 25 minutes, a reduction of 13 minutes.
- Estimated 2040 LOS for new route is LOS C.

Project Cost Estimate (in 2014 Dollars):

Design:	\$12,620,000
ROW:	\$11,300,000
Utilities:	\$8,600,000
Construction:	\$113,530,000
Total:	\$146,050,000



NORMAL CUT/FILL SECTION



SUPERELEVATED CUT/FILL SECTION

New Route TYPICAL SECTION



7.0 PROJECT ANALYSIS

The following sections provide additional detail on the methods of analysis that were used for the development of project sheets as well as summary information used to compare overall corridor alternatives (improvements to the existing corridor compared to the new routes).

7.1 System Traffic Operations

Future year traffic volumes for the existing corridor were determined based on historic traffic count data as well as projected growth within the study area, as noted previously in this report (see Section 3.4). For the new routes, existing year (2014) traffic volumes were provided by KYTC utilizing the Kentucky Statewide Traffic Model (KYSTM). Several future year model runs of the KYSTM were conducted to determine growth rates to apply to the existing year volumes. These model runs included the following:

- I-75 to US 27 (Nicholasville to Richmond Connector) coded as open and closed for various scenarios
- Nicholasville Eastern Bypass coded as open and closed for various scenarios

Growth rates ranged from 0.1% to 0.8%. Based on the route and scenario, the associated growth rate was applied and 2040 ADT calculated. **Table 9** provides the 2040 ADT for each of the new routes compared to the ADT on the existing corridor.

Appendix I contains the full traffic forecast report for the new routes (Route 1, 2, and 3) as provided by KYTC.

Using the projected ADT volumes, LOS and V/C ratios were calculated for the new routes. The improved geometrics were used for the analysis as depicted on the project sheets. Based on this analysis all routes as well as the existing corridor would operate at an acceptable LOS and all sections are under capacity (V/C ratio less than 1.00).

A comparison of travel times along each route and the existing corridor was prepared to provide an additional measure of traffic operations. The evaluation considered travel distance and a posted speed of 55 mph. Additional congestion or delay based on intersection impacts was not considered at this point as these are general corridors and no specific alignment has been selected at this time. As shown in **Table 9**, combining improvements along the existing corridor (i.e. spot and corridor improvements along KY 52 and KY 82) with a new route between the intersection of KY 52 and KY 977 to the intersection of KY 89 and KY 82 would reduce travel time between I-75 and the Mountain Parkway by 13 minutes. A new route through the middle of the study area (Route #2) would reduce travel time by 14 minutes. A new route that utilizes KY 627 in the northern portion of the study area would reduce travel time by 13 minutes. As noted on the project sheet, KY 627 is a two-lane (12-foot lanes) rural principal arterial roadway with 9-11 foot shoulders and a posted speed limit of 55 mph.

Table 9: 2040 System / Traffic Operations

Alternatives	Description	System / Traffic Operations					
		Miles	2040 ADT	Travel Time (Minutes @ Posted Speed)	Travel Time (Minutes @ 55 MPH)	LOS (55MPH for New Routes)	2040 V/C
No Build	KY 52 / KY 499 / KY 89 / KY 82	33	4,500 - 27,400	38	-	A - E	0.08 - 0.62
Existing	Improve KY 52 / KY 499 / KY 89 / KY 82	33	4,500 - 27,400	-	36	A - E	0.08 - 0.56
Existing + Route #1	Improve KY 52 and KY 82 with Route #1	23	3,600 - 27,400	-	25	A - E	0.08 - 0.56
Route #2	Mountain Pkwy (Clay City) to I-75 (White Hall)	22	2,200	-	24	C	0.17
			2,600	-		C	0.22
Route #3	Mountain Pkwy (Kiddville Rd) to KY 627 (Boonesboro Rd)	23	2,600	-	25	C	0.18
			3,000	-		C	0.21



7.2 Environmental / Geotechnical Impact Analysis

A summary table (**Table 10**) was compiled to determine the relative impact of each alternative on identified environmental features in order to quantify the number of impacts within each category. The summary table included all features within the corridor band. Specific alignments chosen during future project development will determine the final number of impacts, as some features could be avoided.

The existing corridor has a higher potential for impact(s) to properties listed or proposed to be listed on the NRHP, and identified sites for USTs or Hazmat sites. New routes have a higher likelihood for property impact(s) and could have the potential to subdivide land parcels.

KYTC prepared a Geotechnical Overview for the new routes and the existing corridor based on information provided by Parsons Brinckerhoff. The full overview is included in **Appendix J**. The study area is located within the Knobs Physiographic Region. It consists of hundreds of isolated, steep sloping, often cone-shaped hills. Many knobs are capped by erosion-resistant limestones or sandstones. The slopes are mostly composed of shales that are less resistant to

erosion than the overlying limestones and sandstones. The base commonly contains Devonian black shales.

Numerous rock formations are present in the study area. It was documented that the shale present will be problematic for construction as they can be highly weatherable (highly susceptible to deteriorating when exposed to weather elements) and mitigation of some type will likely be required in cut and fill areas. Also noted in the report is that rock cut slopes in this area are recommended to be 1V:2H slope where extremely poor, soil-like, shales are encountered.

Additional concerns surround the numerous faults that are indicated in the project area. Specifically mentioned was Route #3 and its crossing of the KY River Fault System. Foundations for bridges in this area would typically be founded on shallow foundations or deep foundations. Where acid producing shale formations are encountered, special design and construction considerations will be required for structures. The soils in the area are generally suitable for embankment construction and it is recommended that both cut and fill slopes be 1V:2H. Any cut section of more than 10 feet requires analyses to design proper side slopes.

Table 10: Environmental / Geotechnical Impacts

Alternatives	Description	Environmental Impact Analysis									Geotechnical Impacts
		No. of Streams Impacted	Floodplains encroached	No. of Known Historic Sites	Known Archaeological Sites	Railroad Crossing	Properties Impacted	Community Facilities	Environmental Justice	UST / Hazmat sites	
No Build	KY 52 / KY 499 / KY 89 / KY 82	0	0	0	0	0	0	No Impact	No Impact	0	No Impact
Existing	Improve KY 52 / KY 499 / KY 89 / KY 82	17	3	30+	0	0	Moderate	Churches: 11 Cemeteries: 6 Schools: 0	Significantly above in 3 of 4 ID groups	10+	Crosses 3 Fault Lines
Existing + Route #1	Improve KY 52 and KY 82 with Route #1	18	4	20+	0	1	Major	Churches: 4 Cemeteries: 3 Schools: 3	Significantly above in 3 of 4 ID groups	6	Crosses 4 Fault Line
Route #2	Mountain Pkwy (Clay City) to I-75 (White Hall)	22	9	7	1	2	Major	Churches: 6 Cemeteries: 3 Schools: 0	Significantly above in 3 of 4 ID groups	4	Crosses 3 Fault Lines
Route #3	Mountain Pkwy (Kiddville Rd) to KY 627 (Boonesboro Rd)	17	4	8	1	2	Major	Churches: 4 Cemeteries: 0 Schools: 1	Significantly above in 2 of 4 ID groups	2	Crosses 5 Fault Lines

No Impact / Minimal Impact
 Moderate Impact
 Major Impact



7.3 Cost Estimates

Planning-level cost estimates were prepared for the improvement options (shown in **Figures 12** and **13**) and new route alternatives (shown in **Figure 14**). Cost estimates for each of the individual spot improvement options are included in each of the project sheets as well as in a summary table (**Table 11**). Utilizing the most recent KYTC bid prices sheet, construction costs were determined for major items such as pavement (asphalt) drainage, etc. with other costs considered as part of a contingency.

Pavement and earthwork costs were calculated as the major construction cost components for the corridor projects (52-E1, 52-E2, 89-A, and 82-A). These were compared to the same cost components for other similar typical section improvement work on recent KYTC design projects. The projects used were located on regions with similar terrain and also were two lane facilities which were being upgraded to an improved typical section. It was determined that a per mile cost of \$3 million (2014 dollars) would be applied for all sections where the construction work would follow close to or along the existing alignment to improve horizontal deficiencies. For areas with both vertical and horizontal deficiencies, a cost of \$3.5 million per mile was used for construction. An inventory of all structures along the existing route was performed, documenting the length of each. Utilizing current constructions prices for structural improvement work, the length was multiplied by a per square foot cost which was then added to the construction cost component.

Costs for major components for the new route alternatives were estimated on a per mile basis such as pavement, earthwork, structures, mobilization / demobilization, and then applied to the

length of each route. Additionally, a structures component was developed as multiple streams and creeks cross the existing route and are present in the study area. This cost was estimated by taking an inventory of the number and types of structures on the existing corridor and determining a percentage of each type of crossing (bridges and culverts) so that this could be applied to the construction cost. Major structures costs including the costs for a new bridge over the Kentucky River (as applicable) was determined separately as well as a major structure to span the CSX railroad line in the eastern portion of the study. The costs for the new routes are shown in **Table 12**.

Utilities and right-of-way cost estimates were provided by KYTC Districts 7 and 10, respectively, for sections of projects in each district. The districts provided a representative cost per mile for utilities and right-of-way cost in each district for the new route alternatives. For the spot and corridor improvement projects, right-of-way costs were determined based on estimates provided to KYTC of acreage and property impacts.

A summary table of costs was prepared to compare the new route alternatives with improvements along the existing route (**Table 12**). The cost for the Existing Corridor Alternative includes all costs listed in **Table 11**. The cost includes 89-B1 which is the most expensive of the three options. For the Existing plus Route #1 Alternative, the cost components include Route #1 plus the following: 52-A, 52-B, 52-C, 52-E1, 82-A, and 82-B (Refer to **Figures 12, 13** and **14** for project locations).

Appendix K includes a detailed breakdown of cost by roadway segment number used to prepare these costs estimates.

Table 11: Cost Estimate for Improvement Projects along the Existing Corridor

Alternatives	Description	Estimated Cost (2014 Dollars)				
		Design (D)	ROW (R)	Utilities (U)	Construction (C)	Total
52-A	KY 52/Eastern Bypass Intersection Improvement	\$50,000	\$50,000	\$100,000	\$200,000	\$400,000
52-B	KY 52/KY 374 Intersection Improvement	\$100,000	\$50,000	\$100,000	\$400,000	\$650,000
52-C	KY 52 / KY 977 Intersection Improvement	\$75,000	\$50,000	\$50,000	\$300,000	\$475,000
52-D	KY 52 / Brassfield-Bybee Intersection Improvement	\$200,000	\$375,000	\$75,000	\$550,000	\$1,200,000
52-E1	KY 52 Roadway Improvement	\$300,000	\$100,000	\$65,000	\$3,060,000	\$3,525,000
52-E2	KY 52 Roadway Improvement	\$300,000	\$300,000	\$75,000	\$2,810,000	\$3,485,000
499-A	KY 499 / KY 52 Intersection Reconfiguration	\$300,000	\$185,000	\$50,000	\$2,300,000	\$2,835,000
499-B	KY 499 / KY 89 Intersection Reconfiguration	\$350,000	\$125,000	\$50,000	\$2,900,000	\$3,425,000
89-A	KY 89 Roadway Improvement	\$1,290,000	\$1,410,000	\$640,000	\$12,870,000	\$16,210,000
89-B1	KY 89 / KY 82 Curve Realignment	\$200,000	\$390,000	\$75,000	\$1,800,000	\$2,465,000
89-B2	KY 89 / KY 82 Curve Realignment	\$200,000	\$170,000	\$75,000	\$1,500,000	\$1,945,000
89-B3	KY 89 / KY 82 Curve Realignment	\$150,000	\$300,000	\$75,000	\$1,300,000	\$1,825,000
82-A	KY 82 Roadway Improvement	\$2,640,000	\$950,000	\$1,395,000	\$26,125,000	\$31,110,000
82-B	KY 82 Curve Realignment	\$60,000	\$25,000	\$75,000	\$650,000	\$810,000



Table 12: Comparison of Cost for Alternatives

Alternatives	Description	Estimated Cost (2014 Dollars)				
		Design (D)	ROW (R)	Utilities (U)	Construction (C)	Total
No Build	KY 52 / KY 499 / KY 89 / KY 82	-	-	-	-	\$0
Existing	Improve KY 52 / KY 499 / KY 89 / KY 82	\$5,865,000	\$4,010,000	\$2,750,000	\$53,965,000	\$66,590,000
Existing + Route #1	Improve KY 52 and KY 82 with Route #1	\$12,465,000	\$5,525,000	\$6,790,000	\$113,895,000	\$138,675,000
Route #2	Mountain Pkwy (Clay City) to I-75 (White Hall)	\$19,400,000	\$12,650,000	\$15,750,000	\$174,600,000	\$222,400,000
Route #3	Mountain Pkwy (Kiddville Rd) to KY 627 (Boonesboro Rd)	\$12,620,000	\$11,300,000	\$8,600,000	\$113,530,000	\$146,050,000

Note: All alternatives include costs for new construction only and do not consider maintenance costs.



7.4 Local Officials / Stakeholder Input

As noted in section 5.1, a meeting was held with the local officials and stakeholders (LO/S) to present to them the improvement options and request their feedback. Survey forms allowed the LO/S to rank projects within the three project categories (spot, corridor, and new route) according to what they considered to be high, medium, and low priorities. **Table 13** shows the distribution of responses from the 17 returned survey forms. Each improvement's rankings were color coded with green having the highest number of responses, yellow the mid-level of responses, and red for the least number of responses.

Table 13: LO/S Improvement Option Rankings

Spot Improvement	High	Medium	Low
52-A: 2 nd Southbound Left Turn Lane	4	9	3
52-B: Left Turn Lanes on KY 52	10	2	4
52-C: Modify Access	11	5	0
52-D: Left Turn Lanes on KY 52 & Approach Road Realignment	4	9	3
499-A: Intersection Reconfiguration	7	3	4
499-B: Intersection Reconfiguration	7	4	3
89-B: Curve Realignment	8	5	1
82-B: Curve Realignment	8	5	2

Corridor Improvement	High	Medium	Low
52-E1 and E2: Increase Shoulder Width	12	3	3
89-A: Roadway Improvement	7	7	3
82-A: Roadway Improvement	9	3	5

New Route	High	Medium	Low
Route #1: KY 89 at KY 82 to near KY 977	12	2	1
Route #2: Mountain Pkwy (Clay City) to I-75 (White Hall)	3	10	2
Route #3: Mountain Pkwy (Kiddville Rd) to KY 627 (Boonesboro Rd)	1	0	14

Sorting this by priority shows that the respondents indicated a high priority for the majority of the projects. **Table 14** shows the reorganized data based on the project ranking assignment.

Table 14: LO/S Ranking by Category

Spot Improvement		
High	Medium	Low
52-C	52-A	
52-B	52-D	
89-B		
82-B		
499-A		
499-B		

Corridor Improvement		
High	Medium	Low
52-E1 and E2	89-A	
82-A		
89-A		

New Route		
High	Medium	Low
Route #1	Route #2	Route #3

The highest priority for new routes was Route #1, with Route #2 receiving some consideration as a medium priority. There was a clear preference that Route #3 is not a priority route.

Additional input was requested for improvement 89-B. There were three options presented for this location:

- B1: Realignment only of the curve to the north
- B2: Realignment only of the curve near the existing alignment
- B3: Realignment of the curve and reconfiguration of the intersection to provide a continuous movement from KY 89 to KY 82

The majority of respondents (7) selected B3 as the preferred option. Two people selected B1 and one person selected B2.



8.0 STUDY RECOMMENDATION AND PRIORITIZATION

8.1 Study Recommendation

Based on the project analysis, discussion with the PDT, input from the LO/S, and referring to the purpose and need established for this project, it was determined that the recommendation from this study is to improve the existing corridor with the addition of Route #1.

As a reference, this includes the following improvement options:

- 52-A
- 52-B
- 52-C
- 52-E1
- 82-A
- 82-B
- Route #1

Overall, improvements to the existing route plus Route #1 best meet the identified purpose and need for this project. A comparison of the alternatives to the project's purpose and need statement can be seen in **Table 15**. The color shading indicates how well each alternatives addresses each project need (green = addresses and red = does not address). As shown in the table, only the Existing + Route #1 addresses all components of the purpose and need statement. Routes #2 and #3 only met portions of the purpose and need components and were ranked as lower priorities by the LO/S. As a result, Routes #2 and #3 are not recommended.

Comparing the cost estimates, the overall cost for the Existing + Route #1 alternative at \$138,675,000 is lower than constructing a completely new route (Routes #2 or #3). However, the cost for the Existing + Route #1 alternative is double the cost for improvements to the existing corridor only (\$66,590,000). Much of this cost can be attributed to the need for a new bridge over the Kentucky River.

If it is determined at a later stage that the construction of Route #1 is cost prohibitive, it is recommended to consider implementing the remaining improvements along the existing corridor. Overall, the next best alternative that meets the purpose and need is improvements to the existing corridor. The remaining projects would include:

- 52-D
- 52-E2
- 499-A
- 499-B

- 89-A
- 89-B3

This would complete improvements to the existing corridor and provide a consistent typical section for a route that would connect I-75 to the Mountain Parkway.

8.2 Project Prioritization

Proposed phasing of the project recommendation is provided to assist with future project development. Three distinct phases were identified considering safety and operations, cost, and LO/S input.

Phase 1 – Spot Improvements

- Includes 52-A, 52-B, 52-C, and 82-B
- Total cost = \$2,335,000
- Individually all improvement projects are less than \$1,000,000
- This would address the safety component by improving two intersections with CCRFs that exceed 1.0

Phase 2 – Corridor Improvements

- Includes 52-E1 (MP 18.64 to MP 19.39) and 82-A
- Total cost = \$34,635,000
- These improvements would address all geometric deficiencies on KY 82 (42 deficiencies)

Phase 3 – Route #1

- Total cost = \$101,705,000
- This connection would provide the last piece to improve travel time, provide connectivity, and allow for an additional through travel option, removing some traffic from the remaining portion of KY 52 and KY 89

These three phases and associated costs are shown on **Figure 15**.

Further priority ranking of projects was completed within Phase 1 – Spot Improvements and Phase 2 – Corridor Improvements. The methodology for the prioritization of the different projects in each phase considered several factors to determine the order in which each piece is recommended to be constructed (high, medium, low priority). This includes input received from the LO/S, traffic volumes (for the corridor improvements), crash rate factors (CCRF) and the number of geometric deficiencies present.



Table 15: Comparison of Alternatives to Purpose and Need

Alternative	Project Needs					
	Safety	Roadway Deficiencies	Travel Time Reliability	Access	Connectivity	Emergency Management
No Build	Does nothing to address 3 intersections with safety issues	Does nothing to address 50+ geometric deficiencies along KY 52, KY 499, KY 89, and KY 82	No improved travel time (remains at 38 minutes)	No improvements to intersections with safety issues that have multiple access points	Does not improve the connection	Does not provide any change in the current roadway to assist with evacuation procedures
Existing	Spot and corridor improvements address all safety issues	Spot and corridor improvements address all geometric deficiencies	2 minutes travel time savings	Spot improvements address all issues	Does not provide a more direct connection	Provides additional shoulder width and improvements to facilitate evacuation procedures
Existing + Route #1	Spot and corridor improvements address issues on KY 52 and KY 82; Route #1 removes some traffic from KY 52 and KY 89, providing an alternate travel route	Spot and corridor improvements address issues on KY 52 and KY 82; Route #1 removes some traffic from KY 52 and KY 89, providing an alternate travel route	13 minutes travel time savings	Spot improvements address all issues	Provides an improved / more direct connection	Provides additional shoulder width and improvements to facilitate evacuation procedures
Route #2	No improvements to existing route	No improvements to existing route	14 minutes travel time savings	No improvements to existing route	Provides an improved / more direct connection	Does not provide any improvement for evacuation procedures from KY 52
Route #3	No improvements to existing route	No improvements to existing route	13 minutes travel time savings	No improvements to existing route	Provides an improved / more direct connection	Does not provide any improvement for evacuation procedures from KY 52



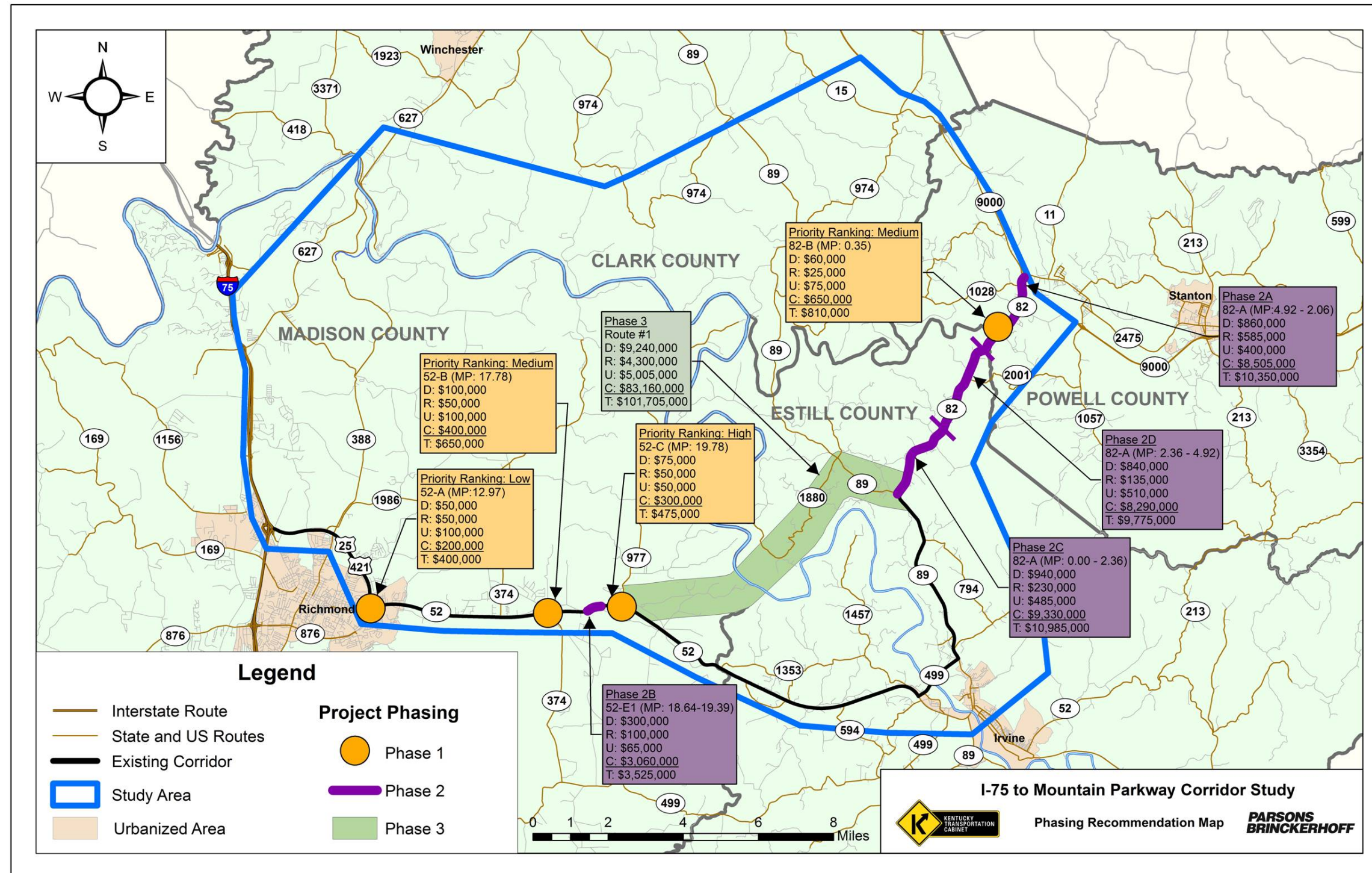
 Addresses project need
 Does not address project need



Figure 15: Project Phasing





Phase 1 – Spot Improvements Prioritization

The spot improvements being prioritized include 52-A, 52-B, 52-C, and 82-B. The following is the assigned priority and includes the corresponding evaluation criteria used to determine the priority.

- High Priority: 52-C
 - Total Cost = \$475,000
 - Highest ranking of the spot improvement projects by the LO/S
 - CCRF = 1.55
- Medium Priority: 52-B
 - Total Cost = \$650,000
 - High ranking response of the spot improvement projects by the LO/S
 - CCRF = 0.77
- Medium Priority: 82-B
 - Total Cost = \$810,000
 - A split of high and medium ranking response of the spot improvements projects by the LO/S
 - CCRF = 0.51
 - 3 Geometric Deficiencies
- Low Priority: 52-A
 - Total Cost = \$400,000
 - Medium ranking response of the spot improvements projects by the LO/S
 - CCRF = 0.93 – 1.70
 - 1 Geometric Deficiency
 - Recent work (less than one year) has been completed to improve southbound left turn queuing issues.

The intersection of KY 52 and the Eastern Bypass at the location of Improvement 52-A recently had the southbound left-turn lane extended. Therefore, this project is recommended as a low priority given the notes above as well as the fact that recent improvements were made. It is recommended that turning movement counts be updated to further evaluate traffic operations and determine if there is additional need for improvements at this location.

Phase 2 – Corridor Improvements Prioritization

The corridor improvements considered for prioritization include 52-A and 82-A. Project 82-A was further subdivided into smaller sections as the PDT discussed improvements to the corridor (i.e. KY 82) should be phased to be at approximately \$10 million projects (threshold suggested at which projects have a greater chance at inclusion in the Six Year Highway Plan). These segments can be seen in **Figure 15**. With regard to project prioritization, a similar methodology as that employed for Phase 1 was utilized.

Considering LO/S input, geometric deficiencies, safety, and traffic volumes, the following is the determination of project phases for the corridor improvements:

- Phase 2A: KY 82 Northern Portion (Estill County MP 4.92: near Powell County Line – Powell County MP 2.06: KY 15)
 - Total Cost = \$10,350,000
 - 22 geometric deficiencies
 - Highest frequency of crashes of KY 82 sections
 - 2040 ADT = 7,300 – 6,000
- Phase 2B: KY 52-E1 (MP 18.64: near Old KY 52 to MP 19.39: near Elliston Rd)
 - Total Cost = \$3,525,000
 - Highest ranking of the corridor improvements by the LO/S
 - 1 geometric deficiency
 - 2040 ADT = 16,100
- Phase 2C: KY 82 Southern Portion (MP 0.00: KY 89 – MP 2.36: OB Stamper Rd)
 - Total Cost = \$10,985,000
 - 15 geometric deficiencies
 - 2040 ADT = 4,500
- Phase 2D: KY 82 Central Portion (MP 2.36: OB Stamper Rd – MP 4.92: near Powell County Line)
 - Total Cost = \$9,775,000
 - 5 geometric deficiencies
 - 2040 ADT = 6,000

More detailed cost estimates are provided in **Appendix K**. For each phase, each deficiency section is identified with a line for the cost to complete improvements. This allows for flexibility in future decision making if it is determined that portions of these phases could be constructed or the phasing limits needed to be shifted.

8.3 Funding / Next Steps

At this time there is no funding in the 2014 Highway Plan for any future phases of project development. Funding would need to be secured for future project development.



9.0 CONTACTS / ADDITIONAL INFORMATION

Written requests for additional information should be sent to:

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Additional information regarding this study can be obtained from the KYTC District 7 Project Manager, Robert Nunley, at (859) 246-2355 (email at robert.nunley@ky.gov) or the KYTC District 10 Project Manager, Jason Blackburn, at (606) 666-8841 (email at jason.blackburn@ky.gov).